WRI INDIA

EVCONNECT

Issue - 22 | July 2020 | *For private circulation only*

NEWSLETTER

INSIDE THE ISSUE

FROM THE CEO'S DESK

Dear Friends,

I am pleased to present to you the 22nd issue of EVConnect. I also hope that you are keeping safe wherever you are.

In this edition of EVConnect, we bring to you a conversation with Mr Chetan Maini of SUN Mobility, Bengaluru, India. Our updates from international and national frontiers indicate progress: new electric two-wheeler models are set to launch and charging stations are being deployed supported by policy revisions. From the international arena, there is continued interest in innovation on battery cell and pack production, as well as cross-cutting collaboration between power grid and energy solutions.

New developments are taking place at a rapid pace, and it is often difficult to keep up with them. These are reported through multiple media channels and are hard to track. This newsletter seeks to bring together several of these developments into one accessible document. We hope this curated and compiled content will come in handy to those who seek the latest information on electric mobility.

We hope you find this edition of the newsletter beneficial and share your thoughts so that we can improve further.

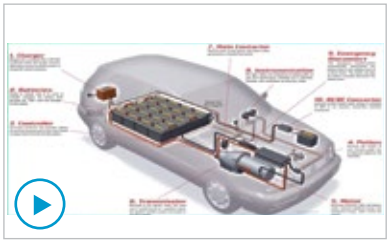
Sincerely,

Dr. OP Agarwal
CEO, WRI India

WATCH

Our EV Connect Power Talk interviews discuss insights, trends and the future of electric mobility with leading EV experts while our spotlight section showcases unique EV innovations from around the world.

Power Talk with Chetan Maini
Co-Founder and Vice Chairman at SUN Mobility, India



Electric Vehicles Components and Working Principles *by Automotive Basic Knowledge*

WATCH the full interview **here**

"Right from day one, swapping stations and fast charging stations could be powered through a clean grid. I believe there is a huge opportunity if we put such policies in place."

"I am hoping that this current situation serves as an opportunity for us to rethink the way forward backed with the public being very positive about electric mobility."

POWERTALK

IN CONVERSATION WITH CHETAN MAINI,

CO-FOUNDER & VICE CHAIRMAN AT SUN MOBILITY, INDIA

Interview taken by Neha Yadav, WRI India. Transcript prepared by Sanjana Singh Raichur

Interviewer: **The International Energy Agency (IEA) recently wrote in their Global Energy Review for 2020 that post-COVID-19, "The rebound in emissions may be larger than the decline, unless the economy is restarted with cleaner infrastructure." We need to "Build Back Better" and electric mobility is one way to do this. How do you think policymakers could additionally support the demand/supply side of electric mobility in India, given the current context?**

Chetan: Clean air is a nice thing to have and there are conversations about how we should have a reduced number of vehicles on the roads once we come out of lockdown. Some states/cities have implemented an odd-even rule and have painted colors on people's license plates. There could be simple policies at the city level. There could be an odd-even stipulation anyway to reduce traffic, but electric vehicles could be allowed. This would enable electric buses, rickshaws and autos to ply all the time and it could incentivize people to purchase an electric vehicle. There is also a feel-good factor that we can leverage that further needs reinforcement at a central level, on EV policies, and reinforcement at a state and a city level around the policy direction. In fact, renewable energy could be linked to mobility for an added push.

Delhi was talking about connecting stations to renewable energy which enables new infrastructure to be directly connected to renewables with policy enabling the same. Right from day one, swapping stations and fast charging stations could be powered through a clean grid. I believe there is a huge opportunity if we put such policies in place. But right now we need to get the economy right and this can be done in a sustainable manner if these policies come through. It needs some efforts and sometimes you need to take a step back before you go a step forward. This allows us to review and correct things. I am hoping that this current situation serves as an opportunity for us to rethink the way forward backed with the public being very positive about electric mobility.

