INDIAN INSTITUTE OF TECHNOLOGY DELHI

NPTEL

NPTEL PROGRAMME ON
TECHNOLOGY ENHANCED LEARNING

Video Course on
Electric Vehicles Part 1

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Lecture # 1
Intro EV Historical_Background

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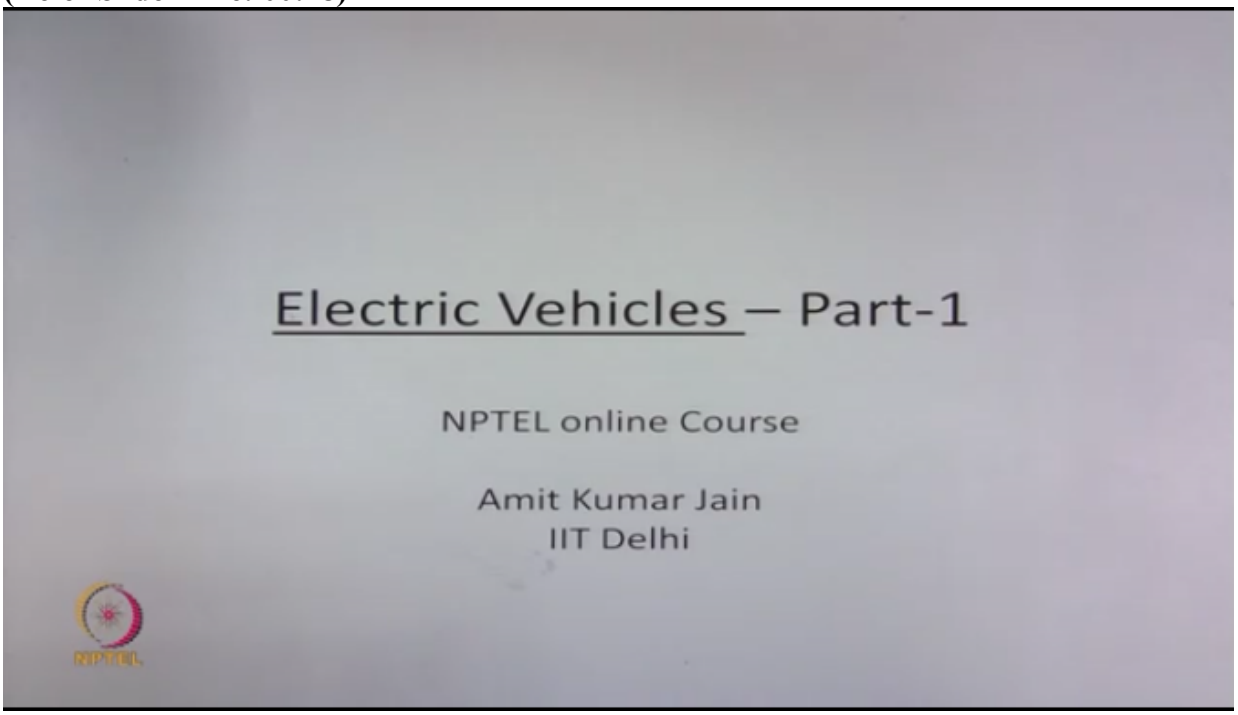

Hello everyone, welcome to the NPTEL Online Course on Electrical vehicles.
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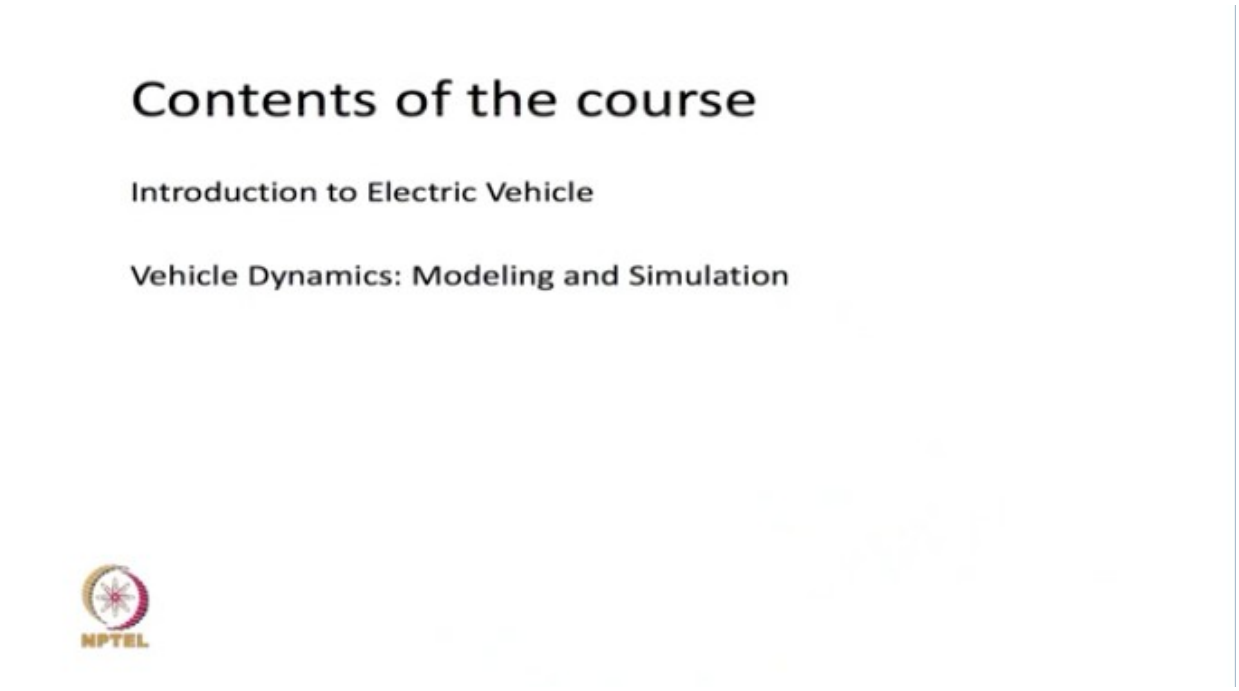

So the contents of this course is are, so let us start the topic of week 1 which is introduction to electrical vehicles.

