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Roadmap 2021

Greening Emerging Tech

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ETN VOLUME 8 – ISSUE 1 • JANUARY-FEBRUARY 2021

24

31

32

33

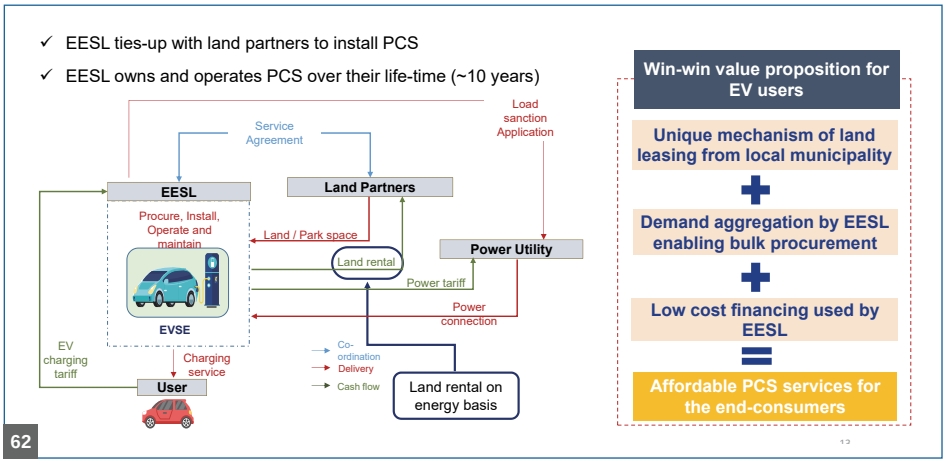
34

74

68

60

54



62

72

78

43

7 EXPERT'S NOTE

9 FROM THE EDITOR

10 NATIONAL NEWS

16 INTERNATIONAL NEWS

BUDGET

24 Budget 2021: What's in store for RE and EV sector?

ROADMAP 2021

30 e-2W - envisioning a smooth ride

36 e-4W market set to accelerate e-mobility

40 Establishing robust charging infrastructure

44 Expansion year for EV component market

46 RE sector pursues *aatmanirbhar* development

52 Inroads towards clean power generation

WOMEN IN ENERGY

54 Dr Shalini Sarin
Executive Director - Elektromobilitat India

E-MOBILITY

56 Decarbonizing transport: Vehicle Scrappage Policy

60 EESL: Charging stations deployment

SAFETY

64 Fire and gas characterization for battery fires

INSIDE TECHNOLOGY

68 Bettering battery analysis

STARTUP

72 Renon India: Battery manufacturing

74 Yulu Bikes: Urban micro mobility

RENEWABLE ENERGY

76 MICRO enterprises: Empowering rural India

HYDROGEN

78 A step towards carbon-free economy

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2021: the year of execution of strategy

Dr Rahul Walawalkar
President – IESA
Managing Director – CES India

As the COVID-19 pandemic continued, this New Year's Eve opened quietly for most of us — well within the confines of our home. The viral outbreak posed a global challenge to people and businesses across the board, but the silver lining amidst this has been that it did not derail the path for the adoption of renewable energy, storage technologies, and e-mobility around the globe.

Studies indicate continued growth in solar and wind installations as well as increasing acceptance by consumers for xEVs. The lockdowns during 2020 resulted in improved air quality, record low ambient noise levels, and instances of nature reclaiming environment, which increased public consciousness to shift to cleaner means of transport and a sustainable lifestyle. We are confident that this shift in mindset will sustain in a post-COVID world. In fact, one thing is clear that it has restored the urgent need for climate action on the part of governments, businesses, global institutions, and society as a whole. In some ways, it has propelled renewed commitment of policymakers, regional and global coalitions to take harmonized efforts to deal with global warming.

Europe has utilized the year 2020 in the most effective way by focusing on manufacturing, supporting the industry, and getting it ready for the transition to clean energy and technology. Battery 2030+ is a long-term research initiative that brings together research institutions, industry, and public funders. It builds on European scientific excellence in electrochemistry, material science as well as digital technologies to deliver breakthroughs in battery technologies. According to European Commission, the annual market value is estimated at €250 billion from 2025 onwards.

> *Studies indicate continued growth in solar and wind installations as well as increasing acceptance by consumers for xEVs.*

EU has launched EBA250 as the industrial development program for the establishment of a complete domestic battery value and a competitive industry. Just in 2020, the EU has witnessed commitments for over 500 GWh of advanced battery manufacturing and additional investments for EV manufacturing. The time isn't far when Europe could catch up with China for R&D and manufacturing capacity, to produce EVs and advanced energy storage technologies.

India has also been working on the National Energy Storage Mission and National Mission on Transformative Mobility and Battery Storage for the past three years. The Indian government has finalized the Production Linked Incentive (PLI) scheme for boosting advanced chemistry cell battery manufacturing in the country, and the RFPs are expected to get released by March 2021. While this is a critical step towards achieving our dream of making India a global hub for advanced energy storage and EV manufacturing, it will take at least 2-3 years for the initial manufacturing facilities to be fully operational. Now the ball is in the industry's court on how fast we can complete the planning and start implementing the strategies to build the initial 50GWh of ACC manufacturing that will be incentivized by the government. We need to use the next 12-18 months to accelerate adoption and address investor concern about demand potential in India.

In a welcome move, India's Finance Minister in the budget 2021-22 announced a voluntary Vehicle Scrappage Policy for scrapping old, high-CO_2 emitting vehicles. Though the details of the policy are yet to be out, climate experts and industry frontrunners hope that incentivizing the sale of old vehicles for new electric ones would help India achieve the ambitious target of electrification of transportation by 2030. It would also allow India to recover useful metal and material that could be reused – paving the way for a circular economy.

While there is a lot more required to be done in India, we believe FY2021 is the year of effective execution of policies and initiatives. In the last couple of years, the government has taken the right steps for establishing the policy framework towards creating an enabling ecosystem for EV adoption and clean energy transition, but what we as an industry achieve in the coming year will determine if India can aspire to compete with China and Europe for leadership in the sector, which will dominate the opportunities in the coming two decades.

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On the road to a clean future

Ashok Thakur
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Considering that 2020 was a year for reflecting, resolving and laying the foundation of a promising future for India in the field of RE, E-mobility and ES; we now have to take measured steps to ensure a steady growth in the clean technology market over the next few years.

Issues such as pollution and global warming resulting in climate change, have intensified the need to adopt cleaner technologies. Clean tech is going to lead the way to a greener environment with innovation, leaner production strategies, and resource efficiency; to name a few.

A door to great opportunities has opened up and India is at the threshold to becoming one of the world's largest producers of green energy. A great time for both domestic and international ventures to ramp up production and services in India. The energy revolution, if I can call it so, has begun in India. Our commitments towards complete transition to RE has helped us achieve targets leading to the big shift. Renewable energy is transforming the way we generate, store and use electricity.

'Roadmap 2021' is our attempt to project an outlook for the year that will possibly initiate India's journey towards green clean tech and e-mobility, riding on sustainable energy. In this issue we have covered views from stakeholders who represent different segments of the sector, to give their standpoint on the factors that will influence the growth of the sustainable energy sector in India.

There is a will from governments across the globe to adopt and promote clean energy. A lot is being done in R&D for emerging technologies. Your cars, homes, offices, shopping malls, etc., will soon run on clean energy. Along with solar energy, now green hydrogen is also becoming a popular choice as an alternative form of energy. Even oil companies are keenly investing in these new technologies; they have to find ways to adapt to sustainable fuel, before they are phased out eventually.

> *A door to great opportunities has opened up and India is at the threshold to becoming one of the world's largest producers of green energy.*

Government's initiatives to promote e-mobility and support the sector to build a robust sustainable ecosystem have been much welcomed. Aid and subsidies to encourage local manufacturing of storage batteries and auto components, have also helped in getting the manufacturers interested in investing in the sector. In this issue, the articles on the growth prospects for this year will give you an idea about the various policies and schemes, and what the stakeholders have to say about them.

It also gives me great delight to announce the launch of the all-new version of the **ETN website**. As we all know, ETN is a leading industry magazine that focuses on news, views, projects, and technology updates in the areas of RE, e-mobility, and energy storage solutions and integration. With the renewed online format, we aim to move beyond focussing on just news, and present analytical articles, in-depth interviews, sector overviews, latest updates on technology development, and much more. And I'm sure the rapid growth we are going to witness will give us ample opportunity to do so.

Gadkari calls for a transition to indigenous battery technologies

With EVs fast becoming the new reality, Road Transport & Highways Minister Gadkari has emphasized the need to transpire as pioneers in developing leading battery and power-train technologies.

Observing that the challenge we presently face is the control on strategic reserves of lithium, which is used to manufacture Li-ion rechargeable batteries used in EVs, the minister has called upon the EV sector to shift towards a fully indigenous battery technology in the imminent years. This could be metal-air, metal-ion, and other budding technologies in the R&D pipeline.

Union Minister Nitin Gadkari, Ministry of Road Transport and Highways

Pointing out the need to accomplish the *Aatmanirbhar Bharat* goal in the transport sector, Gadkari expressed it is essential to commit the coming years to rigorous research and development of such alternative battery technologies with the support of Institutions of Eminence (IoE), industry, scientists, engineers, and the government.

HYDROGEN

IIT-Delhi innovates water-based hydrogen fuel

Researchers at IIT Delhi have generated clean hydrogen fuel from water at a low cost. A sharp rise in global energy demand and the necessity to limit greenhouse gas emissions, have compelled researchers to look for cleaner and greener energy sources as alternatives.

The study which was backed by the Oil and Natural Gas Corporation (ONGC) Energy Centre saw the researchers successfully split water by a process known as the Sulphur-Iodine thermochemical hydrogen cycle to generate low-cost, clean hydrogen fuel for industrial consumption.

"Hydrogen gas, a viable choice as a renewable substitute for fossil fuels, can help mitigate emissions," said Sreedevi Upadhyayula, Professor at the Department of Chemical Engineering.

Ms Upadhyayula added that "there is an imminent need to switch over to renewable energy sources, such as water. The thermo-chemical hydrogen cycle for splitting water offers a practical means of generating hydrogen as a fuel and also oxygen as a byproduct. Hence, it can be considered favourably for the commercial production of hydrogen on a large scale in the near future."

Image for representation purpose only

One of the challenges in the low-cost conversion was to design a suitable catalyst for the energy-intensive, corrosive step of sulphuric acid conversion to sulphur-dioxide and oxygen. But the in-house catalyst developed by them, which is now patented, met these criteria.

"The modified iron oxide catalyst dispersed on silica surface on a silicon-carbide support catalyst is not only cost-effective but also functional under the high temperature and corrosive conditions of the reaction," the institute said in a statement.

Electric Vehicles

Delhi govt. issues tender for charging points

Delhi government in February floated a tender to set up 500 e-vehicle charging points at around 100 locations, informed Satyendra Jain, MoS, Power Ministry.

The aim is to create an enabling charging infrastructure so that EVs can be charged outside homes too. The project will be complete in a year.

Image for representation purpose only

Of the 500 EV charging points at 100 locations, at least 10 percent will have minimum fast charging points and the rates for these would be very nominal, Mr. Jain said.

Earlier, Delhi Chief Minister Arvind Kejriwal launched 'Switch Delhi', an EV mass awareness campaign, to sensitize citizens about the benefits of switching to EVs. The Delhi government has rolled out incentives for the acquisition of EVs among all the States.

CM Kejriwal's vision is to have 25 percent of new vehicles to be electric by 2024. Approximately ₹30,000 subsidies are to be given for two and three-wheelers while ₹1.5 lakh for four-wheelers. "I appeal to people to take part in the campaign to promote the replacement of polluting petrol and diesel vehicles with EVs and make a contribution towards a pollution-free Delhi," he said.

Arvind Kejriwal, Chief Minister, Delhi

He requested delivery chains and big companies, resident welfare associations, market associations, malls, and cinema halls to encourage the use of EVs and set up charging stations at their locations. The Delhi govt. target is to have 25 percent of EVs among total vehicle registrations by 2024.

Central Railway, UNEP & Tata Power to set up EV charging in Mumbai

Central Railway in alliance with the UN Environment Programme (UNEP) and Tata Power has announced the launch of their innovative green initiative for promoting e-mobility in Mumbai. As a part of this initiative, charging points for EVs will be made available at all key railway stations in the city, the suburbs, and the neighboring Mumbai Metropolitan Region.

The charging points will encompass a wide geographical area and offer a unified experience for EV owners to charge their vehicles through a pay-per-use model. The collective venture aims to enhance the overall e-mobility sector and boost green mobility around railway stations.

In the initial phase, contracts have by now been awarded for railway stations like Thane, Dadar, Parel, and Byculla. For the next phase, tenders have been floated for the next set of stations including Lokmanya Tilak Terminus (LTT), Bhandup, Panvel, and Kalyan. Areas at the entry-exit points of railway stations with parking facilities have been allocated for the charging stations as per the availability.