Interviewer: **SUN Mobility has introduced a 'battery swapping system' in India. What are its unique benefits in the Indian context? How do you see this technology evolving in Indian cities?**
Chetan: Unlike the West, 85% of our people go to work on two-wheelers, three-wheelers and buses or opt for shared mobility. While the West predominately focuses on cars and personal mobility, India needs to focus on shared mobility, two-wheelers, three-wheelers, and buses. The challenges we face in electrifying these forms of transportation is largely cost. The cost of electric vehicles is very high with the battery constituting 50% of the overall cost. The other challenge is people are very concerned about range anxiety. There are concerns on, "What happens if I run out of charge?" The third challenge is that the regular infrastructure today allows you to charge your vehicle in 5-8 hours. Fast charging can be done in an hour but it impacts the life of the battery. Consumers are used to 5 minutes of refueling and their mindset is that anything over 5 minutes is an eternity.

"By making a battery swap within one minute, which is possible, we can address both range anxiety and refueling time. It is actually faster to swap batteries than to refuel with gasoline today, which takes about 10 minutes."

Unless you address these three issues you are not going to have electrification at scale. By separating batteries from vehicles, you can bring down the cost of an electric vehicle to that of an internal combustion engine (ICE), the cost of energy becomes cheaper than gasoline, and the cost of maintenance becomes 40% lower. The total cost of acquisition thus becomes lower and the total cost of usage also lessens.

"Providing battery as a service removes those anxieties because consumers will always get a battery that works. It is like a gas cylinder that gets changed and guarantees you the same amount of energy."

By making a battery swap within one minute, which is possible, we can address both range anxiety and refueling time. It is actually faster to swap batteries than to refuel with gasoline today, which takes about 10 minutes. For the consumer, there is no change in habits. Consumers are also very concerned about the warranty on batteries – after all, they see cellphones die very quickly. A lot of the original equipment manufacturers (OEMs) for two/three-wheelers are offering a one-two year warranty. They know the price of the battery is 50% of the vehicle, and they are accordingly nervous about the battery failing. Providing battery as a service removes those anxieties because consumers will always get a battery that works. It is like a gas cylinder that gets changed and guarantees you the same amount of energy. We believe battery swapping can become an enabler and our focus will be to enable battery swapping for two-wheelers, three-wheelers, and buses.

Interviewer: **If you were to retrace your near 30 year journey – from making a solar electric car to Amerigon to building India's first electric car 'Reva' and now an enterprise – what insights would you offer to Indian policymakers to create a 'workforce' sufficiently talented to participate in the value chain of electric vehicles that is vastly different from that of conventional vehicles'?**
Chetan: There has been a higher level of education emerging over the last two years but there is still a big gap. At the education level, electric mobility

training needs to be coupled with access to a lot of projects. 30 years ago, the idea of creating a solar car or hybrid car strongly motivated me and gave me learnings that I could never have received in college. Today you have programs like SAE, Electric Baha, Formula SAE and some other solar car projects — these need to be done at a much larger scale. College graduates must experience what it means to go electric and the curriculum needs to support that.

The second part is that a large amount of training is needed for people who are already in the industry or who are just graduating. So, you might consider finishing schools for 3–4 months for knowledge updates. If you consider the 90s and the IT boom, there were little schools everywhere teaching anyone and everyone, so we need to do the same for electric mobility, at scale. Electrics are more complex because they are a combination of mechanical engineering, electronics, and software, which is often termed Mechatronics. Mechatronics training is not very strong in India. Traditionally, people say, "I am an IT Engineer/Mechanical Engineer/Electrical Engineer" etc. When you work on electric vehicles you need to be an engineer who understands that he/she has to code and do mechanical and electronics because they are all integrated. This is the kind of knowledge that companies seek and finishing schools could prove to be of tremendous value.

The third part is that while you need training at the operations and manufacturing level, how do you service electric vehicles? How do you install charging stations and new infrastructure? You need to have a technical level trained workforce for that. Today, people know how air-conditioning works and how plumbing functions but we do not have a demarcated training program for electrical and electrical infrastructure. A lot of safety norms also come into play. Training has to be done for infrastructure and support staff — e.g. fire attenders need to know how to deal with an emergency situation related to electric mobility. There needs to be complete ecosystem training.