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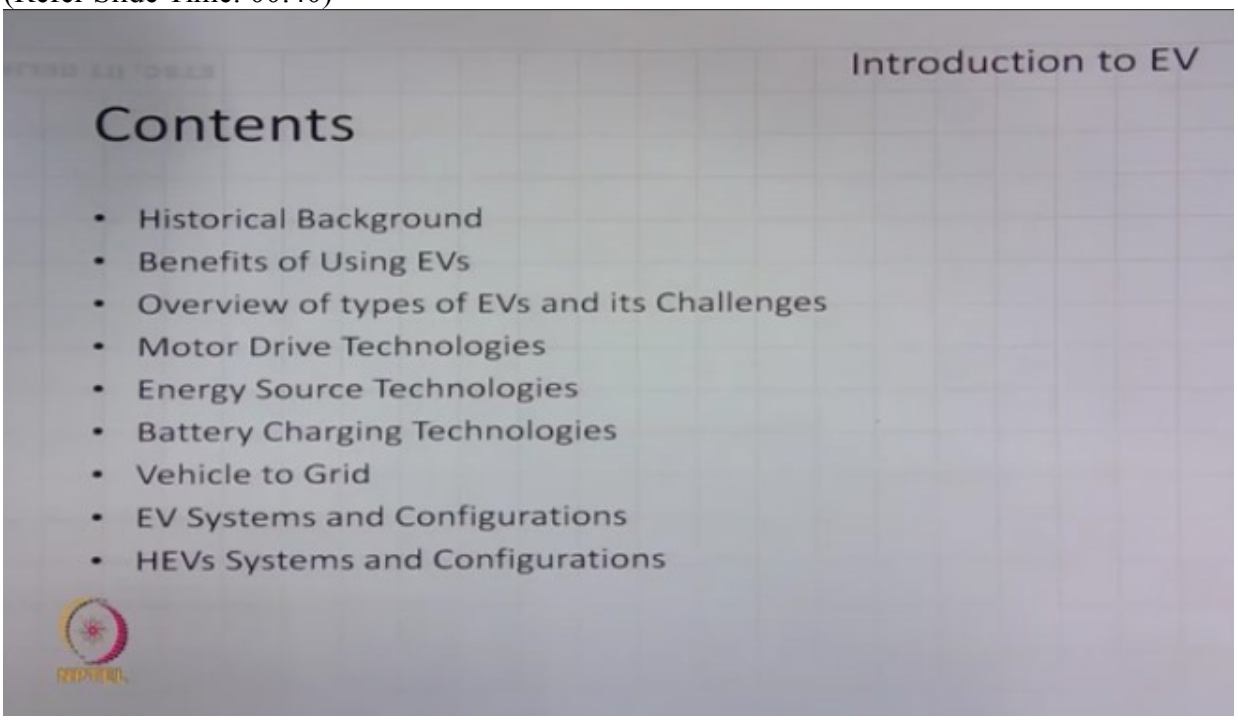

So content of this first topic are the following, please start with historical background, then we will discuss the benefits of using EV's compared to other modes of transport, overview of different types of EV's and their challenges, motor drive technologies, energy source technologies, battery charging technologies, vehicle to grid, different types of EV's subsystems and their configurations and different types of HEV subsystems and their configurations.

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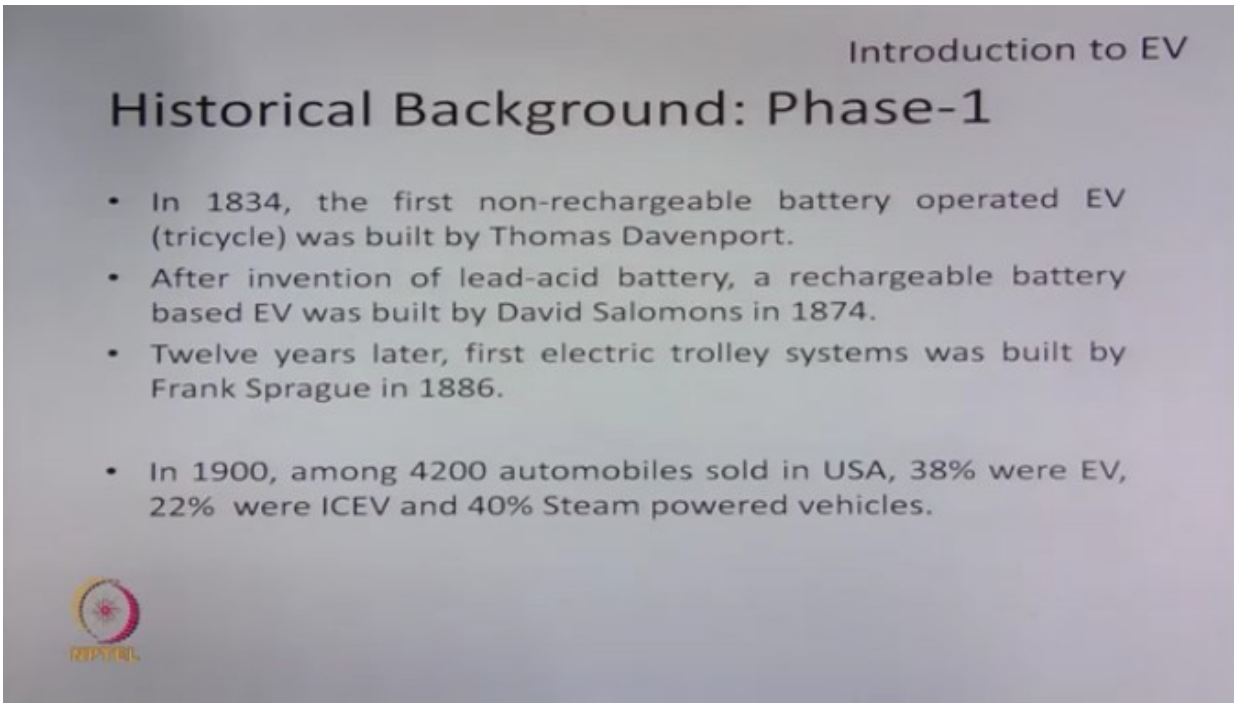

It is very interesting to know that the first EV was built in 1834, which is about 150 years back, it was built on a non-rechargeable battery that was available at that time. After the invention of lead-acid battery, rechargeable battery based EV was possible and was built in 1874 by David Salomon.