Image for representation purpose only

"A transition to e-mobility is one of the best solutions for combatting the challenges of air pollution and the climate crises with electrification being a flexible, energy-efficient, and sustainable way to decarbonize the economy," said Atul Bagai, Head of UNEP's India Office.

Robin Kalia, Senior Divisional Commercial Manager of the Central Railway of Mumbai, highlighted that an EV charging station has also been installed at Chattrapati Shivaji Maharaj Terminus (CSMT). Further the plan is to extrapolate this model for installing EV charging stations at all major railway stations under the Mumbai division.

Electric Vehicles

Triton - BEL to make batteries in India

New Jersey based electric car maker Triton Electric Vehicle has signed an agreement with India's state-owned Bharat Electronics Limited (BEL) to make batteries used in energy storage systems and EVs.

As per the memorandum of understanding (MoU), Triton will provide the know-how and BEL will be the exclusive manufacturing partner in India for the products.

"Joining hands with BEL will definitely strengthen our commitment towards technology and clean energy driven EV and ESS market. The whole world respects India's technical capabilities in various sectors, we wish to leverage this through building great products around ESS [energy storage system] and EVs," said Himanshu Patel, MD of Triton EV.

The company confirmed that the aim of the partnership is to produce an innovative 'Made in India' product that will transform the EV and energy storage system segment in the country.

Triton Electric Vehicle's N4 electric sedan

Source: Triton Electric Vehicle

Triton intends to bring technological advancements to the existing EV ecosystem and clean energy solutions.

GreenCell Mobility, PMI Electro Mobility to deploy 350 e-buses in UP

GreenCell Mobility, an e-mobility-as-a-service (eMaaS) provider in India acquired a strategic stake in two Special Purpose Vehicle (SPV) companies incorporated by PMI Electro Mobility Solutions.

PMI is a 'zero-emission' commercial vehicle manufacturer in India that has bagged bids for deploying 350 electric buses along with the charging infrastructure across the cities of Lucknow, Varanasi, Gorakhpur, Kanpur, Prayagraj, and Jhansi in the State of Uttar Pradesh (UP).

Source: PMI Electro Mobility Solutions Pvt Ltd (PMI)

The e-buses are aimed at creating 'green routes' in UP, with state-of-the-art nine-meter buses. The city of Lucknow and Kanpur will get 100 buses each, Varanasi and Prayagraj will get 50 buses each, and Gorakhpur and Jhansi will get 25 buses each, the company said in a statement.

Few key features of the e-bus:

- Single charge range of 120 km with capability to do 200 km in city traffic with opportunity charging.
- 151 kWh liquid-cooled Li-on battery with fast charging capability (30-45 minutes)
- Low floor bus (650 mm) having monocoque chassis
- Automatic transmission and ultra-silent air-conditioned cabin
- Superior pick up (Torque 3000 N-m)
- Height-adjustable power seats for driver
- Full air suspension system
- Wheel-chair access with ramp provision
- CCTV enabled with mobile charging points for commuters

Telangana announces exemption of levies for EVs

Image for representation purpose only

The Telangana government has announced that it has exempted road tax and registration fees on the purchase of different kinds of EVs running on batteries, instead of fuel.

According to the order, 100 percent road tax and registration fee exemption would be given for the first two lakh e-2Ws, first 20,000 e-3Ws, first 10,000 electric light goods carriers including 3W (goods carriers), first 5,000 private cars, and 5,000 e-4W (commercial passenger vehicles like cabs and tourist taxis).

Likewise, 100 percent exemption on road tax and registration fee would also be given for the first 500 e-buses, and also e-tractors. A retro-fitment incentive at 15 percent of the cost, capped at ₹15,000, will also be given to the first 5,000 existing three-wheelers, which convert their diesel or petrol engines to battery-run engines.

The order added that tax exception, being offered as part of the Telangana EVs and energy storage policy announced on October 29, 2020, would be given only on the vehicles procured and registered within Telangana State.

The State government had announced the EVs and energy storage policy to bring down automobile pollution, said Puvvada Ajay Kumar, State Transport Minister. He appealed to the private entrepreneurs and green energy producers to make use of the incentives being given by the State government.

As per the policy, which will be in force till 2030, the government would also extend support to the private sector for establishing charging infrastructure for EVs. It calls for setting up charging or swapping stations at every 50 km on national and State highways within the State, and supports prevailing residential townships with 1,000 plus families to develop charging stations lots.

The policy also recommends that the Telangana State Electricity Regulatory Commission shall provide a special power tariff category for EV charging stations. The Telangana State Renewable Energy Development Corporation will act as a nodal agency to establish public charging stations directly or under the licensee/franchisee/PPP model.

Okinawa plans 2W manufacturing unit in Rajasthan

Electric two-wheeler manufacturer Okinawa Autotech has announced its plans to invest ₹150 crore in setting up a new manufacturing unit in Rajasthan and roll out fresh products as it sets a target of selling 100,000 units in the next financial year, as per company sources.

The company, which had freshly launched B2B e-2W - Okinawa Dual, priced at ₹58,998, targeting the delivery sector, anticipates sales from the segment to account for around 20 percent of its total sales.

"We are coming up with a new facility and new products. The total investment in the next fiscal year will be around ₹150 crore," said Jeetender Sharma, Founder and MD - Okinawa Autotech.

The new manufacturing unit will be near the company's prevailing plant in Rajasthan and will have an annual capacity of 500,000 – 600,000 units in the first phase, and can go up to 1,000,000 units in the future. Further the company is said to be aiming at both the B2B and B2C segments.

Sharma feels that the COVID-19 pandemic has fast-tracked the rise of e-commerce and last-mile deliveries. It has become vital for businesses in the delivery segment to innovate, ensure ease of operational costs, and increase efficiency, and Okinawa Dual will address that need. The company will launch its high-speed motorcycle OKI100 in the first half of this year, he added.

Source: Okinawa Autotech

On the sales front, he said Okinawa would close in on cumulative sales of around 1 lakh units by the end of the current fiscal since it started operations in 2017. "In FY 21-22, whatever we have done so far, we will double the number with the coming in of two-three new models. It is a fair estimate that we will sell around 1 lakh units next fiscal," Sharma informed.

Sharma underscored that with the shift to BS-VI emission norms, prices for conventional scooters and motorcycles have gone up, thus reducing the gap with electric counterparts, and Okinawa has focussed on localization to be cost-competitive.

"We have more than 92 percent localization to date. In the next quarter, we are going to be 100 percent," Sharma said, adding that although the battery cells come from outside, the company has a devoted supplier in India supplying the battery packs.

Okaya gets REIL contract for charging stations across India

Battery major Okaya Power Pvt Ltd has obtained Department of Heavy Industries (DHI)-funded contract from Rajasthan Electronics & Instruments Ltd (REIL) for the supply, installation and commissioning of more than 4,244 EV charging stations across the country.

As per the contract, the multi-standard EV charging stations will be a CCS, CHAdeMO, Type-2 and Bharat specification protocol. The contract is funded by the DHI, Ministry of Heavy Industries and Public Enterprises.

"We are delighted to be awarded with the DHI-funded contract for supply, installation and commissioning of 4244 multi-standard EV charging stations with CCS, CHAdeMO & Bharat specification protocol from the prestigious Mini Ratna PSU, Rajasthan Electronics & Instruments Ltd.," said Anshul Gupta, Director, Okaya Power Pvt Ltd.

This is the second such contract won by Okaya. Previously, Okaya bagged a contract for the supply, installation and commissioning of over 200 multi standard EV chargers in all metro cities and major highways, starting with Delhi-Jaipur-Agra, and Mumbai-Pune.

One of the leading Li-ion and lead-acid battery manufacturer and supplier in India, Okaya has also won a contract for the deployment of 1,020 EV charging stations from Energy Efficiency Services Ltd (EESL) as part of the World Bank funded contract. The company has already deployed more than 500 EV charging stations in the last six months, and 250 MWh BESS across the country.

Adani Green secures SECI's 600-MW wind-solar hybrid power project

Adani Green Energy Ltd (AGEL) has announced that its wholly-owned subsidiary Adani Renewable Energy Holding Eight Ltd (AREHEightL) has been awarded a 600 MW wind-solar hybrid power project by Solar Energy Corporation of India.

AREHEightL participated in a tender issued by SECI for setting up 1,200 MW ISTS-connected wind-solar hybrid power project.

"It has won the letter of award (LOA) for the 600-MW wind-solar hybrid project. On December 31, 2020, AREHEightL received the LOA," AGEL informed.

The tariff for this project capacity has been fixed at ₹2.41 per kWh for 25 years. The project is expected to be commissioned in the duration of 18 months from the date of signing the PPA (power purchase agreement), the company said.

With the latest win, AGEL's total capacity stands at 14,795 MW of renewable energy. Of this, 2,950 MW of renewable energy projects are operational and 11,845 MW projects are under implementation, it said.

TPSSL gets GSECL solar project

Tata Power Solar Systems Ltd (TPSSL) has announced that it has received a letter of award (LoA) for a solar photovoltaic project worth around ₹460 crore for Gujarat State Electricity Corporation Ltd (GSECL). As per the award Tata Power Solar will build 95 MW of ground-mounted solar PV project, with the commercial operation date set for April 2022.

With this addition, the order pipeline of TPSSL stands at about 4.2 GWp with a value of about ₹12,500 crore. The company specializes in providing comprehensive EPC (engineering procurement and construction) solutions and also manufactures high-efficiency PV modules.

"We are glad to announce this new win of large grid-based solar EPC contract from GSECL. These orders are a motivation for us to continue focusing on delivering the best to our customers and live up to their expectations," said Praveer Sinha, CEO and MD - Tata Power.

Image for representation only

India & Denmark unveil Green Strategic Partnership

India and Denmark have announced that they have begun a new era in the form of a far-reaching 'Green Strategic Partnership' that will facilitate Denmark in providing sustainable solutions to India.

Prime Minister of the Kingdom of Denmark, Mette Frederiksen, and PM Narendra Modi at the virtual summit

Source: ANI

The partnership is a mutually beneficial arrangement to advance political cooperation, expand economic relations and green growth, create jobs, and strengthen cooperation on addressing global challenges and opportunities; with a focus on an aspiring implementation of the Paris Agreement and the UN Sustainable Development Goals.

The agreement is in line with the vision expressed by Mette Frederiksen, prime minister of the Kingdom of Denmark, and Narendra Modi, prime minister of India, who held a virtual summit on September 28, 2020. The two prime ministers recognized the importance of instituting the Green Strategic Partnership, under which India and Denmark will collaborate through relevant ministries, institutions, and stakeholders.

This partnership will build on and amalgamate the existing agreement instituting a Joint Commission for Cooperation (signed February 6, 2009) between India and Denmark that envisioned cooperation within the political field; economic and commercial field; science and technology; environment; energy; education and culture.

PM Modi also recommended exploring the opportunity for creating an India-Denmark Skill Institute to help Danish companies operating in India to select the people that they require from the local skilled population. Mr. Modi and Ms. Frederiksen held an in-depth exchange of views in a warm and approachable atmosphere on bilateral relations; discussed the COVID-19 pandemic and global matters of interest to both sides, comprising climate change and a green transition; and reached a common understanding with a view to fast-tracking sustainable economies and societies.

The Ministry of External Affairs said over 140 Danish companies are presently participating in the 'Make in India' initiative in India.

Speaking about the Green Strategic Partnership, the Danish Ambassador to India, Freddy Svane expressed, "The Green Strategic Partnership is a vital milestone in the ever-closer cooperation between India and Denmark. Both countries are working on a government-to-government level in the strategic sectors of energy, water, and environment, urbanization, and IPR. This new age partnership will not only lead to creating a green and sustainable future but will also boost job creation, innovation and investments."

India-IEA MoU for knowledge exchange on energy security, sustainability

India recently announced a strategic partnership agreement with the International Energy Agency (IEA) to reinforce cooperation in global energy security, stability, and sustainability. This partnership will lead to an extensive exchange of knowledge and would be a stepping stone towards India becoming a complete member of IEA, according to a statement by the Power Ministry. The framework for the strategic partnership between the IEA members and the government of India was signed on January 27, 2021.

Sanjiv Nandan Sahai, Power Secretary, India and Fatih Birol, Executive Director – IEA, during the signing of the MoU at the virtual summit

Source: International Energy Agency

The contents of the strategic partnership will be mutually decided by IEA members and India, including a phased increase in benefits and responsibilities for India as an IEA strategic partner, and building on prevailing areas of work within the association and the Clean Energy Transitions Programme. The MoU was signed by Power Secretary Sanjiv Nandan Sahai and IEA Executive Director Fatih Birol.

The IEA Secretariat will be in charge of the implementation of the cooperative activities in India and for enabling discussion between the IEA members and India to further develop the strategic partnership. Through this agreement, the Indian government endeavours to take the necessary steps to boost and promote strategic and technical cooperation in the energy sector in the identified areas.