The fourth thing is the research that needs to be done and research institutes have to be created — we do not have enough of that. We do not have enough universities nor do we have enough individual organizations in these areas. We need a Centre for Excellence (CoE) in the country to look into this. The government and industry need to come together to establish a Centre for Battery Excellence/ Motor Excellence/Electronics Excellence to facilitate research, development and knowledge sharing. USA and China have done a very good job in creating such excellence centers, either integrated as separate institutes or integrated with universities as public-private partnerships. This allows to build up the research component and synch the academia with the industry.

The last thing is there is no single window of policy making. The Environment Ministry believes electric mobility is critical, the Power Ministry says we need to figure things out because it is going to affect infrastructure, the Science and Technology Ministry says we should be promoting technology for electric mobility, the New and Renewable Energy Ministry is saying this needs to be integrated while the Department of Heavy Industry and Automotive Industry brought in the Faster Adoption and Manufacturing of (Hybrid &) Electric Vehicles (FAME-India) policies.

When you look at such a complex thing you must put it all together. If tomorrow, EVs are designed to give back energy to the grid, it will need a smart network, a smart grid and appropriate policies in place. Unfortunately, there is no integrated policy making in this area. If the policy is driven from a particular department, it is highly focused in parts and does not consider what is needed at the country-level to effect the needed transformation. If, by 2030, India went all-electric, the country will need about 250 GW of renewable energy which is probably half of what we are looking at today. But is there a policy that is linking the needed RE to mobility and are we even considering the bigger picture?

Can there be a think-tank around integration of policies that looks at policy making holistically. In many ways, NITI Aayog fulfills some roles but there is a gap between the thought process, the ground level implementation and the kind of policy direction needed. Successful countries like China were able to implement this vision at the top level that then percolated all the way down to successfully grow the EV market.

Interviewer: **What are your views on the role of research (e.g. WRI India and academia) in creating the clean, connected and shared mobility ecosystem in India? What are some of the topics that need investigation?**
Chetan: One of the areas that I consider is the holistic impact of energy and mobility in a city. That can help policy makers connect the dots. What would that impact be if a city went that way in 3, 4 or 7 years from today? This can give policy makers the clarity of the impact, that we can reduce the cost of energy consumption and reduce pollution levels by factoring in a policy that supports the use of renewable energy in mobility. However, there is a lack of awareness in this area. These are easy, simple decisions and people can invest in this area, the Government does not have to do it. The second area is that there have been a lot of successes in India. How do we emulate the success stories and extend the learnings on other fronts? For example, if a certain battery swapping solution has worked, how do we take those learnings and translate them to other areas? Can cities rethink their policies to enable this to happen?

And the third is a set of policy drivers that are working in some cities that can be extended to others. But there are some real-world challenges in making that happen. For example, several cities have said that they were banning ICE three-wheelers with Kerala and Chandigarh taking that direction. But as cities bring in green policies, there is a disconnect between the local reality, the local unions etc. that hampers high adoption. If this is understood better, and researched, a policy framework can be put into place with regards what cities should consider, how they can learn from past mistakes and how they can ensure the adoption of best practices. Policy makers want to move in this direction, but they cannot make informed decisions and they cannot make technology neutral decisions — be it in infrastructure or fast charge swaps.

It is important that policy makers understand the co-existence of multiple technologies. Different consumers will use different technologies — two-wheelers will be used differently than three-wheelers. There is a potential of disrupting shared mobility with electrification. In my conversations with leading e-commerce players and others, there is huge interest for them to go electric and they all want to do it. I do not think this intention was there 18 months ago. The intention now is to go electric and save money; and consumers too expect them to move in this area.

So, how do we start to create models of shared mobility, in cities, where a combination of players can come together to make it happen? Uber, Ola, Flipkart, Amazon, BigBasket and Yulu all want to go electric, but it is happening in pockets. What is the vision of shared mobility in a city for goods and people transport and how can infrastructure be co-shared to further reduce cost and other systems? These are areas of early market entry and simple policy changes can help to motivate people.