With this development it was possible to develop commercial products by 1886, so all these developments led to properization of EV's in the mainstream automobiles in the global scenario, so it can be seen that in 1900 among 4200 automobiles that were sold in USA, 38% were EV's,

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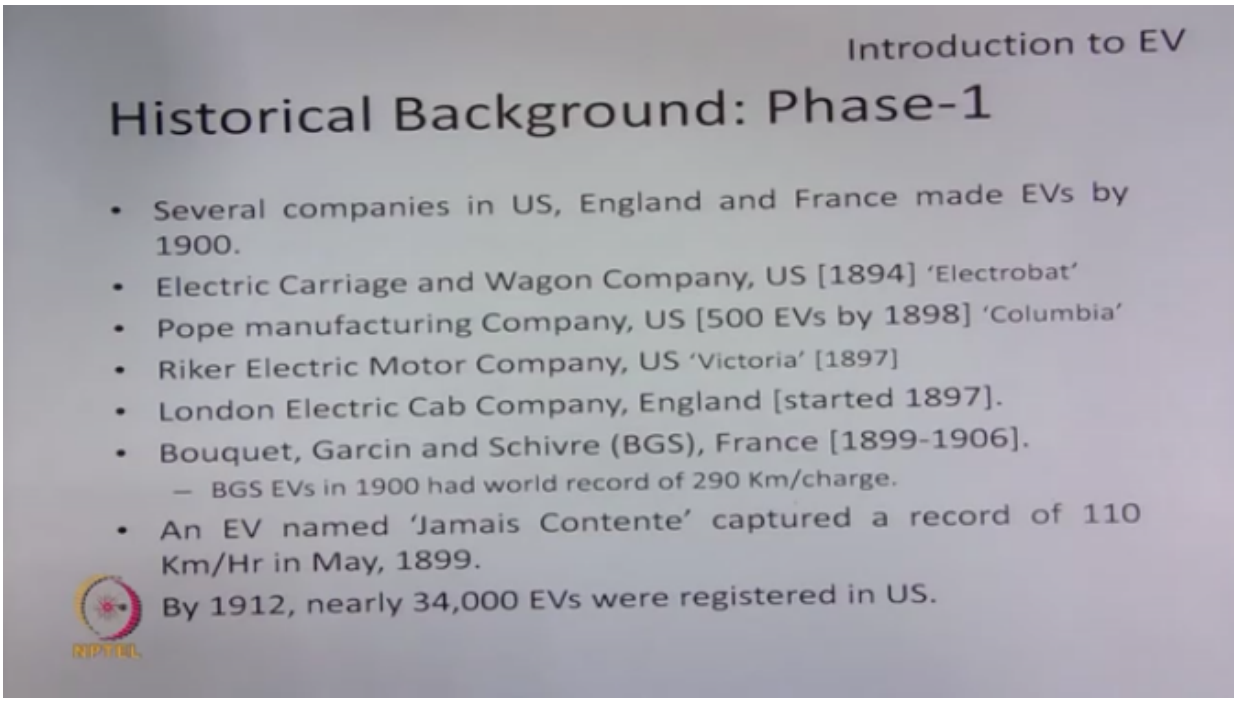

so several companies in US, England and France made EV's by 1900, some of them popular companies are Electric Carriage and Wagon company which came up with its model called Electrobat in 1894.

Similarly there was a model called Victoria in 1897 which has become a household name in 1900 since it has a very good design, this company called BGS in France which has developed many types of EV's in all scales, right from cars, buses and limousines of all variaties.

So one of its products had a world record of 290 kilometers per charge, there was another EV names Jamais Contente which has captured a record of 110 kilometer per hour in 1899, apparently the meaning of this word is never satisfied, so we can see that by 1912 around 34,000 EV's were registered in US, so it was one of the mainstream modes of transport during that time,
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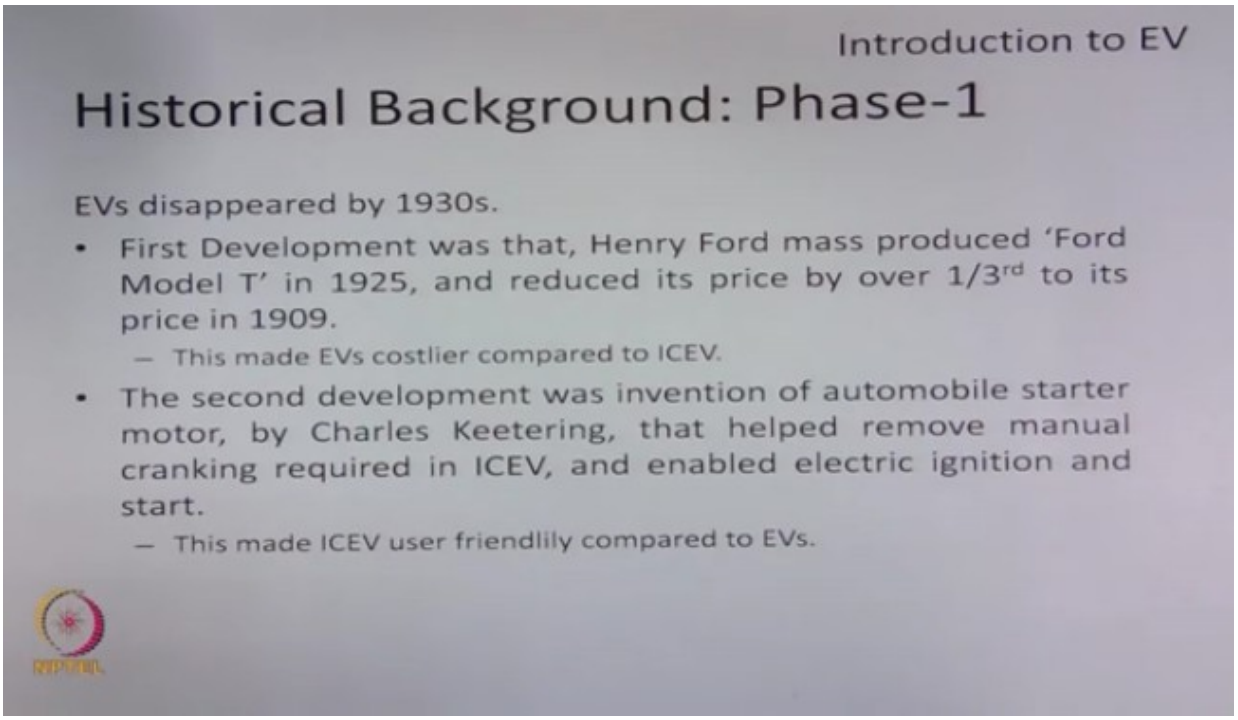

but unfortunately EV's started disappearing by 1930's.