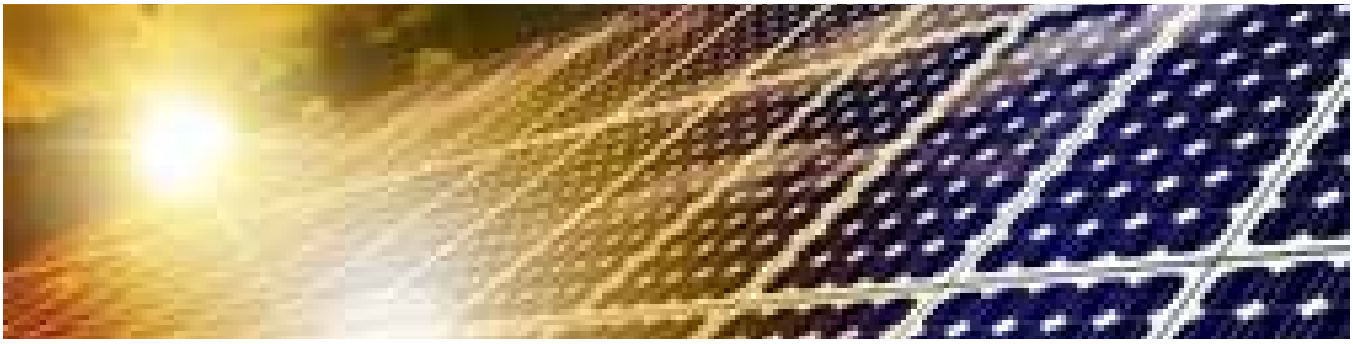

Image for representation purpose only

Total acquires stake in AGEL

French oil and gas major, Total announced that it has acquired 20 percent minority interest in Adani Green Energy Limited (AGEL) from the Adani Group. This acquisition is in line with both Total and Adani's commitment to the development of renewable energy in India.

"This agreement is an important step in our alliance with the Adani Group in India and our common vision and goals with respect to the importance of access to low carbon energy in India," said Patrick Pouyanné, Chairman and CEO of Total.

The latest partnership with AGEL in the renewables space in India is intended to be a key contributor to Total's objective of reaching 35 GW of gross production capacity from renewable sources by 2025, and adding 10 GW per year afterward.

Total and Adani began their energy partnership back in 2018, with investment by Total in Adani Gas Ltd. city gas distribution business, associated LNG terminal business, and gas marketing business. At the time of the partnership, it was agreed that both the parties will continue their alliance into the wider energy space.

Total and Adani agreed on the acquisition of a 50 percent stake in a 2.35 GW portfolio of operating solar assets owned by AGEL and a 20 percent stake in AGEL for a global investment of $2.5 billion. Along with the 20 percent minority interest in AGEL, Total will have a seat on the Board of Directors of the company.

Electric Vehicles

E-bus maker Proterra to go public

Electric transit bus and charging system manufacturer Proterra has announced it will become a publicly listed company through a transaction with ArcLight Clean Transition Corp. The transaction represents an enterprise value of $1.6 billion for Proterra.

The latest deal will provide the U.S. based manufacturer up to $825 million in cash to fund growth initiatives, and $415 million in PIPE investments by Daimler Trucks, Franklin Templeton, Chamath Palihapitiya, Fidelity Management & Research Company LLC, and Funds and accounts managed by BlackRock.

Proterra plans to use the newly injected cash for funding growth initiatives including R&D and the expansion of its next-generation battery program. This new program is designed to improve the cost and performance of Proterra's battery technology to enable the electrification of all commercial vehicle segments, helping reduce pollution, improve air quality, and safeguard the environment around the world.

Proterra has three complementary businesses: Proterra Energy which offers end-to-end turnkey charging and energy management solutions, Proterra Power that delivers battery systems and electrification solutions to commercial vehicle manufacturers and Proterra Transit that provides components used by electric transit bus OEMs.

Proterra Metro-link e-buses

Source: Proterra

Alibaba, SAIC Motor partners to launch innovative electric car

Chinese e-commerce group Alibaba Group Holding has announced that it has stepped up its participation in China's EV sector, launching a sedan with wireless charging under a new brand formed together with SAIC Motor, the country's largest car company.

The sedan unveiled on January 13 under the brand IM (intelligence in motion) was developed by a joint venture between Alibaba, State-owned SAIC, and Shanghai Zhangjiang Hi-Tech Park Development, an investment arm of the city government.

The trio formally launched an electric car joint venture called Zhiji on December 25, 2020. SAIC is the largest shareholder, with a stake of 54 percent, while Alibaba and Shanghai Zhangjiang each hold 18 percent. Alibaba and SAIC first connected to developing high-tech models in 2014.

The IM sedan features a new solid-state battery from Contemporary Amperex Technology (CATL), China's leading battery maker, with a higher energy density than those in use now, as well as chips from the U.S. tech group NVIDIA.

The vehicle will be able to self-park and includes smartphone functions such as photo-shooting and social media sharing. IM will start taking orders in April during the annual Shanghai auto show. A second model, a sports unit vehicle, is targeted for delivery in 2022.

Concept car - IM electric sedan

Source: IM Motors

HYDROGEN

Engie, Total partner for green hydrogen plant

Image for representation purpose only

French oil major Total and utility Engie have inked an agreement to design, build, and operate France's largest renewable hydrogen production site near Total's La Mede biorefinery.

The Masshylia project at Martigues, west of Marseilles will include 100MW solar, 40MW electrolyzer 5mt/day green hydrogen from 2024, subject to necessary financial support and public authorizations.

The green hydrogen produced at the facility will be used to meet the needs of the biofuel production process at Total's biorefinery, avoiding 15,000 MT of CO2/yr, the companies said in a joint statement.

The construction of the project is expected to start next year following the completion of advanced engineering study and the production could begin by 2024 provided the companies secure the required subsidies and funding.

The project has already applied for subsidies from the French (AMI) and European authorities (IPCEI, Innovation Fund).

The companies will also implement solutions for the production and storage of hydrogen to manage the intermittent production of solar and biorefinery's need for continuous hydrogen supply. These solutions include digital piloting system, optimizing the integration of several solar farms supplying the electrolyzer to minimize energy losses and limit grid congestion and hydrogen storage.

France plans to spend €7 billion ($8.4 billion) towards decarbonized hydrogen economy with a 2030 target of 6.5 GW electrolyzer capacity, as per the National Strategy presented by the government last September.

Linde to build 24 MW electrolyzer for green hydrogen

Global chemical company, Linde has announced construction of a 24 MW Proton Exchange Membrane (PEM) electrolyzer plant in Germany.

The electrolyzer is expected to start its production by the second half of 2022 and will be built, owned, and operated by Linde at its Leuna Chemical Complex, Germany. The construction of the plant will be completed through a joint venture between Linde and ITM Power, ITM Linde Electrolysis GmbH.

Linde's plant in Germany.

Source: Linde

"Clean hydrogen is a cornerstone of the German and EU strategies to address the challenge of climate change. It is part of the solution to help reduce carbon dioxide emissions across many industries, including chemicals and refining," said Jens Waldeck, President Region Europe West - Linde.

The hydrogen produced from the facility will be supplied to Linde's industrial existing network of customers. Additionally, it will distribute liquefied green hydrogen to refueling stations and other industrial customers in the region.

According to Linde, the total green hydrogen being produced can fuel approximately 600 fuel cell buses, driving 40 million km and saving up to 40,000 tons of CO_2 tailpipe emissions per year.

As on date, Linde has installed approximately 200 hydrogen fueling stations and 80 hydrogen electrolysis plants worldwide. The company also operates the world's first high-purity hydrogen storage cavern, with a pipeline network of about 1,000 km to supply its customers.

European Commission approves €2.9 billion aid for battery industry

The European Commission earlier this week approved €2.9 billion ($3.5 billion) funding by 12 member States for supporting pan-European research and innovation in the entire battery value chain.

The project called 'European Battery Innovation' was jointly prepared and notified by the States of Austria, Belgium, Croatia, Finland, France, Germany, Greece, Italy, Poland, Slovakia, Spain, and Sweden. The commission has noted that the latest public funding is expected to further trigger €9 billion in private investments, three times more than the public support.

"For those massive innovation challenges for the European economy, the risks can be too big for just one Member State or one company to take alone. So, it makes good sense for European governments to come together to support the industry in developing more innovative and sustainable batteries," said Margrethe Vestager, Executive Vice-President in charge of the competition policy.

The project is aimed at supporting the complete battery value chain starting from the extraction of raw materials, designing and manufacturing of battery cells, modules, and packs to their repurposing, recycling, and disposal in a circular economy with a focus on sustainability.

Source: European Commission

The funding is expected to contribute towards new technological advances from R&D on different cell chemistries and novel battery production processes in addition to other innovations along the battery value chain.

The European Commission plans to cut down greenhouse gas emissions from the transportation sector under the European Green Deal, an ambitious plan that aims to make EU climate-neutral by 2050.

According to the commission, the project will involve 42 companies and 46 projects, including small and medium-sized enterprises (SMEs) and start-ups with activities in one or more member States. The direct participants will closely cooperate with each other through nearly 300 collaborations envisaged, and with over 150 external partners, such as universities, research organizations, and SMEs across Europe. The overall project is expected to be completed by 2028 (with differing timelines for each sub-project).

"Thanks to its focus on a next-generation of batteries, this strong pan-European project will help revolutionise the battery market. It will also boost our strategic autonomy in a sector vital for Europe's green transition and long-term resilience," said Maroš Šefčovič, VP of European Battery Alliance (EBA). "Our success lies in collaboration, with some 300 partnerships between industrial and scientific actors foreseen under this project alone."

The latest funding is intended at making Europe a global battery hotspot and reduce the region's reliance on Asian markets. Sefcovic estimates that the actions under the EBA will result in an industry robust to power at least 6 million electric cars each year.

"By establishing a complete, decarbonised and digital battery value chain in Europe, we can give our industry a competitive edge, create much-needed jobs and reduce our unwanted dependencies on third countries - in short, make us more resilient," stated Thierry Breton, Commissioner for Internal Market.

AGL selects Wartsila, Fluence as suppliers for battery storage plan

Australian energy company AGL Energy recently announced that energy storage technology provider Wartsila and Fluence have been selected to supply up to 1000MW of grid-scale battery storage.

Wartsila and Fluence have signed a non-exclusive five-year Large Scale Storage Frame Agreement for AGL's energy storage projects.

The three partners are said to be well advanced with the planning process and expect the framework agreement to reduce timeframes for individual projects, enabling faster project schedules and commercial operations.

In 2020, AGL announced its plans to develop energy storage installations near Loy Yang power station in Victoria (200 MW), Liddell power station (150 MW), and Broken Hill (50 MW) in New South Wales, and Torrens Island (250 MW) in South Australia. These grid-scale energy storage plans are expected to play a key role in the Australian energy industry's transition from fossil fuel-based energy towards cleaner energy.

"Australia is a country with unparalleled renewable energy resources and a unique opportunity to swiftly decarbonize and move towards renewable energy. Flexible capacity such as energy storage will be needed to balance renewables and keep the grid stable and reliable," said Kari Punnonen, Director Australasia - Wärtsilä Energy.

"AGL is a valued customer for Wärtsilä and we look forward to supporting AGL's plans for critical firming capacity that will play a leading role in the energy transition from coal to renewables."

Fluence, a pioneer in storage technology, currently contracting and deploying 100+ MW storage solutions and portfolios of storage assets on grids across the globe also expressed its commitment to support AGL's goal of delivering firm renewable power.

"AGL is leading the way, taking battery-based energy storage in Australia to the next level to deliver large-scale flexibility that is critical to support the National Electricity Market," said Jan Teichmann, Vice President of Global Markets at Fluence. "Australia's grid is evolving quickly, and batteries can fill critical gaps left by coal and gas retirements, both the super-fast services needed to strengthen the grid and as a source of peak power."

Fluence and Wartsila will offer its latest-generation technology to support the 1000MW grid-scale battery storage plan.

AGL Loy Yang Lights 1 Project

Source: AGL Energy

VanadiumCorp signs trilateral deal for battery technology for marine ships

Mining and technology company, VanadiumCorp has announced a trilateral partnership with Conoship International Projects BV (Conoship) from the Netherlands and Vega Reederei and Partners GmbH (Vega) from Germany, to commercially develop next-generation vanadium redox flow-battery technology (VRFB battery) and high-energy-density electrolyte technologies for marine propulsion applications.

As per the MoU the three companies will establish a Special Purpose Vehicle company (SPV) that will combine the shipping expertise of Conoship, the technical innovation of Vega along with Vanadium Corp VRFB development expertise. The SPV targets Zero-Emission shipping markets with next-generation redox flow batteries.

