Fundamentals of Electric Vehicles
Technology and Economics
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Lecture 71
Bulk Chargers Swap Stations - Part 1

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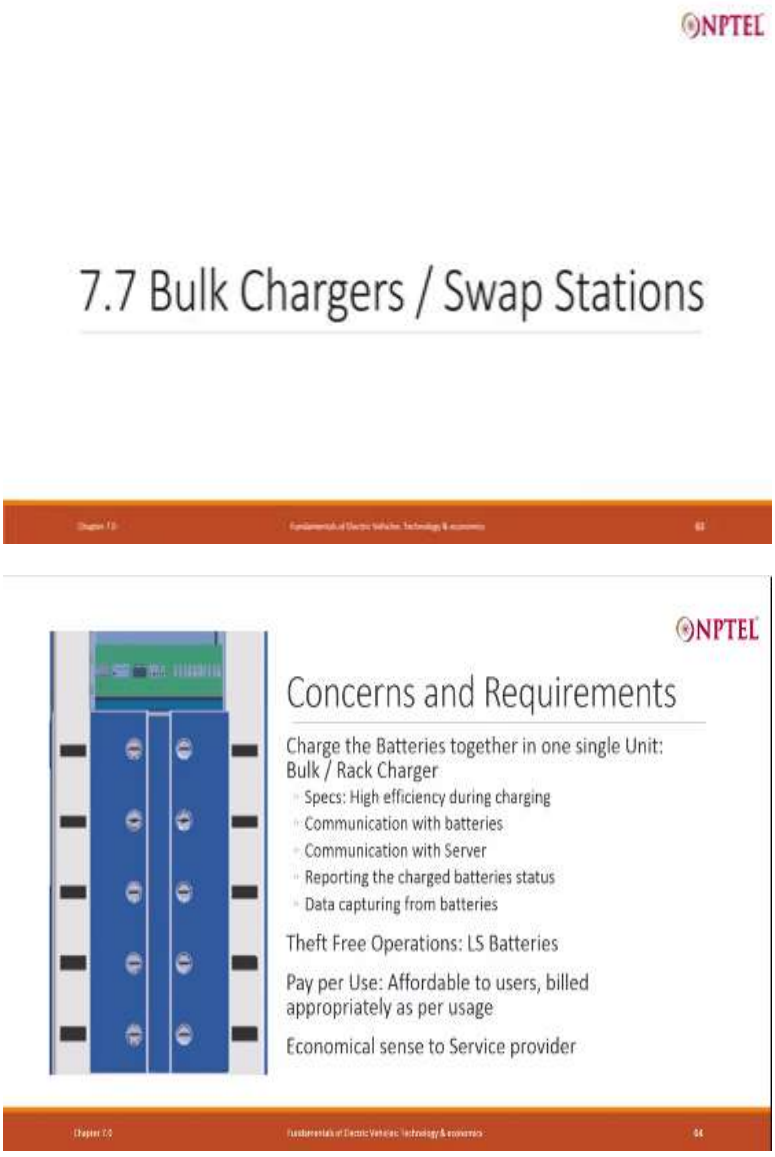

We go to our next section Swap Stations. We anyways understand all of us the concept of swapping that we are taking out the battery swapping it as and when it is needed so battery is not fixed, but as per the use I am taking the battery from somebody if I am a user of the electric vehicle I am going to an operator and asking him that hey my battery is over give me

another battery. So the requirement is that all those batteries for an operator the operator needs to charge them altogether.

When he is charging all these batteries altogether he needs to make sure that this conversion efficiency is very, very high. Why because in portable charger as a user if I have one charger which is 80 percent efficient I am losing about 20 percent of power. So the loss is about 20 percent, but when he is using and if he has to use 10, 20, 30, 40, 100 such chargers in the rack and every charger is 80 percent.

He is losing 20 times I mean 20 percent since that is a loss into N number of slots because that keeps on multiplying that is where the efficiency becomes very, very important and becomes very critical whenever we are talking about bulk charges. So, in portable charger you can get away with the low quality charger. For a bulk charger you cannot because that will ultimately lead to higher powers consumption and therefore his entire electricity bill goes for a toss.

So, if it comes out to be that actually eventually whatever you are using only 10 percent of it or 50 percent of it is going to the battery that means whatever battery is consuming as let us say 1 unit for which you will be paying about let us say 5 rupees, but I am spending about 10 rupees to charge 5 rupee this thing so that is where the efficiency becomes very important. So see when we talk about chargers or talk about any technology in the field the technology and economics go hand-in-hand.

So we cannot tolerate the inefficiencies in electronics because that gets translated into loss in business. Second part that we need to have communication with the battery, communication with the server and why is that here very, very important for the charger, for portable, for fixed batteries it is not mandatory or may not be that you need to have communication with the battery always or you need to have history of the battery also or analytics running on to it.

But when we are doing the job of a swap operator that becomes very important why as an operator if I have 50 batteries and I am distributing it to all of you then I can give you one battery to somebody which runs for 100 kilometers I can give a battery which runs for 50 kilometers, I can give a battery which is 40 kilometers, but all these batteries I bought one day similar specs, all everything similar.

But because of its operational usages differently by different people their lives are different. So as an operator when I give you the battery I need to make you a promise that this battery would last this much that is where the communication become very important to understand that what is the promise I am going to make as an operator to the user and that is possible only when I am keeping the history of the battery and performing the analytics on to that.

Communication with the server because that is where I am keeping all the history of it and doing all the analytics. Reporting the charge battery status from the charger on to if you can I do not know if it is visible, but here if you see there are some interfaces. So a display where the operator can figure out that which battery is charged to what level. So I have to get the maximum charged battery to the user.

And that is how it has to be keeping I mean need to keep flowing. Theft free operation which we call as locked smart batteries or commonly in our routine terms we use the term as LS battery. Now what does the LS battery do is that for the swapping operation how it becomes very important is that if I am a user he is an operator I am going to him and telling that give me a battery he gives me a battery.

Now it is my sweet wish I go back to him and return the battery or do not return the battery. Since I have taken the battery I may keep that battery at my home. So, I have not invested my CAPEX into that battery still I am using that battery. So it is a loss to him. It is a lot of gain to me. Now I do not want as an operator that he loses all the asset that he has procured so there is no business over.

So, in order to do that what we use is the concept that is locked smart battery. So before he gives me a battery he locks the battery seamlessly with the vehicle. So that outside of the vehicle I should not be able to use it in my UPS application or any other application and do not come to him again for charging. So, what he does is actually while issuing me the battery he locks that battery with the vehicle.

Where vehicle also has an intelligence that this battery would only be discharged in that vehicle. If you want to take it out and give it to your friend it would not work and if you want to try to charge it at your home it again would not be charged. So, it is locked both for discharging lock for the charging as well. So, the battery gets locked to the charger, battery gets locked to the vehicle.

That would mean that once I have used the battery I have no choice, but to go to this operator and say that okay you take this battery also and give me another battery and that goes for a cycle. So that is where we talk about this concept of LS batteries then pay per use which is kind of affordable to the users because affordability is the key that is where we are going for swappable batteries rather than fixed batteries.

Economical sense to the service provider has to be there because ultimately he has to make a business and there are number of factors that come into account especially from technology side of it not purely from business, but how technology can aid to make his business profitable and that is where this is there.