There were two developments which let of this happening. First development was that Henry Ford has gone for mass production of Ford Model T in 1925 and was able to reduce the price of it by over 1/3rd of its conventional price at 1909, so due to this the EV become most costlier compared to IC engine based cars.

Another development which supported the first development for the invention of automobile starter motor, incidentally the IC engines that time were unable to start on its own and need manual cranking, so this automobile starter motor were able to start and provide electrical ignition to the IC engines which you say big milestone in the development of IC engine based vehicles, so due to this two developments, not only the cost of IC engines based cars where less also it is very user-friendly compared to EV's in customer satisfaction, because IC engine can be used now in urban areas and remote areas, and it doesn't require electricity to charge the batteries required in a conventional EV.

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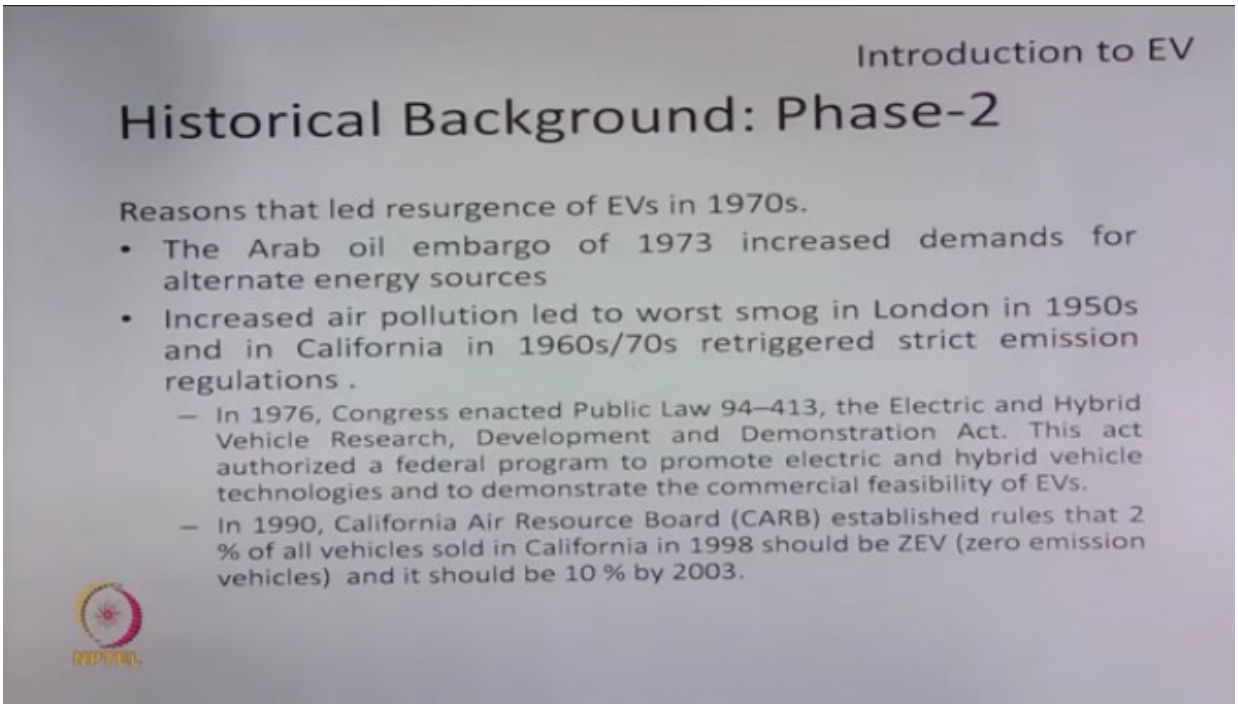

So after a gap of around 40 years again there was a resurgence in the evolution of EV's, there were few developments at that time which led to this, first was there was a oil shortage Arabian countries and global countries were looking at possibilities of alternate energy resources.

Secondly by 1950s onwards lot of cities like London and California have seen worst kind of smog and this has pushed the governments to bring strict rules and regulations which can enable governments to take decision in development of EV technologies and make it feasible for commercial development.

There is a famous regulation which is known as CARB, which is California Air Resources Board, so the regulation is very famous in EV domain because this was the regulation which has led a serious rethink in a development of EV, so the rule says that 2% of all vehicle to be sold in California by 1998 should be zero emission type, and it should be 10% by 2003.

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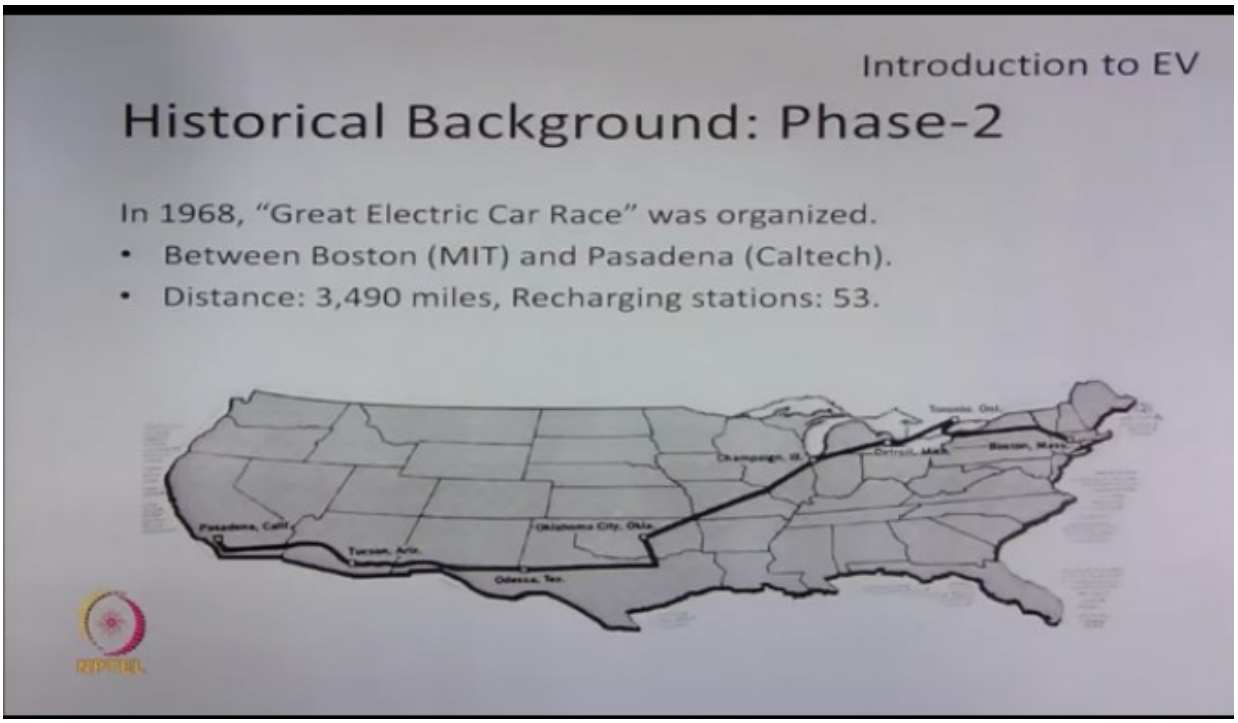