"Greenhouse gas reduction is exceptionally challenging for the shipping industry. The industry's 2050 climate goal of halving greenhouse gas emissions from 2008 levels can only be achieved with the accelerated construction of zero-emission ships and novel solutions," said Adriaan Bakker, CEO of VanadiumCorp.

The role of VanadiumCorp is to develop the main components of the VRFB system that includes a battery stack of appropriate power size and an optimized electrolyte formulation of favorable energy density. VanadiumCorp will enlist its skilled partners in electrolyte production, VRFB manufacturing, and R&D.

As per VanadiumCorp the SPV seeks to:

- Develop a next-generation redox flow-battery stack based on a breakthrough high-energy-density vanadium electrolyte that is specifically formulated for marine propulsion applications.
- VanadiumCorp will contribute new flow-battery designs, a high-energy-density electrolyte formulation, manage research and development, and provide its network of manufacturing partners.
- Conoship will contribute marine engineering designs to integrate the more compact redox flow-battery into the propulsion systems of marine vessels and ships.
- Vega will arrange project financing, contribute fleet operations expertise, and conduct field testing of the marine battery prototype.

Key advancements in energy density form a strong business case and stem from VanadiumCorp's R&D cooperation with CENELEST (the German-Australian Alliance for Electrochemical Technologies for the Storage of Renewable Energy that combines the strengths of both the Fraunhofer Institute for Chemical Technology and the University of New South Wales (UNSW) in redox flow battery systems.

The new battery technology seeks to decarbonize shipping routes and in-port ship movements.

The company noted that next-generation VRFB Battery design and the new high energy electrolyte solves the challenge of high-energy-density not met by conventional VRFBs and solving this challenge allows the SPV designs to scale to large capacities, deliver energy without waste heat, and vastly extend energy storage beyond lithium-ion's typical 4-8 hour operating time.

Image for representation purpose only

Source: Flickr

Fortum Klaipėda combined heat and power plant.

Source: Fortum

Fortum expands EV battery recycling operations in Finland

Finnish State-owned energy company, Fortum announced an expansion of its EV battery recycling operation with a new processing plant in Finland.

The announcement came in conjunction with the launch of Finland's National Battery Strategy that aims to make the country a pioneer in sustainable battery manufacturing. The new mechanical recycling processing plant will be opened this month (February 2021) in Ikaalinen, Finland.

"Our new plant in Ikaalinen will enable us to leverage our existing recycling operations in Finland and will give us the annual capacity to recycle approximately 3,000 tons of used batteries, corresponding to about 10,000 EV batteries," says Tero Holländer, Head of Business Line Batteries at Fortum.

Mr. Holländer confirmed the company plans to gradually increase this capacity in the coming months to bridge the raw material gap faced by the automotive industry working towards electrification of transportation.

The new plant in Ikaalinen will complement Fortum's existing hydrometallurgical pilot facility in Harjavalta, Finland, which is already capable of operating on an industrial scale.

At present, several operators recycle battery metals by smelting which results in lower material recovery rates and higher emission, however, Fortum's recycling operations use both mechanical and hydrometallurgical methods for recycling batteries.

This approach can reach a recovery rate of up to 95 percent of the metals included in the valuable active materials of a battery's black mass, Fortum said in a statement.

Volkswagen opens its first recycling plant for electric car batteries

German automobile major Volkswagen Group (Volkswagen Group Components) opened its first recycling plant for electric car batteries in Salzgitter.

The global auto manufacturer has been taking measures to ensure sustainable end-to-end responsibility for the entire value chain of the electric vehicle battery and hopes the Salzgitter plant will help recover valuable raw materials such as lithium, nickel, manganese, and cobalt in a closed-loop together with aluminum, copper, and plastics, achieving a recycling rate of more than 90 percent over the long term.

"Volkswagen Group Components has achieved a further step in its sustainable end-to-end responsibility for the battery as a key component of electric mobility," said Thomas Schmall, Member of the Board of Management of Volkswagen AG, Technical Division, and Chairman of the Board of Management of Volkswagen Group Components.

"We are implementing the sustainable recyclable materials cycle – and play a pioneering role in the industry for a future-oriented issue with great potential for climate protection and raw material supply," Schmall added.

A distinguishing feature of the Salzgitter plant is that it only recycles batteries that can no longer be used for other purposes. Prior to recycling, an analysis determines whether the battery is still powerful enough to be given a second life in mobile energy storage systems such as the flexible rapid charging station or the mobile charging robot, the company stated.

According to the company, the CO_2 savings from the recycling process does not involve energy-intensive smelting in a blast furnace. The used battery systems are delivered, deep discharged, and dismantled, post which, in addition to aluminum, copper, and plastics, also yields valuable "black powder", which contains the important raw materials for batteries such as lithium, nickel, manganese, and cobalt, as well as graphite. The separation and processing of the individual substances is done by hydrometallurgical processes.

"As a consequence, essential components of old battery cells can be used to produce new cathode material," said Mark Möller, Head of the Business Unit Technical Development & E-Mobility.

"From research, we know that recycled battery raw materials are just as efficient as new ones. In the future, we intend to support our battery cell production with the material we recover. Given that the demand for batteries and the corresponding raw materials will increase drastically, we can put every gram of recycled material to good use."

Andreas Salewsky (r), plant manager Volkswagen Group Components Salzgitter, and local works council chairman Dirk Windmüller, commence operation of the recycling plant.

Source: Volkswagen Group

U.S. set to rejoin Paris climate accord

United States President, Joe Biden signed an executive order in January, to rejoin the U.S. in the Paris climate agreement – in his first major action aimed at tackling global warming.

Globally, 190+ countries have adopted the Paris Agreement, which is a landmark, global action plan to tackle climate change. The accord gives the governments around the world a framework for avoiding the dangerous impacts of climate change by limiting global warming to well below 2°C and pursuing efforts to limit it to 1.5°C.

Biden signs Executive Order for United States' return to the Paris Agreement.

Source: ANI News

Biden has vowed to move swiftly on climate change action and his inclusion of climate experts and scientists throughout the newly formed government marks the beginning of major policy reversal after Trump withdrew from the agreement in 2017.

Welcoming the U.S. back in the accord, French President Emmanuel Macron said, “We will be stronger to face the challenges of our time. Stronger to build our future. Stronger to protect our planet. Welcome back to the Paris Agreement!”

UN Secretary-General Antonio Guterres also welcomed the decision and called upon President Biden to adopt ‘an ambitious plan to fight global warming’. “I warmly welcome President Biden's steps to re-enter the Paris Agreement on Climate Change and join the growing coalition of governments, cities, states, businesses, and people taking ambitious action to confront the climate crisis," Guterres said in a statement.

John Kerry will serve as the Special Presidential Envoy for Climate.

Hydrovolt to set up Norway’s first EV battery recycling plant

Hydrovolt, the joint venture between Swedish battery producer Northvolt and Norwegian industrial group Hydro has started the construction of Norway’s first recycling plant for EV batteries.

The plant which will be 100 percent powered by renewable energy will be located in the town of Fredrikstad, Norway, and is intended to harness recycling synergies between battery and aluminum industries. Hydro and Northvolt together have invested NOK120 million in the plant through the joint venture.

“Norway has long been a global leader in electric car adoption. At the start of 2021, we became the first country in the world where over half of all new cars sold are electric. We should therefore also aim to be world-leading in recycling the used car batteries when the electric cars reach their end-of-life,” said Fredrik Andresen, CEO - Hydrovolt.

According to Hydrovolt, the plant will be extensively automated and designed for crushing and sorting batteries, having an initial plant capacity to process more than 8,000 tons of modules from batteries each year. Through a possible expansion, the plan is to also process batteries other than car batteries, including those from the marine sector, from all over Europe. The plant is set to start operations in late 2021.

Image for representation purpose only.

Source: Hydro Media

Hydro has also confirmed that Batteriretur, a Norwegian company located next to the new Hydrovolt plant in Fredrikstad, will supply batteries and operate the plant.

The plan is to closely integrate operations with Hydro and Northvolt’s existing businesses. Aluminum from the used batteries will be recycled and reused by Hydro, while the ‘black mass’ containing lithium, manganese, nickel, and cobalt will either be reused in Northvolt’s battery production or sold to other parties.

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Budget 2021: What's in store for RE and EV sector?

Finance Minister Nirmala Sitharaman addresses press conference after presenting the Union Budget 2021 in the Indian Parliament

Finance Minister Nirmala Sitharaman presented the Union Budget 2021-22 in Parliament on February 1, 2021. Presenting the first-ever paper-less budget, the FM expressed, "the preparation of this budget was undertaken in circumstances like never before." Speaking of making India *Aatmanirbhar* (self-reliant) Ms Sitharaman noted that the budget for 2021-22 will rest on six pillars:

- **Health and Wellbeing**
- **Physical & Financial Capital, and Infrastructure**
- **Inclusive Development for Aspirational India**
- **Reinvigorating Human Capital**
- **Innovation and R&D**
- **Minimum Government and Maximum Governance**

Speaking of *Swachh Bharat* and *Swasth Bharat*, the FM said the government proposed to provide an amount of ₹2,217 crore for 42 urban centers with a million-plus population to tackle the problem of air pollution.

Vehicle Scrapping Policy

She also announced a voluntary Vehicle Scrapping Policy to phase out old and unfit vehicles. As per the policy terms, all the vehicles will have to undergo fitness tests (after 20 years in case of personal vehicles, and after 15 years in case of commercial vehicles).

"This will encourage fuel-efficient, environment-friendly vehicles, thereby reducing regular pollution and oil import bills," she underscored.

Production Linked Incentive (PLI) scheme

Speaking of the *Aatmanirbhar Bharat* vision and the PLI scheme, the FM noted that for a $5 trillion economy our manufacturing sector will have to record a double-digit growth on a sustained basis. To achieve this ambitious goal, the government has announced the PLI Scheme for 13 key sectors (including Advanced Chemistry Cell battery manufacturing, automobiles and auto components) and committed ₹1.97 lakh crore for over five years starting this financial year.

"This initiative will help bring scale and size in key sectors, create and nurture global champions, and provide jobs to our youth," Ms Sitharaman emphasized.

Power infrastructure reforms

Highlighting a need for a framework to give consumers alternatives to choose from among different distribution company, and expressing concern over the viability of the distribution companies, the FM proposed to launch a revamped reforms-based result-linked power distribution sector scheme with an outlay of ₹3,05,984 crore over five years.

The scheme will provide assistance to Discoms for infrastructure creation including pre-paid smart metering and feeder separation, upgradation of systems, etc., tied to financial improvements.

Hydrogen energy

In November 2020, PM Modi - in the 3rd Global RE-INVEST Renewable Energy Investors Meet & Expo – had announced plans of a Comprehensive National Hydrogen Energy Mission. Following this the FM announced a proposal to launch a Hydrogen Energy Mission in 2021-22 for generating hydrogen from green power sources.

Non-conventional energy

With the objective to boost power

generation from the non-conventional energy sector, the FM proposed an additional capital infusion of ₹1,000 crore to the Solar Energy Corporation of India and ₹1,500 crore to the Indian Renewable Energy Development Agency (IREDA).

"We have already acknowledged that solar energy has huge promise for India. To build up domestic capacity, we will notify a phased manufacturing plan for solar cells and solar panels," she added.

To encourage domestic production, the FM also proposed to raise duty on solar invertors from 5percent to 20 percent, and on solar lanterns from 5 percent to 15 percent.

MSMEs

FM highlighted that several steps were taken to support the MSME sector, and has provided ₹15,700 crore to this sector in this year's budget.

Innovation and R&D

The FM recalled that in her Budget Speech of July 2019, she had announced the National Research Foundation, adding that the NRF outlay will be of ₹50,000 crore, over five years. It will ensure that the overall research ecosystem of the country is strengthened with focus on identified national priority thrust areas.

Emerging Technology News magazine spoke to industry players to understand their take on the Union Budget 2021, following are some excerpts.

GUENTER BUTSCHEK
CEO & MD
Tata Motors

"Budget 2021 is a progressive statement of intent and action that aims to both stimulate and sustain growth following an unprecedented year. The significant increase in overall allocation towards capital expenditure has been complemented with comprehensive measures to catalyze multiple levers - focus on rural, infrastructure investment, impetus to manufacturing, social welfare, entrepreneurship and digital - to enable overall holistic development.

For the automobile sector, which is a significant contributor to India's GDP, there are multiple welcome announcements including a voluntary vehicle scrapping policy to phase out old and unfit vehicles, augmenting public transport system in urban areas, continuing focus on adoption of cleaner fuels, and enhancing outlays for developing road infrastructure and expanding the *Swachh Bharat Mission.*"

CHETAN MAINI
Chairman & Co-founder
SUN Mobility

"The Budget is focussed on speeding up recovery post-COVID, while also providing solid direction to do so, over the next few years, which is excellent.