WRI India and other organizations are playing a very important role and I have seen a lot of the studies that WRI India has published. While these are very informative, I do believe that going forward organizations can play a larger role in this area.

UPDATES FROM THE WORLD

Tesla wins approval to use cobalt-free batteries in its China-made Model 3 | *Technology and Strategy*

Tesla is actively looking to reduce the amount of Cobalt used in manufacturing electric vehicle battery packs. The company has sought Chinese government approval to build Model 3 vehicles in China, equipped with Lithium Iron Phosphate (LFP) batteries. According to a document available on the website of the Ministry of Industry and Information Technology. The demand for Cobalt, a finite mineral that naturally occurs in only in a few places on earth, is surging and has driven up prices. This has contributed to increasing the price of electric vehicles. In a recent note to shareholders, Tesla shared its intent to reduce the Cobalt content "next to nothing" in its vehicles. Tesla is in discussion with Chinese battery maker CATL to, instead, use Lithium-Iron Phosphate (LFP) instead for Model 3 vehicles that are built at the automaker's new Shanghai Gigafactory. **Read more**

Germany ramps up electric vehicle battery production with big state subsidies | *Policy and Market Development*

The German government has initiated battery cell research and production with a €300 million grant to Varta, a battery company. In the long haul the government will invest more than €1.5 billion ($A2.4 billion) in battery cell research and production. This inaugural funding kickstarts a new initiative set up under the European Union's Important Project of Common European Interest (IPCEI) program. The German Ministry of Economic Affairs and Energy will award grants to four other companies for battery cell projects along with Varta— namely BASF, BMW Group, Opel, and Umicore. The European Battery Alliance estimates that the potential market value for European-made batteries will be €250 billion by mid-2020s. With lithium-ion battery packs according nearly 40% of the value of electric vehicles, the German Government's support for battery-cell projects is timely. **Read more**

Hitachi completes acquisition of ABB's Power Grids Business | *Market Development & Technology*

Hitachi is acquiring ABB's power grids business to create 'Hitachi ABB Power Grids'. This will combine ABB's world-class power grids business with Hitachi's advanced digital technologies to provide innovative energy solutions needed to realize the energy transition. The rapid rise in distributed power generation and changes in consumption patterns (for example, the emergence of prosumers) are part of this changing energy landscape. Furthermore, the growth of electric vehicles and expansion of the world's data centers has ramped up electricity demand. **Read more**

UPDATES FROM INDIA

IOC launches battery swapping facility for quick recharge of electric vehicles | *Strategy & Technology*

Indian Oil Corporation (IOC) has partnered with SUN Mobility for setting up a battery swapping facility, called Quick Interchange Station (QIS). Electric vehicles can drive into a QIS facility and exchange a discharged battery with a fully charged one in a couple of minutes. The Pilot QIS, located at one of the IOC pumps in Chandigarh, has 14 batteries, a touch screen for swapping preloaded cards, and an electricity sub-meter. These QISs will play a pivotal role in providing an alternative energy solution to the three-wheeler segment in the area and gradually, IOC plans to set up 20 such stations across India. **Read more**

BGAUSS A2 and B8 electric scooters unveiled; India launch in August | *Market Development & Strategy*

BGAUSS, an RR Global company, is set to launch two new electric vehicles for India — A2 and B8 electric scooters — in August. The vehicles are equipped with artificial intelligence (AI) and Internet of Things (IOT). The BGAUSS A2 is a slow-speed electric scooter with a maximum speed of 25 kmph, while the BGAUSS B8 offers a top speed of 50 kmph. A2 is available with an option of lead acid or lithium-ion battery, while B8 will only carry an advanced Lithium Ion-based battery. **Read more**

Guidelines Revised for EV Charging Infrastructure | *Policy & Market Development*