There was also a great push in academic circles to promote the research and development in EV area, one of them was the organization of Great Electrical Car Race that was organized in 1968, so this race is between Boston near MIT to Pasadena near California Institute of Technology which is known as Cal Tech in short,

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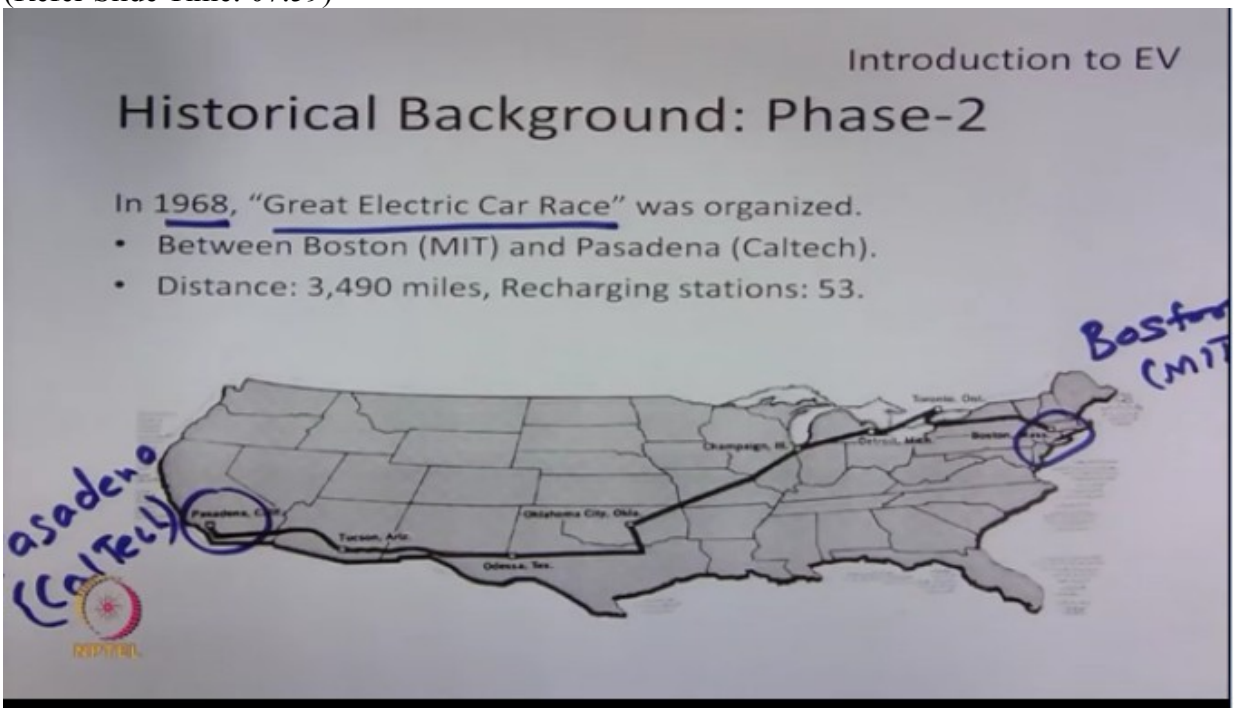

so the challenge was this that both the universities will develop their own EV's, and the EV's developed by this universities will travel from MIT to Pasadena and Pasadena to MIT covering a distance of around 35,000 miles and there were able to reach out their EV's by 53

intermediate recharging stations, so this was one of the important event which led to development EV's in many universities in US and it helped the industry in US to come up with commercial EV's.

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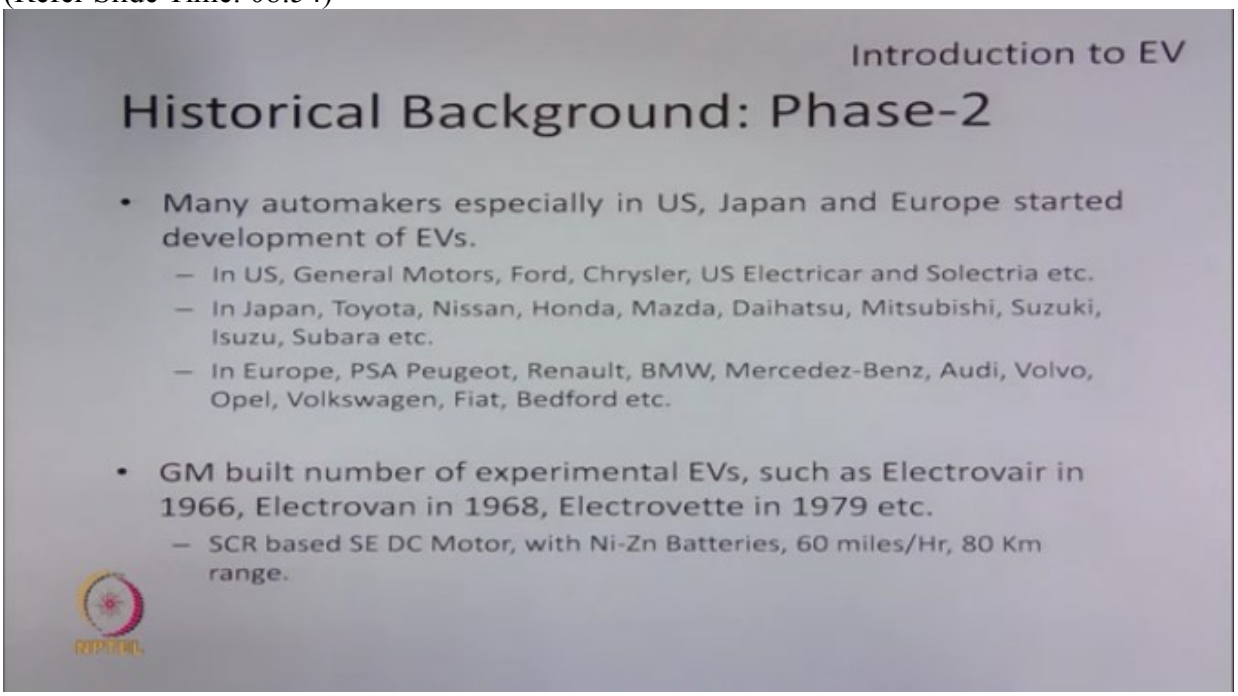