When it comes to e-mobility, the main expectation was a firmer commitment from a policy standpoint by the government for accelerating e-mobility and enabling charging and battery swapping infrastructure in the country for the same. One of the key measures for doing so would have been to fix the inverted duty structure for components such as batteries from 18 percent to 5 percent, and for charging/swapping infrastructure services from 18 percent to 5 percent as well. While this was not mentioned during the Budget, we look forward to the GST Council taking this up, and implementing it soon.

The announcement of the outlay of ₹18,000 crore to support augmentation of public bus transportation services is a welcome announcement, along with the deployment of 'MetroLite' and 'MetroNeo' services for ease of mobility across Tier 2 cities and peripheral areas of Tier 1 cities. This opens up the possibilities of providing last mile connectivity in and around these locations via electric vehicles like e-autos and e-rickshaws, provided adequate support is given by the government for setting up charging and swapping infrastructure.

Similarly, implementation of the scrappage policy is a good move, which can be further enhanced by providing additional incentive for replacing old vehicles with electric ones, instead of other ICE vehicles, for driving mass EV adoption.

The EV industry needs to not only 'Make in India', but also 'Design in India', so we look forward to the details of the ₹50,000 crore Innovation and R&D outlay that was announced, as well as the PLI scheme and how they can benefit the sector, as these will be key enablers in making EVs take off in the country. This will help create manufacturing global champions for an *Aatmanirbhar Bharat,* boosting start-ups to achieving a $5 trillion economy."

GURPRATAP BOPARAI
Managing Director
ŠKODA AUTO Volkswagen India

"The Union Budget for 2021-22 augers well to create capacity for development and growth in the country. Increased outlays in the road sector, infrastructure development and introduction of the voluntary vehicle scrappage policy will not only create a safer and environment-friendly auto sector but also drive replacement demand in the sector.

The support announced for the rural economy and farm sector will be a big boost for wealth creation in the non-urban markets and increase the scope for auto demand in these regions. While further details of the prior announced PLI scheme is awaited, the same is expected to help the Indian auto industry to improve production efficiency and become self-reliant – *Aatmanirbhar*.

It is important to keep in mind that even in the coming financial year, the passenger vehicle market is unlikely to reach the level of 2018 and the much-required rationalization of GST and cess to aid the auto industry was missing. Additionally, the increase in customs duty on certain auto parts to 15 percent will further increase input costs and prices for cars which depend on specialised components which cannot be manufactured locally due to unviable volumes."

KUSH SINGH
CEO
Essar Power

"We would like to thank the government for giving due emphasis to the power sector in this year's budget 2021. In a highly anticipated move FM announced a ₹3,05,984 crore scheme to reform the power distribution sector in the country. T&D losses have plagued the power sector for a number of years and this scheme will surely help reduce losses and improve efficiency of electricity distribution companies (Discoms).

The proposed amendments and Electricity (Amendment) Bill, 2021, with measures such as 'de-licensing' of the power distribution business to bring in competition is a very consumer-centric move, which aims at creating a level playing field for all distribution companies.

The ₹1,000 crore grant for the growth of the solar energy sector and ₹1,500 crore to the renewable energy sector is also a welcome move, and will help the country in achieving the ambitious target of 175 GW of renewable energy capacity by the year 2022. These measures and reforms will definitely help improve the health of the sector and enhance growth in the coming few years."

SANJAY AGGARWAL
Managing Director
Fortum India

"The Union Budget announced has crucial steps to contribute towards the growth of the Indian economy. Fortum India welcomes the measures proposed by the government to address concerns related to air pollution and promotion of renewable energy sector. The outcome and result-based financial package of ₹3 lakh crore for Discoms is a good move. Setting up of the National Hydrogen Mission, allocation of ₹2,500 crore to SECI and IREDA, and introduction of a phased manufacturing plan for solar cells and panels will help boost the renewable energy sector, going forward.

Considering the high levels of pollution that the country has been witnessing, the FM's proposal of ₹1.41 lakh crore for Urban Clean India Mission, ₹2,217 crore for 42 urban centres with million-plus population for clean air, and launch of a voluntary vehicle scrapping policy is laudable. The scheme would promote fuel-efficient and environment-friendly vehicles while cutting on India's huge import bills."

N VENU
Managing Director
Hitachi ABB Power Grids in India

"The Union Budget 2022 covered areas that will have a multiplier effect and create long-term opportunities for India and India Inc. As a player in the power industry, we appreciate the focus on capital expenditure, education and research, and bank recapitalization.

We see the ₹2,500 crore funding to promote renewables and the push for a Hydrogen Energy Mission from green power sources as good news in the longer run for the power sector.

The competition in power distribution can help ensure performance-based assistance totaling ₹3 lakh crore for Discoms doesn't become a redux of Uday 2.0. The industry will parallelly need to adapt to the higher duties on solar cells while also balancing the continued GST slabs.

Besides, attention on urban transportation through metro rail and city bus services can become steps towards our clean energy transition goals, if there is greater emphasis on mass electric transportation. There was no mention of National Electric Mobility Mission plan 2020, and extension of capital subsidies under FAME. We were also hoping to see the inclusion of e-mobility infrastructure and other ancillary power supply chain in the PLI scheme to give the desired push to self-reliance.

Focus on building freight corridors, a record outlay for future-ready railway system and electrifying 46,000 RKM by this year are much appreciated and are positive announcements for us. They will create the need for modern and reliable power infrastructure. Yet, the timeline for 100 percent electrification by December 2023 may prove challenging unless government and industry work in close collaboration."

NISHANT ARYA
Executive Director
JBM

"The allocation of ₹18,000 crore for the public bus transport services has come as a sigh of relief for the bus makers who have been caught in the doldrums from 2019. The proposed PPP model will in turn help the sector to create employment as well and overcome the adverse effect of the pandemic.

We, as an industry player, are now looking forward to the details of the vehicle scrappage scheme which will be an added advantage for the auto sector. The heavy and medium commercial vehicle sector will also have a boost in demand as a sum of ₹5.54 trillion has been allocated for infrastructure development. The 2.5-5 percent reduction in the customs duty on some of the semi-finished and finished steel products will have a positive impact on the automotive industry.

The solar sector is now awaiting notification on phased manufacturing for solar cells and solar panels. The increased custom duty on solar inverters, solar lanterns/lamps from 5 percent to 20 percent and 15 percent respectively will encourage domestic production which is the need of the hour to fulfill the dream of *Aatmanirbhar Bharat.*

The government's thrust towards green energy generation has further been consolidated and initiatives such as SATAT aimed towards setting up biogas projects will see speedy deployment."

DEEPAK PAHWA
Managing Director
Bry-Air (Asia)

"The Union Budget 2021 stands up to the challenges put up in the pre- and post-COVID world and gives preference to economic growth. The budget has pushed a substantial increase in expenditure to bolster the infrastructure sector growth in India. This in turn will show significant results in the near future and create employment opportunities. The roadmap presented for the healthcare and infrastructural sector will revitalize the economy and bolster growth.

The automobile industry is the number one sector in the country and will continue to be one. The FM has already increased the taxes on the imported automobile components. So, naturally, the 'Make in India' movements will get a boost and it is going to create more employment potential and add to growth in our country.

The old vehicle scrappage policy will lead to a boost in demand for new cars. This step will help the automotive industry bounce back after witnessing a significant down in the revenue sheets. The government has taken a strong decision to hike the basic customs duty on certain auto components as this measure will encourage local manufacturing in India.

Also, the announcement for the adoption of solar energy in multiple sectors will definitely open new

business opportunities and will help India in faster adoption.

The FM has not tinkered around with corporate taxation, which will lead to improved business earnings for corporates. Also, tax-payers were awaiting some kind of rebate in ITR but, it was given a miss. Nevertheless, it's good that the government has not played with tax slabs otherwise it would have sent negative sentiments among tax-payers. Buyers will have money in their pocket to spend, which will lead to increase in demand and thereby stabilize the economy. Monetization of Assets and Disinvestment will provide time to the industry to recover from the global slowdown. The Union Budget FY 21-22 has brought a ray of hope to energize and strengthen the economy."

SIDDHARTH R MAYUR
Founder & CEO
h2e Power Systems

"It is motivating to see that our government is focused on climate crises and is giving impetus to fuel cell and alternate fuel sector with the National Hydrogen Energy Mission. We welcome this initiative - the generous allotment given to renewable energy sector. It shows the seriousness of our government towards climate change.

Taking cue from other regions across the world, driving change and encouraging the green hydrogen sector via various policies, the Indian government is well set on the path to establish a leadership position in green hydrogen, just as we did with the International Solar Alliance under the dynamic leadership of the Honourable Prime Minister."

PRABHAJIT KUMAR SARKAR
MD & CEO
Power Exchange India Ltd (PXIL)

"The Union Budget for 2021-22 has given a big push to the power sector by announcing close to ₹3.06 lakh crore power distribution sector scheme. We welcome this move as it is expected to assist Discoms for infrastructure creation tied to financial improvements, including prepaid smart metering, feeder separation, and upgradation of systems. Additionally, the government's proposed framework to give consumers more than one Discom choice was a much-needed move. It will help to enhance efficiency in the power distribution sector, induce fair competition, and address the monopoly business of Discoms.

Besides, we foresee that reforms such as ₹1,500 crore allocation for the renewable energy sector, 100 percent Railway electrification and expansion of metro rail networks, and hydrogen energy mission for generating hydrogen out of green-powered sources will contribute significantly in enhancing the country's power demand."

INDERVEER SINGH
Founder & CEO
EVage

"As a four-wheeler commercial EV manufacturer, we at EVage welcome the steps the government has taken with the new scrappage policy as it will help accelerate the EV adoption in India; and the boost to road infrastructure, which will in turn enhance consumption pattern and increase disposable income.

Lastly, the increase in custom duty to 15 percent will facilitate indigenising auto components manufacturing, enhance job creation and tech capabilities in India. Along with these positive measures, we were hoping that the government would also induct the EV sector as a priority lending sector."

R. MUKUNDAN
Managing Director & CEO
Tata Chemicals

"The first budget of the new decade has ensured the right balance of sustainable growth, social equity and long-term competitiveness of the Indian economy.

The continued support of manufacturing with the Productivity Linked Incentive (PLI) Scheme will further strengthen the *Aatmanirbhar Bharat* Mission to help the country integrate more strongly with the global supply chain. The PLI scheme coupled with duty rationalisation of inputs especially naphtha will bode well for value-added products and speciality chemicals. Also, the start of the hydrogen economy is a welcome step.

The proposed step to create more stability in tax regime is a welcome move. This, combined with simplification and a further improvement in the dispute resolution process, will augur well for tax compliance and increase in resource mobilization.

All in all, a balanced approach to resource mobilization, stability in taxation and focused sectoral steps to spur manufacturing growth will ensure that we come out of this pandemic stronger and more competitive."

RAMINDER SINGH JAURA
Managing Director
Schaltbau India Pvt Ltd

"The automotive sector was feeling the bite of a slowdown even before the pandemic struck the world. The budget aimed at a post-pandemic economic recovery and introduced some important policies for the automotive sector. This will flip to EV industry as well.

There are many good steps such as introduction of the Vehicle Scrappage Policy, strengthening of the public transport sector under PPP models with an outlay of ₹18000 crore for operating 20000 buses; ₹2,217 crore for 42 urban centers with a million-plus population, announcement of capital investment of ₹5.54 trillion in developing infrastructure around the country, which will boost the demand for heavy and medium commercial vehicles, tax holiday for startups, etc.

I think the budget pushes businesses towards 'Make in India' as there is increase in custom duty on certain auto components. This should be considered in right spirit as there is enough capability available within India to boost local manufacturing.

I think we should look for more support on inverted duty structure and the production-linked incentive (PLI) scheme for EV industry."

Industry body welcomes announcements on hydrogen, PLI scheme and microgrids

DR RAHUL WALAWALKAR
President
IESA

Commenting on the announcement of vehicle scrappage policy, Dr. Rahul Walawalkar, President - India Energy Storage Alliance (IESA) said: "This is a great opportunity and a welcome step."

IESA is India's only industry alliance focused on the advancement of advanced energy storage, and e-mobility technologies in the country.

Applauding the decision on Hydrogen Energy Mission, Dr. Walawalkar added that "advanced chemistry cell battery manufacturing mission and hydrogen mission together can enable India to fast-track decolonization of grid, industrial sector, and transportation sector in coming decade."

On MSMEs and rural infrastructure development, Dr. Walawalkar noted that the allocation of Rural Infrastructure Development Fund from ₹30,000 crore to ₹40,000 crore has been a step in the right direction.

"We are confident that energy storage and microgrids have the potential to transform not just India's electric grid in next the 5-10 years, but also to help advance energy access challenges around the globe," Dr. Walawalkar said.

While IESA applauds the influx of funds in the MSME sector, Dr. Walawalkar mentioned that there is a need for an infrastructure fund dedicated to the rural.

IESA recommendations to FM for EVs and ES sector

The India Energy Storage Alliance (IESA) wrote a recommendation letter after garnering views from several industry members operating in the electric vehicle and energy storage sector in India. In the recommendations to Finance Minister Nirmala Sitharaman, IESA urged the government to reduce GST for batteries and charging / swapping, suggesting to keep it at 5 percent.