The Ministry of Power has amended the charging station guidelines issued in October 2018. They have now limited the tariff, for the supply of electricity to EV public charging stations, to be no more than 15% of the average cost of power supply. Another change is that for all practical purposes, the battery charging station (BCS) will be treated at par with the public charging station (PCS). Tariff for electricity supply will also be the same for PCS and BCS. Here, PCS refers to any EV charging station, while BCS implies a battery swapping station where discharged batteries can be exchanged with fully recharged ones. **Read more**

EV @ WRI

A Webinar on 'Lithium-ion battery hazards and design challenges for the electric vehicle sector'

Listen to the full webinar here

This webinar encapsulates a discussion on:

- Hazards with lithium-ion batteries for EV
- Challenges with lithium-ion battery designs for EV
- Mitigation of hazards
- Charging infrastructure challenges

EV FEATURE

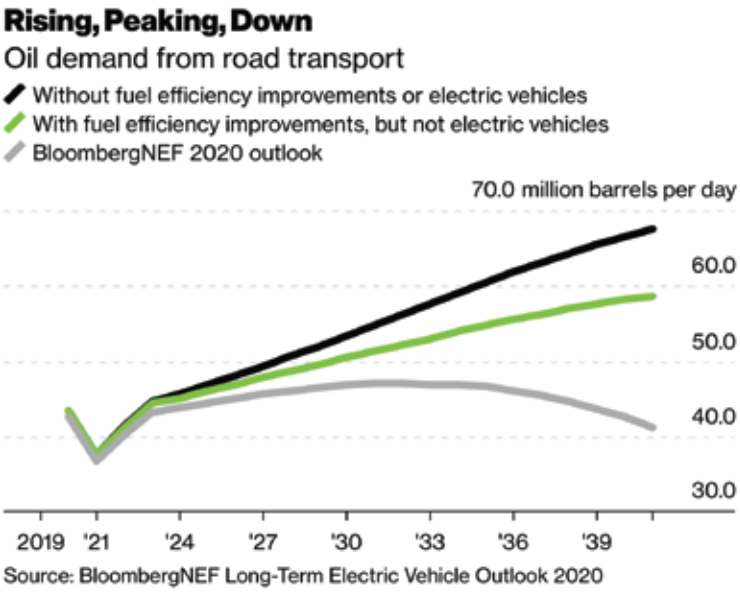
Not All Electric Vehicles Are Cars, You Know

Two- and three-wheeled EVs are responsible for more avoided oil consumption than any other category

by Nathaniel Bullard | May 2020 | This opinion piece first appeared in Bloomberg.com

This year is shaping up to be an awful one for the global auto sector. In its latest Long-Term Electric Vehicle Outlook, BloombergNEF expects a 23% decline in sales of internal combustion engine vehicles—in a market that's already three years off its peak. Electric vehicles won't be immune to the pandemic, but they're a relative bright spot with sales projected to sink 18% this year before rebounding.

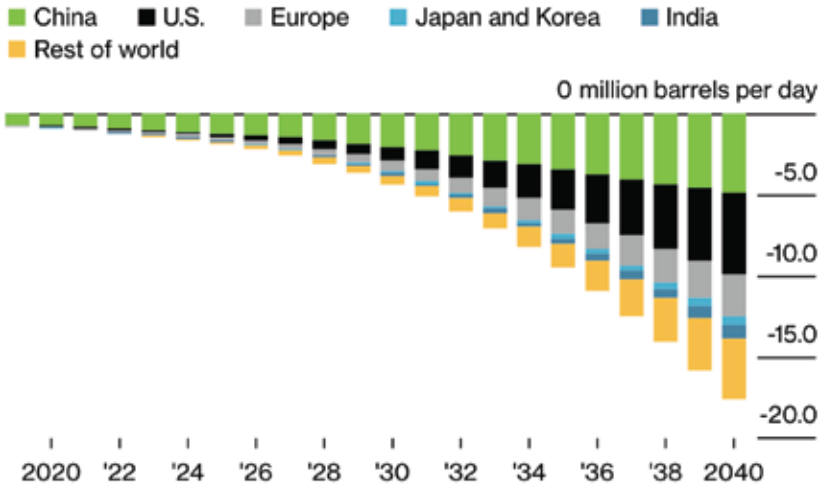
What's bad news for auto companies is also not-great news for the oil companies extracting, refining and selling fuel for the existing vehicle fleet. BloombergNEF expects that the electric vehicles currently on the road are already avoiding a million barrels per day of the world's would-be oil consumption. That's not a huge number out of last year's 100 million barrels a day of consumption, but it's rather more of today's coronavirus-crippled demand.