Due to strict regulations and the opportunity of getting subsidies many automakers in US, Japan and Europe started development of EV's, so we have listed out some of the main companies like General Motors, Ford, Chrysler in US and Japan almost all the companies like Toyota, Nissan, Honda, Mitsubishi, Suzuki led the way for development of EV's.

In Europe Peugeot, Renault, BMW, Mercedez - Audi, Volvo, Volkswagen most of this companies have launched around EV's in the near future.

So General Motors were able to launch few of experimental EV's such as Electrovair in 1966, Electrovan in 1968, and Electrovette in 1979, so these technologies were based on conventional separately as a DC motor with a SCR based invertors, since the conventional IGBT based VSI were not available at that time.

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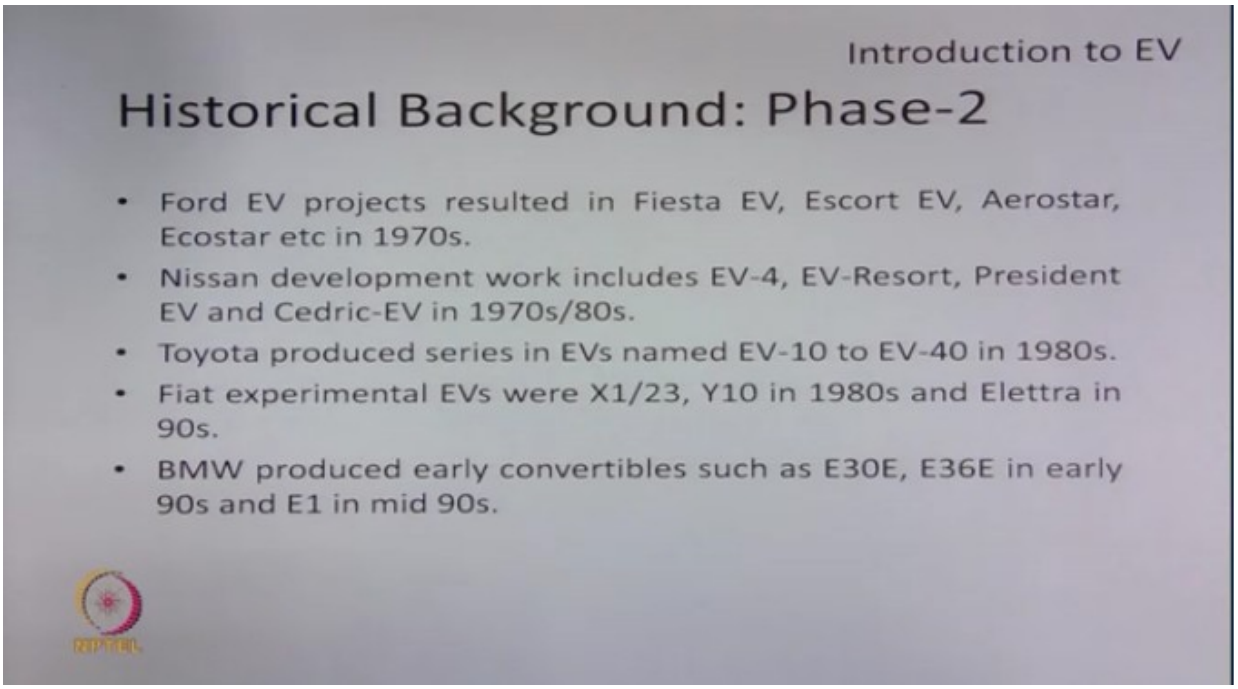

The other companies like Ford has launched some of his EV's like Fiesta EV, Escort EV and etcetera, Nissan, Toyota, Fiat, and BMW have launched their own EV's by late 1980s and 90s.

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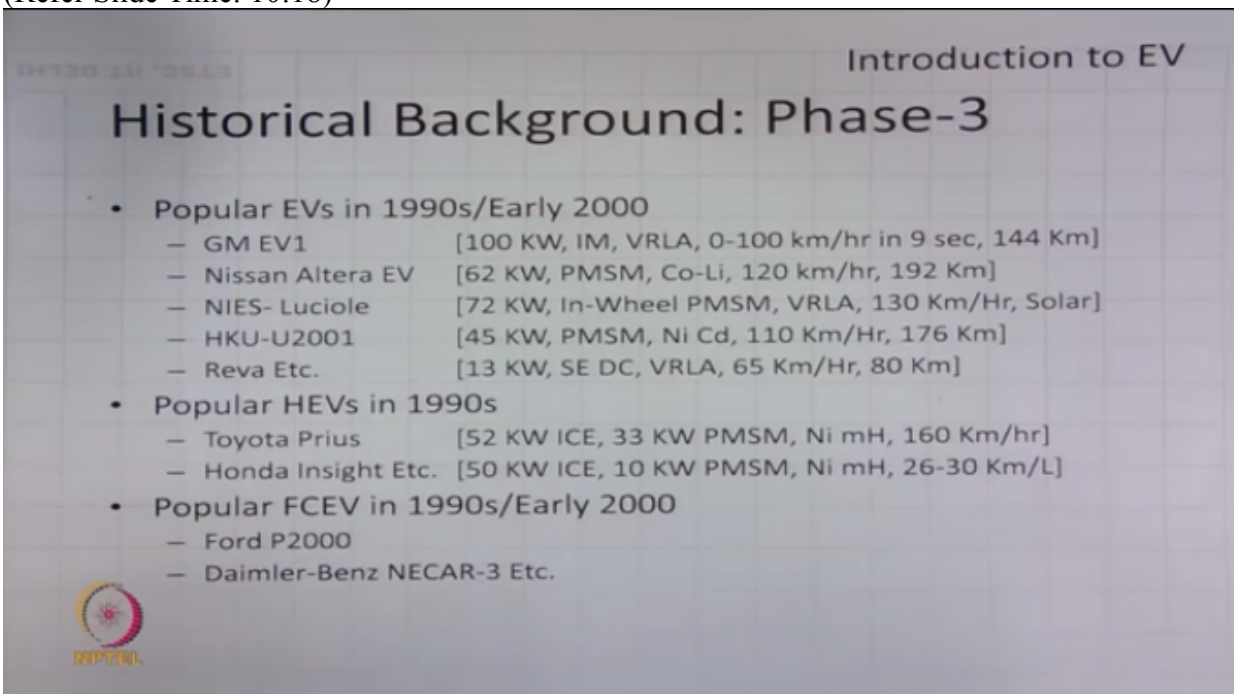