IESA acknowledged that GST council, in 2020, reduced the GST rates on EVs from 12 percent to 5 percent, the GST for stationary storage batteries (for Li-ion only) remained as high as 18 percent. Similarly, differential taxation structure, i.e., 5 percent GST on chargers and 18 percent on the charging/swapping services, has stunted the sector's growth. The industry expects to reduce the GST across the energy storage technologies (including advanced battery technologies like flow batteries, zinc batteries, sodium batteries, metal air batteries, etc.).

The alliance emphasized the need to provide a level playing field for GST on batteries for all energy storage applications. It also urged the government to consider EV charging or battery swapping as a special service. The applicable GST can be 5 percent for, similar to the EVs and public transport services that are currently administered at 5 percent.

On duties for cells and supply chain components including raw and processed materials as well as manufacturing equipment, IESA urged the government to bring all the components under 5 percent margin in order to create competitive and robust market. The alliance stated, the only way to accelerate the pace of domestic manufacturing is by supporting demand creation, and reduced duties will help in accelerating the adoption in next 12-18 months.

Speaking of tax benefits for storage projects, IESA urged the government to extend provision of exemptions of tax benefits (charges & duties) to storage projects to encourage storage projects and overcome largescale RE integration issues. It has requested for relaxation of tax benefits to storage projects for at least three years.

Image for representation only

India's e-2W sector envisions a smooth ride towards e-mobility

The EV sales have increased in the past five years with an increase in the adoption of high-performance e-2Ws. Over the years, e-2Ws have penetrated the market and will continue to witness an increase in demand; accounting for nearly 97.5 percent of all EVs sold in FY20.

EV adoption in India over the next five years is going to be essentially driven by two-wheelers and three-wheelers. The e-2W market in India is developing on account of increased government policies supporting battery-powered vehicles, the growing cognizance toward the environment, snowballing petrol prices, and strict emission norms. It is not a new development that there has been a constant push for the adoption of EVs in India for a few years now. India has shown considerable progress in the e-2W space with serious players entering the EV market.

With a massive focus on e-mobility around the world, India needs to push the adoption of EVs and develop the infrastructure. Therefore, the centre has introduced several policies such as FAME II and the phased manufacturing plan for EVs. Even the State governments are offering additional subsidies for end consumers and have also introduced policies that have focussed on creating attractive incentives for OEMs to set up manufacturing plants. These initiatives will act as a catalyst to the development of the sector and will address the apprehensions of the manufacturers, sellers, and customers.

Recent government policies have taken into consideration the need to electrify the motorized 2W fleet. In 2019, the national government recommended a plan to sell only e-2Ws (up to 150 cc) from March 2025 onward.

Furthermore, to regulate the pollution emitted by vehicles, the central government has skipped Bharat Stage V (BSV) emission standards and directed that all vehicle manufacturers, both of 2W and 4W, manufacture and sell only BSVI vehicles from 1st April 2020. The strict emission standards have led to a surge in conventional fuel-based two-wheelers prices in the range of 7-15 percent, which is further projected to benefit the Indian electric scooter and motorcycle market.

As part of the drive towards e-mobility, the government now plans to set up more electric vehicle charging points across the country. Minister for Road, Transport and Highways Nitin Gadkari said that the Center's strategy is to set up at least one EV charging station at around 69,000 petrol pumps across the country, to drive people to use more EVs in the future.

Gadkari had also recommended that EV manufacturers should keep the cost of EVs down to appeal to more buyers and forfeit profit for the time being to reap the benefits later. He had said, "Reducing cost may result in some losses initially, but will bring great benefits. As a marketing strategy, you have to reduce the cost to get numbers."

Innovations in e-bikes are snowballing swiftly. Bulky lead-acid batteries have made way for much more compact and lighter nickel cadmium and Li-ion batteries. Innovations have also given rise to novel trends including folding e-bikes and IoT enabled smart e-bikes with app connectivity. With such development, e-bikes have become a highly sustainable and effective solution to the air pollution and traffic congestion woes of India.

For deriving the maximum revenue from the swiftly growing Indian e-2W market, there has been a surge in industry players as well as startups foraying into this space.

- Electric 2W manufacturer Okinawa has announced the launch of a e-2W - Okinawa Dual, designed with the delivery sector in view. It has also announced its plans to invest ₹150 crore in setting up a new manufacturing unit in Rajasthan, and roll out fresh products as it sets a target of selling 1 lakh units in the next financial year.
- Delhi-based e-2W manufacturer Komaki has introduced a new electric scooter in the market. It announced the launch of three battery-powered 2Ws - TN95, SE, and M5.
- Mumbai-based e-2W manufacturer Odysse Electric Vehicles, has launched a series of low-speed electric scooters called the E2Go and E2Go Lite in the Indian market
- Mumbai-based Earth Energy EV has ventured into the e-2W segment with three new offerings. It has launched the Glyde+ electric scooter, and two electric motorcycles - EvolveR and the EvolveX - all of which, the company says have been completely developed in India.
- Bengaluru-based EV manufacturer Ola Electric, has started testing its electric scooter and will commercially launch it soon.
- Ola has announced that it has partnered with Siemens to build India's most advanced EV manufacturing facility in Tamil Nadu worth ₹2,400 crore.
- Ahmedabad-based technology startup – Matter, has announced that it plans to unveil EVs and a range of energy solutions in India starting 2021.
- Public bike sharing company SmartBike has announced that it has introduced its world class e-bike and the country's first shaft transmission (no chain) NextGen bicycle in Chennai, in collaboration with Greater Chennai Corporation (GCC) and Chennai Smart City Ltd.
- Goa-based Kabira Mobility has launched two high-speed electric bikes - KM3000 and KM4000.

Industry Outlook for 2021

To learn more about the industry's viewpoint on e-2W sector development in the year 2021, ETN connected with few prominent manufacturers, following are their views.

NAVEEN MUNJAL
Managing Director
Hero Electric Vehicles

Expectations for the year 2021

With 2020 taking a hit as far as the entire vehicle market is concerned, e-2Ws however, had a silver lining. Through the lockdown, with the absence of petrol vehicles on road, the world noticed how clean the environment could be if we switched to electric on a global scale. This resulted in several thousand consumers in India alone opting for clean mobility in the form of electric two-wheelers and electric cars to an extent.

Going in 2021, I feel the trend would continue, as awareness levels rise. The e-mobility space has been slowly and steadily moving upward. Now with new norms, policies, and mandates by the government sectors; technological innovations and product offerings by the manufacturers; and self-actualization by the consumers; the numbers would only increase.

Product/Technology/Policy to stimulate sector growth

We firmly believe that government mandates will be the missing link between EVs and mass adoption. With existing policies pushing for subsidies offered to manufacturers, resulting in lower costs to

Hero Electric Optima E-bike
Source: Hero Electric Vehicles

consumers, it's a stepping stone to what further can be done. If government mandates for the conversion of all commercial use vehicles to EVs in sectors related to the delivery of goods, public transport, and last-mile mobility solutions; in a country like India, where most e-commerce deliveries take place on ICE two-wheelers the scale would be impactful and certainly stimulate the growth of the segment as non-commercial users would witness said mode as viable and sensible.

Growth plans for the year

While delivering cost-effective, value-for-money products has and always will be our mission, we feel a there's a huge scope for improvement within the B2B segment. E-commerce being just one domain that could benefit from switching over to e-2W, there are several other ride-sharing, renting, e-bike taxi segments as well, which could reap plentiful by ditching fossil fuel-based vehicles for e-mobility and that's a key area we are working on – to develop and provide custom solutions for each business model, aiding them in not just adopting a cleaner fleet but also help reduce operational costs in the mid to long term.

Product launch/ facility development plans

We are constantly working towards developing better, newer, more advanced products for our consumers that perform better, offer more range, more features, more appeal, all while maintaining the price cap that India desires from a two-wheeler.

We have come out with several new variants offering a host of features and specs suited to various user requirements.

In the new vehicle segment, we have two new products lined up for 2021 – through which we aim to bring a fresh new look and appeal within the electric scooter segment.

JEETENDRA SHARMA
Founder and MD
Okinawa Autotech

Expectations for the year 2021

We are very optimistic and hopeful that 2021 will be a turning point for EVs in India. It can prove to be a revolutionary year for the EV industry. As budget out recently, it has set the roadmap for the next few years. We are glad to see the government's increased customs duty on automobile parts, which will rightly encourage domestic manufacturing.

This year's budget also comes with an increased focus on strengthening the infrastructure of the country. Additionally, the commitment of ₹1.97 lakh crore for PLI schemes covering 13 sectors, also comes as a cheer for the industry.

Product/Technology/Policy to stimulate sector growth

It has become more evident that the Indian government aims to make India a major hub for EVs. With a total budget of $1.41 billion, the FAME II program has been deployed over three years from April 1, 2019, to benefit the EV sector. Speaking of which, we are the first Indian company to get a FAME II subsidy from the government of India. We believe that this push from the administration is estimated to make India one of the largest EV markets in the future. We are going to see the growth in sales pick up in the next three to four years. I truly believe FAME-II needs to be a policy for more than three years.

Growth plans for the year

For FY2021 we are targeting 50 percent growth in revenue. Since last year, we have doubled the digit revenue so fae. Few of the industry reports highlight that the market share of Okinawa in India in the high-speed segment (>25 km) in FY2020 is 36 percent.

We are also coming up with a new facility and new products this year. The new manufacturing unit will be near the company's existing plant in Rajasthan. The new facility will have an annual capacity of five-six lakh units in the first phase and might go up to 10 lakh units soon.

Product launch/ facility development plans

At Okinawa Autotech, we started the year 2021 with a new product launch of 'Okinawa Dual', which is India's first B2B e-2W, designed to transform the delivery sector and enhance efficiency for businesses. The product is a first-of-its-kind vehicle designed to cater to the niche requirements of delivery. We launched the product in two colors - red and yellow, with a sturdy-built 70 percent metal body. At present, the company ensures 92 percent localization in its products and aims to take this to 100 percent by April 2021. There are multiple products in the pipeline for this year. We will be launching our first ever e-bike Oki100 in April, i.e., Q1 of FY2021-22.

Industry-readiness for ACC manufacturing

Government's recent announcement to extend the PLI scheme to the automobile sector, for

Okinawa Ridge Plus E-bike
Source: Okinawa Scooters

manufacturing of Advanced Chemistry Cells (ACC), is commendable. This will give a boost to local manufacturing, and intensify the domestic demand by further incentivizing individual and commercial consumption of EVs pan India. Such a holistic approach would create a thriving ecosystem for EVs and cement India's position as a global EV hub, offering abundant opportunities for growth and attracting huge investments for further innovation.

RAVNEET S. PHOKELA
Chief Business Officer
Ather Energy

Expectations for the year 2021

2020 has been a tough year but largely positive for the EV industry. A new segment of consumers has been born that is now considering EV as a serious contender while making the purchase. On the demand side, people who had deferred their purchases are beginning to come back in the market, and that's been a positive development.

The EV industry is also witnessing growth in terms of young companies and new products evolving in the market. Demand has picked up and several ICE counterparts have also introduced their EVs in the market. The market is definitely turning in favor of electric in a big way. But the bigger change has been in the customer mindset. Today, people are walking into an EV showroom expecting to be wowed by EVs. EVs are seen as an upgrade with most customers expecting their current vehicles to be the last fossil fuel vehicles.

We would like to see policies around creating supplier parks at concessional rates, supplier side incentives for import of raw materials, and incentives around CAPEX and R&D investments in India, which will go a long way in building up the supplier ecosystem in India.

Product/Technology/Policy to stimulate sector growth

The Central and the State governments have been introducing multiple policies to promote EV adoption and encourage brands to introduce high-performance vehicles. In India, the demand was always there, but it needed strong, well-performing products that are viable alternatives to ICE vehicles to unlock this demand. Government policies such as FAME II have played an important part in this, by incentivizing high performing products. If you look at petrol two-wheelers, at every price point consumers have multiple options, which is not the case in e-2Ws. Because of FAME II and its intent many players have introduced or are introducing high-performance e-2Ws. Traditional automakers entering the market have also prompted consumers to take EVs more seriously, and have expanded their appeal. EVs are no longer a compromise, thereby giving birth to a new set of consumers making the entire category more aspirational.

FAME II as a policy, we believe will stimulate the growth of this sector. Any policy that comes into play takes a few years to stabilize, 2019 and 2020 saw FAME II policy stabilizing and paved the way for traditional automakers to introduce new and powerful vehicles, which led to demand generation and 2021 will see the scale and distribution.