More important for the oil business is where road transport demand is going. Here's what the long term looks like: Demand recovery next year in the auto sector would lead to steadily increasing demand from for oil, but if and only if there's no technological change. Fuel efficiency improvements bend that curve slightly. Electric vehicles tip it over, causing demand to peak in 2032 and tumble lower than 2019 levels within just a few years.

All the Avoided Fuel

Oil demand avoided by alternative drivetrains and shared mobility

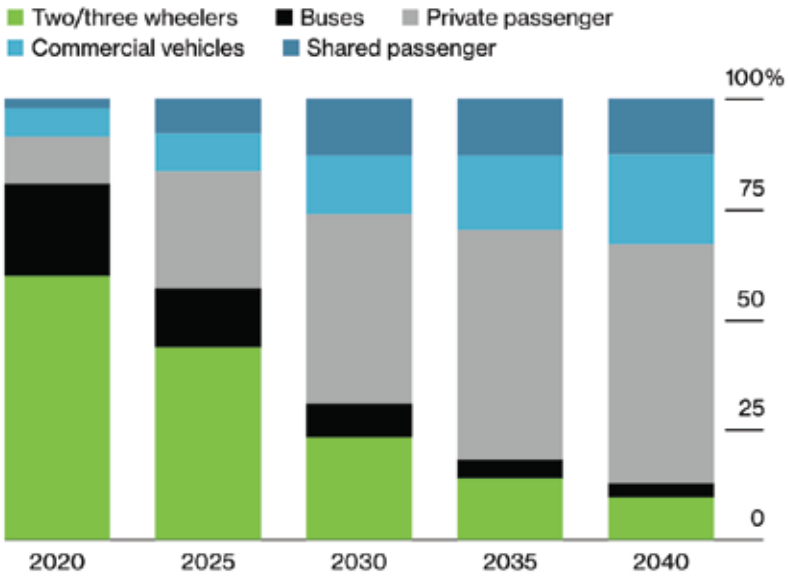


Source: BloombergNEF Electric Vehicle Outlook 2020

The chunk of oil demand that electric vehicles make go away is quite concentrated in a few auto markets. China and the U.S. represent more than half of the total in 2040. Europe is smaller but more significant because of strong government policy supporting electric vehicle sales; India matters more than Japan and Korea combined.

Two Wheels Over Four

Avoided oil consumption from electric vehicles, by vehicle type, % of total



Source: BloombergNEF Electric Vehicle Outlook 2020

Here's the bit I find most fascinating: how different electric vehicle classes contribute to reduced oil demand. There are now millions of personal electric vehicles on the road, hundreds of thousands of electric buses, and many commercial electric vehicles. Yet none of those categories is the main part of avoided oil consumption today.

In 2020, it's the tiny electrics with two or three wheels that are responsible for more than half of that vanished demand for oil. There are almost a quarter-billion such electric vehicles on the road today. China buys more than 18 million electric two-wheelers a year; by 2040, BNEF expects the world to buy 70 million in total.

From a high-end-low-end market perspective, scooters would be considered far inferior to luxury sedans, and they satisfy an easy-to-ignore niche of transport demand (at least for those outside of Asia). But demand for oil is molecular—it doesn't care about the size of a vehicle. Each one of those little vehicles takes a tiny nibble out of global oil demand, but it's not the size of the bite that matters. It's the collective appetite.

Nathaniel Bullard is a BloombergNEF analyst who writes the Sparklines newsletter about the global transition to renewable energy.

COURTESY FOR THE ARTICLES

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VIDEO CREDIT

Electric Vehicles Components and Working principles: https://www.youtube.com/watch?v=K0LBGKMo3zQ

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