So by late 90s many companies were able to launch their EV's, and which were you can say a very good vehicles in terms of performance and efficiency.

There is a vehicle named as GM EV1 so it used 100 kilowatt induction machine with lead acid battery and is able to achieve 100 kilometers per hour within 9 seconds and it has a range of

144 kilometers, these vehicle has got a very good name in terms of design and it was almost certain that EV will picked up from there.

Nissan has launched his EV named as Altera EV which is based on 62 kilowatt PMSM drive and it was able to go up to 120 kilometer per hour with 192 kilometer range, there is an institute in Japan which is known as National Institute of Environmental Studies, short form NIES which went ahead with very high performance EV's which are very complex to build and operate, so this works on a principle of in-wheel drives which means that separate motors are used to control separate wheels of the vehicle, is very complex but it has taken the EV's to a next level with performance better than IC engine based vehicles in terms of operation.

Another university known as Hong kong University has launched a similar vehicle named as U2001, this similar performance, in India a electric car called Reva was launched in 2002 which was a low power urban car based on separately excited DC machine with a top speed of 65 kilometers per hour and range of 80 kilometers.

The hybrid electric vehicles also became popular in 1990's, some of them were Toyota Prius all of us know, and Honda Insight so they were launched within span of 2, 3 years, so both were based on high engine capacity and low power electric motor, so you can say it is a engine heavy hybrid electric vehicle.

There were some popular fuel cell electric vehicles also launched at that time, so one was from Ford, another from Daimler Benz, so this vehicle use hydrogen as a fuel.
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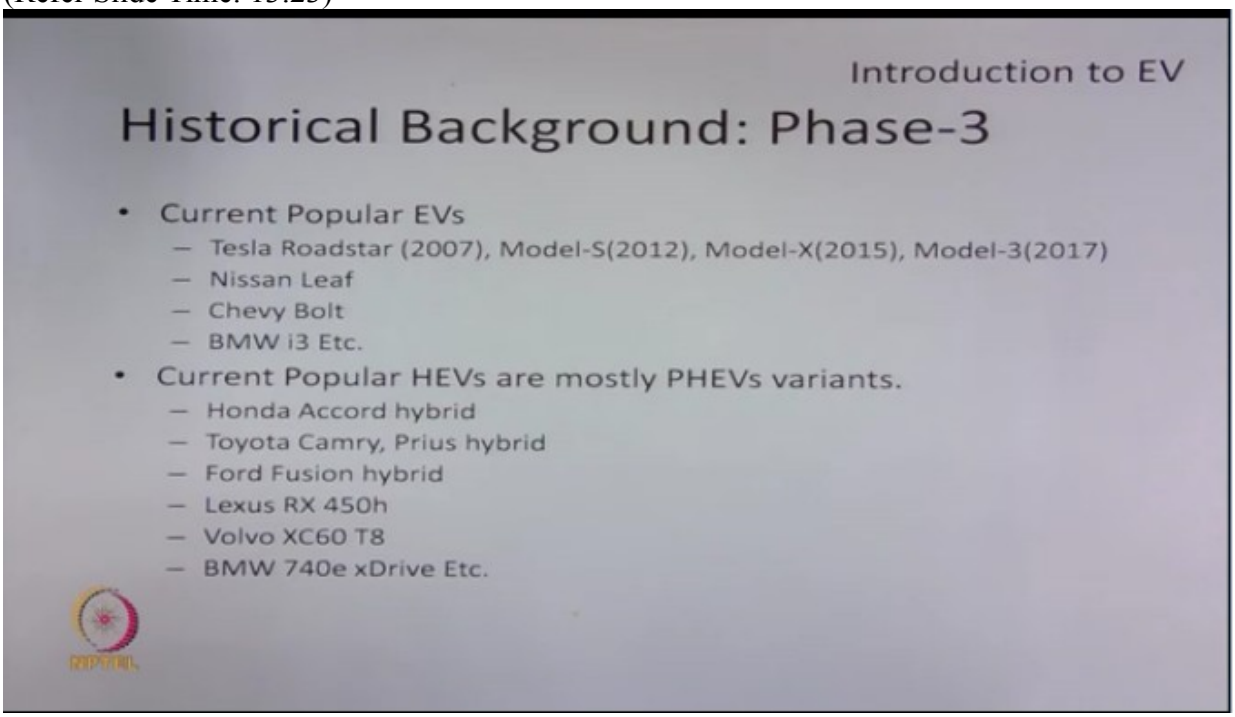

In the current scenario the EV's are extremely popular and they are able to compete with conventional IC engines in terms of performance. The famous models of tesla is known to

everyone, so they have launched four vehicles till now starting with Roadstar and now recently they have launched model 3 which is extremely high performance EV.

Product by Nissan which is called Nissan Leaf is also extremely popular globally. Similarly the name of Chevy Bolt is a household name Europe, there other products such as BMW i3 which is also popular.