Ather 450x E-bike
Source: Ather Energy

Technology is also going to excite the sector. EVs are adopting Internet-of-Things (IoT) technology; building product lines that are built around the benefits of connectivity and technology features. The EV industry will lead the move to a technology-backed shift in personal commute - from AI-enabled vehicle personalization, predictive maintenance, regular feature updates leading to shorter model cycles. Vehicles built on connected technology also allows for new business models - new ownership models that encompass everyday subscription-based ownership, usage-based models, etc.

Growth plans for the year

With the launch of our new scooter Ather 450X, we were preparing for 11 markets: Bangalore, Chennai, Mumbai, Pune, Delhi, Hyderabad, Kochi, Coimbatore, Kolkata, Calicut, and Ahmedabad, but by the end of 2020, we have added 16 new cities to our phase-II of expansion - Mysore, Hubli, Jaipur, Indore, Panaji, Bhubaneshwar, Nasik, Surat, Chandigarh, Vijayawada, Visakhapatnam, Guwahati, Nagpur, Noida, Lucknow, and Siliguri. Our expansion plan will continue at a rapid pace and we expect to be in about 40-45 cities by the end of 2021.

The deliveries of the Ather 450X have begun in multiple markets already and will soon hit the roads across nearly all States in India in the coming months. We have already crossed the pre-COVID levels in terms of demand, our experience centres walk-ins, and even test ride requests. Also, in the last quarter, we have seen a 30 percent increase in sales.

2020 has largely been positive in terms of awareness, and 2021 will be all about scale and distribution. Our presence, reach and capability of delivering will be way higher this year and we are optimistic to grow multiple folds in this year. Our new factory is up and running at Hosur, Tamil Nadu, which can be scaled up

to a capacity of half a million scooters a year and thereby letting us fulfil the demand across the country.

Product launch/ facility development plans

This year is all going to be about deliveries of the Ather 450X across the entire set of markets that are in the pipeline. In the 8 markets that Ather has a presence in, 74 charging points are already installed with more in the pipeline. No new product is planned for this year.

Industry-readiness for ACC manufacturing

The PLI scheme announced by the Central government for manufacturing ACC batteries looks like an interesting prospect, and solidifies their intention of making the growing Indian automobile sector electric. This is a good move and will incentivize large domestic and international players in establishing a competitive ACC battery set-up in the country.

RAHUL SHONAK
Chief Operating Officer
Nexzu Mobility

Expectations for the year 2021

We believe that 2021 is the year of growth of the EV industry. We have seen a massive hike in the Y-o-Y growth in domestic EV adoption till 2019. Due to the pandemic though, the projected growth came to a halt in 2020. But, in hindsight, this period gave the consumers a chance to see how clean the environment can be if ICE vehicles go off the roads. Witnessing cleaner air during the lockdown was an unforgettable experience, because of which the post-pandemic consumer is more awake, aware, and environmentally conscious. So, 2021 will be a high-growth year for EVs, as well as for Nexzu. We are excited to be working on game-changing technology projects in the EV space to make e-mobility a mainstream concept in the country.

Product/Technology/Policy to stimulate sector growth

Let me take the example of e-cycles as a product and technology put together. Electric-bicycles have been the turning point in the adoption of e-mobility in India as well as across Western markets. Nexzu has already put best-in-class electric bicycles to strengthen our sector and eco-system by bringing more 'locally (Indian) made products'. On the policy side, financing schemes to help suppliers to develop technology or even tooling, and policies towards financing research will propel our aim of stimulating growth in our sector.

Growth plans for the year

At Nexzu, we have a steady plan of growth in 2021. We will be launching next-generation electric bicycles for the domestic market and premium export destinations such as the United Kingdom and the United States. We are also working on critical technology development in the area of the powertrain.

Product launch/ facility development plans

We are geared up to launch two new electric bicycles to gratify a wider set of the target audience.

Industry-readiness for ACC manufacturing

At Nexzu, we are exploring a longer driving range in our products via research in battery technology. We welcome our policy maker's views on the 'Make in India' push, which also covers the ambit of battery manufacturing. The industry as a whole is working towards the common objective of bringing down the upfront cost of EVs, and domestic manufacturing of batteries will be a great step towards this goal. The consumer side will benefit from the Advance cell chemistry batteries.

Nexzu Mobility Roadlark E-bicycle
Source: Nexzu Mobility

Moulin Oza
Assistant Editor
ETN

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The e-4W market set to accelerate e-mobility in India

With the arrival of numerous new technologies and innovations in the EV space, there are several opportunities on the rise!

India has huge plans for EVs and their emerging technologies. The country has great expectations of accomplishing a high level of penetration in e-mobility by 2030. EVs have opened up ample business opportunities for automobile companies in India and across the globe.

In the last few years, India has observed a series of measures taken by the government to support the shift to e-mobility. Regardless of favorable policy measures and increased drive by the government along with the introduction of more products, the market acceptance of BEVs, particularly in the passenger vehicle segment, remains low due to the challenges of the higher upfront price of EVs, range anxiety, lack of charging infrastructure, and low consumer awareness.

The EV market is expected to be a ₹50,000 crore opportunity in India by 2025 and it is projected to drive higher electrification of the vehicles in the medium term in the wake of COVID-19. The EV market in India has gained significant momentum after the implementation of the FAME India scheme. In FY 2019-20, the industry sold ~3000 units.

The industry is also capitalizing aggressively in technology and towards building the ecosystem. This, along with reducing battery costs will positively boost the sector in upcoming times. Furthermore, the demand for EVs will see a substantial jump owing to future emission norms such as Corporate Average Fuel efficiency (CAFÉ), Bharat Stage Emission Standards (BSVI) Phase-II and Real Driving Emissions (RDE).

Government's drive to encourage e-mobility

In May 2020, the Ministry of Heavy Industries and Public Enterprises (MHIPE) delivered a notification to all the testing agencies under Faster Adoption and Manufacturing of Electric Vehicles in India (FAME II). The notification covers the suitability under the reviewed Phased Manufacturing Program (PMP) for xEV parts.

PMP will be valid for five years until 2024 and promotes domestic production across the EV value chain. The MHIPE extended the effective date for indigenization of xEV parts to April 1, 2021.

In August 2020, the Ministry of Road Transport and Highway (MoRTH) declared that all the States and Union Territories are permitted to list and retail EVs without pre-fitted batteries. The prototype of EVs and battery types has to be authorized by the test agencies according to the Central Motor Vehicle Rules.

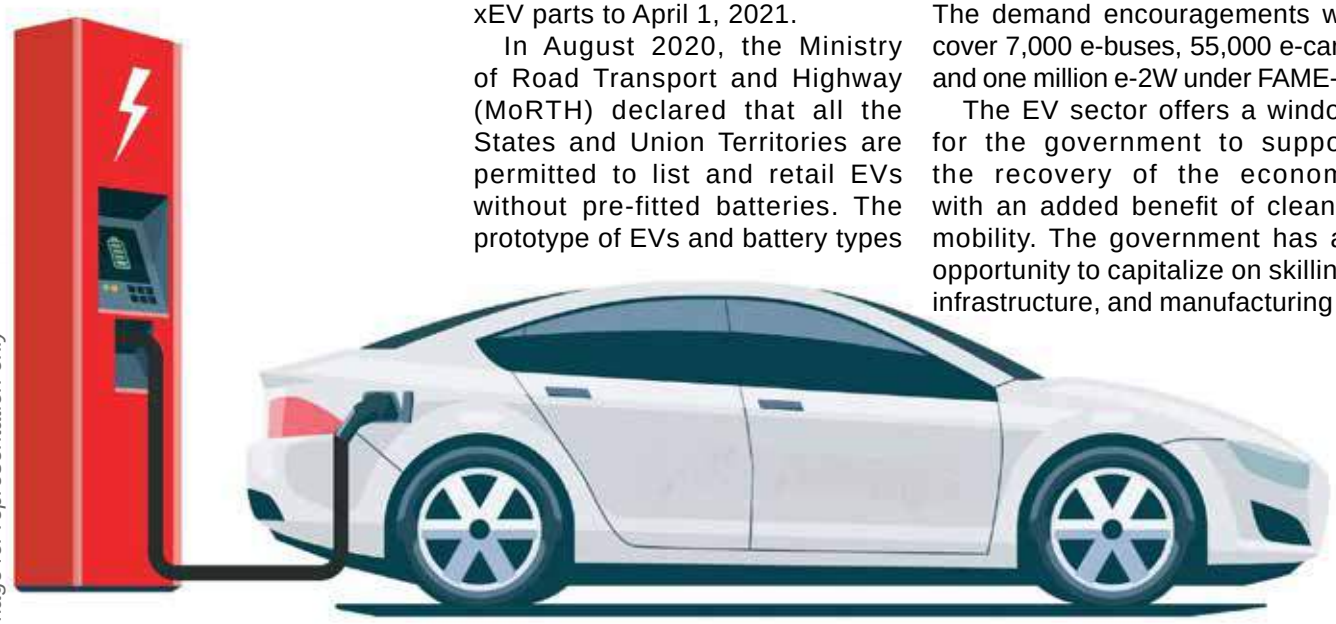
The government also extended the validity of the FAME-II program for all sanctioned EV models by three months up to December 31, 2020.

In August 2020, the government introduced the Delhi Electric Vehicle Policy 2020 to enhance EV adoption in the national capital region (NCR). The new policy proposed tax waivers, charging and swapping infrastructure establishment, battery cycling ecosystem, and creating a non-lapsable State EV Fund

The Telangana government also released its new Electric Vehicle and Energy Storage Policy for 2020-2030, declaring subsidies, policy measures, and other incentives to turn the State into an EV and energy storage system development and manufacturing hub.

In September 2020, Union Heavy Industries and Public Enterprises Minister, Prakash Javadekar, said in Lok Sabha that the Centre had delivered a demand incentive of ₹950 million (~$12.9 million) towards 27,201 EVs until September 10, 2020. The demand encouragements will cover 7,000 e-buses, 55,000 e-cars, and one million e-2W under FAME-II.

The EV sector offers a window for the government to support the recovery of the economy with an added benefit of cleaner mobility. The government has an opportunity to capitalize on skilling, infrastructure, and manufacturing in



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Tata Nexon EV
Source: Tata Motors

Tata Motors has partnered with relevant Tata group companies to launch the 'Tata uniEVerse', a facilitating ecosystem to catalyze the adoption of EVs in India with thrust on local manufacturing of key components and development of supporting infrastructure.

Morris Garage India ZS EV
Source: MG India

MG Motor India, which recently launched the updated 2021 ZS EV, is also planning to bring in an EV, which will have a range of up to 500 km.

Porsche Taycan EV
Source: Porsche AG

German automobile manufacturer Porsche has announced that it is set to launch its EV model Taycan in India this year.

Triton N4 electric sedan
Source: Triton Electric Vehicle

US-based carmaker Triton is gearing up to enter India with its electric sedan N4, with a price starting at ₹35 lakh.

Audi e-tron EV
Source: Audi AG

The all-electric offering of Audi, the Audi e-tron, is anticipated to hit the Indian market in 2021.

the EV sector to deliver the requisite reboot to the economy. Making this recovery investment in the sector, will fast-track the transition to clean mobility in India.

It is an appropriate moment for the government to commence the much-needed re-skilling of labour to fit the green sectors such as EV. Besides, focusing the recovery stimulus on supporting innovation and small-scale businesses is critical as it will permit for a more ground-up and wide-ranging approach in encouraging the EV sector in India.

The imperative is facilitating an all-inclusive growth for the EV sector and developing a robust EV value chain in the country. This will also support the government's objective of the country becoming self-reliant and improving domestic manufacturing. India is a huge market for automobiles, and with

Tesla Model 3 EV
Source: Tesla Inc

Tesla CEO Elon Musk has established the company's plans to arrive in the Indian market, within days of the EV maker registering its arm in the country.

Bengaluru-based EV startup Pravaig Dynamics officially unveiled the Extinction MK1 premium electric car, completely made in India, and it is set for commercial launch this year.

Pravaig's Extinction MK1 EV
Source: Pravaig Dynamics

a paced transition to EVs the country can boost local manufacturing, lower oil dependence and consumption, and certainly facilitate a global clean transition.

Way Ahead

To boost EV adoption, original equipment manufacturers (OEMs) and the Central and State governments need to work jointly for an integrated policy, creating a favorable ecosystem for India's e-mobility vision.

A blend of facilitating policy measures, infrastructure development, total cost of ownership (TCO) parity, and a market buzz-promise to accelerate the shift to electric, are required for the emergence of a new era for the automotive industry. ETN

Moulin Oza
Assistant Editor
ETN

For deriving the maximum revenue from the swiftly growing Indian e-4W market, there has been a surge in industry players as well as startups foraying into this space.