HEVs are also popular, but now all are PHEV type means plugin hybrid electric vehicles which means it is electric motor heavy HEV, so IC engine is a low power device primarily used to recharge the battery for long range requirements, so some of the popular products are Honda Accord Hybrid, Toyota Camry and Toyota Prius Hybrid, Ford Fusion Hybrid, there are also luxury version of them which are costly and mean for high segment like Lexus RX, Volvo T8, and BMW xDrive so these are called luxury sedans,
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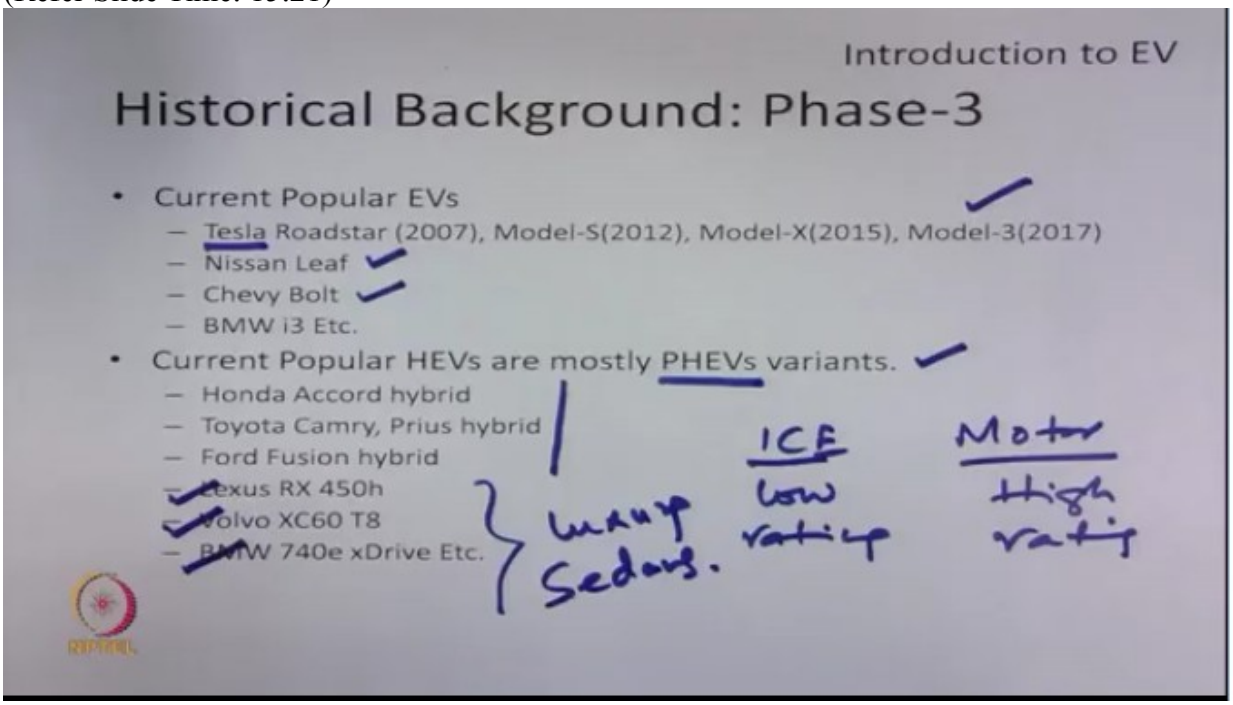

so the internal parameters of this vehicles will be discussed as we go along in the presentation and we will see how this EV's and HEV's are configured internally.

So this is the end of our first topic, introduction to EV which is historical background,
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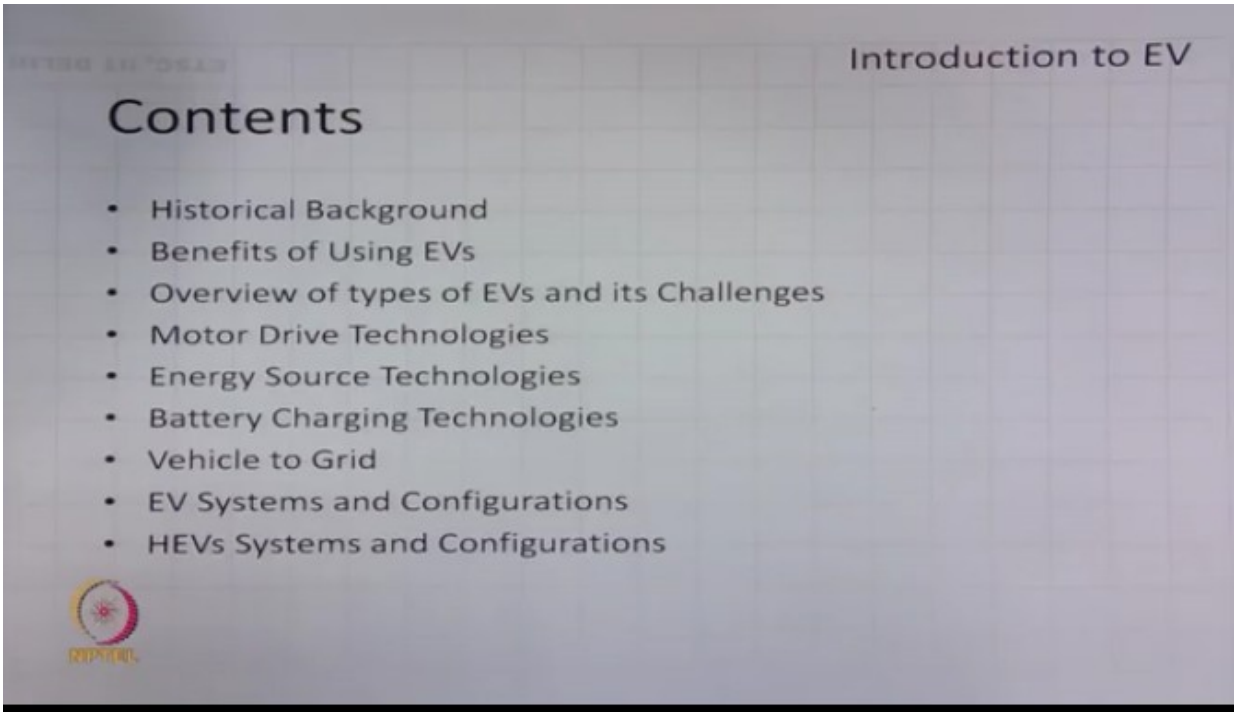

and we will go to next topic of this sub session which is benefits of using EV's compared to other modes of transport and thank you.

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