- Tesla CEO Elon Musk has established the company's plans to arrive in the Indian market, within days of the EV maker registering its arm in the country.
- US-based carmaker Triton is gearing up to enter India with its electric sedan N4, with a price starting at ₹35 lakh. The company has also signed an MoU with Bharat Electronics Limited (BEL) for developing EVs and energy storage systems.
- Tata Motors has partnered with relevant Tata group companies to launch the 'Tata uniEVerse', a facilitating ecosystem to catalyze the adoption of EVs in India with thrust on local manufacturing of key components and development of supporting infrastructure.
- Tata Motors is expected to launch the electric version of its hatchback model Altroz in the Indian markets this year.
- MG Motor India, which recently launched the updated 2021 ZS EV, is also planning to bring in an EV, which will have a range of up to 500 km.
- German automobile manufacturer Porsche has announced that it is set to launch its EV model Taycan in India this year.
- British automobile manufacturer Jaguar I-Pace is expected to introduce its first electric SUV in India in March 2021.
- South Korean automobile manufacturer Hyundai is working on launching low-cost EVs for the Indian market by 2021.
- The all-electric offering of Audi, the Audi e-tron, is anticipated to hit the Indian market in 2021.
- Bengaluru-based EV startup Pravaig Dynamics officially unveiled the Extinction MK1 premium electric car, completely made in India, and it is set for commercial launch this year.
- Mahindra Logistics plans to deploy EVs for its last-mile delivery shortly, ensuing Amazon India's decision to deploy electric carts for last-mile deliveries.

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Establishing robust charging infrastructure; accelerated EV uptake expected

A strong EV charging infrastructure is crucial to facilitate rapid growth in EV adoption, requisite to reach India's policy targets.

One of ways to contribute to cleaner and greener environment is by adopting EVs as favoured mode of transportation. EV is the future and massive prospects exist in this space given that this shift is starting from virtually zero; charging is just one aspect of the business opportunities.

Mobility is changing swiftly, and India is powering ahead to a sustainability-driven future by embracing EVs. Availability of adequate charging infrastructure is one of the key necessities for further accelerating EV adoption in India. India is one of the emerging markets with very few local and international players in the EV charging sector. This presents India with a massive potential to rise in this market.

Lack of charging infrastructure remains one of the biggest hurdles to EV adoption in most countries, but this could be particularly crucial for meeting India's striving electrification goals.

A key challenge for the creation of battery charging or swapping infrastructure is the lack of availability of space. Hence, the government's plan of deployment of charging stations across fuel stations makes absolute sense as it will be easier to implement and help in the creation of robust charging infrastructure.

Government's push for developing EV charging infrastructure:

The government of India has undertaken several initiatives to encourage manufacturing and adoption of EVs in India; EVs have started penetrating the Indian market. However, availability of sufficient charging infrastructure is one of the key necessities for accelerated adoption of EVs in India.

The government of India aims to support the development of EV charging infrastructure by extending capital grants to organizations for encouraging the use of EVs. It targets to build a network of charging stations throughout the country, to guarantee that at least one charging station is available every 25 km on both sides of the country's highways and roads.

Under the Phase-II of Faster Adoption and Manufacturing of Electric Vehicles in India (FAME India), Centre sanctions 2,636 EV charging stations in 62 cities. Out of these charging stations, 1,633 will be for fast charging, and 1,003 will be for slow charging. The government is planning to install around 14,000 charging stations across selected cities.

In February 2020, the government had given an in-principle permission to firms, including NTPC, EESL and REIL, to set up 2,600 EV charging stations.

In October 2020, The Department of Heavy Industries floated an Expression of Interest for inviting proposals from government organisations, PSUs (State/Central), State-owned Discoms, Oil PSUs and similar other public and private entities to build and operate public EV charging stations.

Proposals have been invited

Image for representation only

Central govt. sanctions 2,636 EV charging stations in 62 cities

States	No. of charging stations to be installed
Maharashtra	317
Andhra Pradesh	266
Tamil Nadu	256
Gujarat	228
Rajasthan	205
Uttar Pradesh	207
Karnataka	172
Madhya Pradesh	159
West Bengal	141
Telangana	138
Kerala	131
Delhi	72
Chandigarh	70
Haryana	50
Meghalaya	40
Bihar	37
Sikkim	29
Jammu & Kashmir	25
Chhattisgarh	25
Assam	20
Odisha	18
Uttarakhand	10
Pudducherry	10
Himachal Pradesh	10

Source: Ministry of Heavy Industries and Public Enterprises, India

from interested entities to build and operate EV charging infrastructure on the Mumbai-Pune, Ahmedabad-Vadodara, Delhi-Agra Yamuna, Bengaluru-Mysore, Bengaluru-Chennai, Surat - Mumbai, Agra - Lucknow, Eastern Peripheral and Hyderabad-ORR Expressways. Likewise, proposals have also been invited from entities for highways including Delhi-Srinagar, Delhi-Kolkata, Agra-Nagpur, Meerut to Gangotri Dham, Mumbai-Delhi, Mumbai-Panaji, Mumbai-Nagpur, Mumbai-Bengaluru and Kolkata to Bhubaneswar.

In November 2020, Union Transport Minister Nitin Gadkari announced that at least one e-charging kiosk will be set up at around 69,000 petrol stations across India, furthering the government's plan to make India an EV nation by 2030.

- The Delhi government has started the process to set up 100 vehicle battery charging points across the national capital to drive adoption of EVs by masses. It has also issued the largest tender for public charging stations in India to date.
- The Union Ministry of Heavy Industries and Public Enterprises has approved setting up of 178 EV charging stations for the State of Telangana.
- Power PSUs' joint venture EESL plans to install around 500 more EV charging stations in the country during FY2020-21.
- The Karnataka government has proposed a subsidy of 20 percent or ₹10 lakh, whichever is higher, to individuals eager to set up public charging stations for EVs.
- In January 2021, Mysuru's first EV (EV) charging station was launched on the premises of the Chamundeshwari Electricity Supply Corporation's (CESC) Corporate Office at Vijayanagar, near Hinkal
- The Chief Minister of Goa, Pramod Sawant, inaugurated the first public EV charging station installed by Convergence Energy Services Limited (CESL), in the State as part of the Green Goa Initiative.

Industry backing the development of EV charging

- New Delhi-based Okaya Power has announced that it has already installed more than 500 EV chargers nationally and has installation orders for a further 10,000-plus systems.
- Okaya Power also bagged a contract from State-owned Rajasthan Electronics and Instruments Limited (REIL) for setting up 4,244 multi-standard EV charging stations across the country.
- ABB India installed its first public DC fast charger in New Delhi with EV Motors India, the major charge point operator for BSES Yamuna Power.
- Hitachi ABB Power Grids has announced partnership with Ashok Leyland for implementing its flagship fleet EV charging technology Grid-eMotion for large scale public transport and commercial fleets in India.
- Mumbai-based EV charging company Magenta Power has signed an MoU with app-based electric scooter rental service eMatrixmile India to install and commission EV charging stations in Maharashtra.
- Fortum has signed an agreement with Finland's Finnfund whereby the impact investor will invest in a minority share of Fortum's public charging point operator (CPO), Fortum Charge and Drive India Private Limited (FCDIPL), to drive growth of EV charging infrastructure in India.
- Mumbai-based smart e-2W mobility platform eBikeGo has announced its plans to launch its own IoT enabled smart charging stations – 'eBikeGo Charge' in five cities

National Capital Region (NCR), Mumbai, Bangalore, Hyderabad, and Chennai. It also aims to install 12,000-15,000 charging stations across the country.

- Indian Oil Corporation (IOC) has already installed EV charging points at 76 fuel stations, and battery swapping facilities at 11 outlets across the country.
- In January 2021, Panasonic Life Solutions India has joined hands with PMI Electro Mobility Solutions to set up EV charging infrastructure across 17 cities in India for over 1,000 e-buses.
- MG Motor in partnership with Tata Power has deployed the first 60 kW superfast public EV charging station in Mangaluru.
- In February 2021, Central Railway, Tata Power, and UN Environment Programme (UNEP) joined forces to install EV charging points for at several railway stations in the city of Mumbai. Starting with Chhatrapati Shivaji Maharaj Terminus (CSMT), Thane, Dadar, Parel, and Byculla, for which work orders have already been issued. The second phase will cover the stations of Lokmanya Tilak Terminus, Bhandup, Panvel, and Kurla.

Industry outlook for 2021

To learn more about the industry's viewpoint on EV charging infrastructure sector development in the year 2021, ETN connected with few of the prominent industry charging solutions providers.

AWADHESH JHA
Vice President
Charge & Drive - Fortum Charge & Drive India Pvt Ltd

Expectations for the year

Indian economy is not insulated from what is happening at the global level. As more and more countries are adopting EVs, it will shortly start moving at a higher pace, and India being a globally connected economy will reap the benefits of global adoption and it will reach majority stage in a shorter span than other countries, as Indian customers will form part of an early majority in terms of the global market.

Globally, EV is gradually inching towards being the mainstream vehicle, particularly in the passenger vehicle segment. Indian car OEMs are also taking steps to join this movement. In the year 2021, I expect that customers would have more than 12-15 products in the passenger vehicle segment to choose from compared to five-six products available at present. In the Union Budget 2021, the voluntary scrappage policy announced by the Finance Minister is also expected to give a fillip to roll out of new EVs.

With the PM's call for trusting our private sector, I expect that the involvement of private players would be encouraged in creating a robust and reliable public charging infrastructure, which is touted to be one of the major impediments for the adoption of EVs.

Product/Technology/Policy to stimulate sector growth

The country has already taken various steps to enable EVs to take off. Five percent GST on battery electric vehicle, waiver of road tax and registration charges by various State governments, demand-side incentive through FAME-II, etc., are few seminal policy measures to encourage both OEMs and customers to go for EV.

The recently announced PLI scheme is expected to stimulate growth in the EV sector by promoting manufacturing of advanced batteries in India, which should bring down the cost quickly, making the cost of EV at par with ICE. It is important to note that the cost of ICE vehicles would keep increasing due to stringent emission norms being pursued by the country for making our life healthier, whereas the cost of EVs will continue to fall due to technological advancement in battery and scale. Once EV attains the price parity with ICE, which I expect to happen in two-three years, buying of ICE vehicles would be like buying a horse, which is for hobby and not for utility - to borrow the words of one of my colleagues.

Fortum Public Charging station at IOCL Kompally, Hyderabad (20 kW DC Fast Charger)

Source: Fortum Charge & Drive India Pvt Ltd

Growth plans for the year

We are an electric fuel company that enables the end customers to forget the range anxiety while driving their EV. We intend to empower them to decide the location, time, and price of getting the battery of their EV filled with electric fuel. We are hardware agnostic. We believe that public charging infra has to precede the adoption of EV. We have been expanding the network in *pari passu* with the demand for EVs in the market, and we would continue to be doing so. We have been operating 97 public charging points across seven cities in India, where both low voltage high voltage passenger EVs can be serviced.

Product launch/facility development plans

To bolster growth for EV charging infrastructure in India, we have recently signed an agreement with Finnfund, a Finnish development financier and professional impact investor. Finnfund will invest in a minority share of Fortum's public charging point operator (CPO), Fortum Charge and Drive India Private Limited (FCDIPL). This partnership would create a shared ownership structure and Finnfund's investment will accelerate FCDIPL's growth plans in the charging infrastructure business and reaffirm its market-leading position. We will further continue to offer software as a service (SaaS) for operating EV charging infrastructure networks and customer interfaces to other CPOs.

Industry-readiness for ACC manufacturing

According to NITI Aayog's Advanced Chemistry Cell and Battery gigafactory plan, manufacturers can expect to get incentives close to $25/kWh. Secondly, they would be disincentivizing the high-scale import of EVs and associated components, thereby ensuring the 'Make in India' campaign. This is important because of the backward integration required for EV manufacturing in India. The government, looking to encourage more private investment in the sector, has initiated tax incentives for manufacturers and a basic customs duty safeguard from 2021-2030 for those making advanced chemistry cells and batteries in India.

ANSHUL GUPTA
Director
OKAYA Power Group

Expectations for the year

EVSE (Electric vehicle supply equipment): This year, we expect several original equipment manufacturers (OEMs) to launch new EV models in the country. In the premium range, we look forward to Porsche Taycan, while in the affordable range we are expecting new electric models from prominent manufactures like Tata Motors and Mahindra.

We also aim to accelerate the deployment of HC/DC and ADC chargers in the private sector domain.

Electric two-wheelers: We expect a surge in sales of high-speed and low-speed e-2W after a slump phase in 2020, due to COVID-19 induced nationwide lockdown.

There is a need for a stricter 'Make In India' plan and specific guidelines to be directed by the Ministry of Heavy Industries and Public Enterprises to boost and encourage indigenous manufacturing. Alongside, consumer awareness for the switching to e-mobility has to be undertaken for reaching out to the masses, and accelerating the deployment of EVs.

Electric three-wheelers: This year, we envisage a surge in deployment of electric cargo e-3W as the industry braces to implement e-mobility to reduce the carbon footprint and achieve zero emissions and move towards sustainable transportation for cost-efficient last-mile delivery. This will in turn drive the battery chargers' replacement sector in the country.

Okaya Power EV charging solution
Source: OKAYA Power Group

Growth plans for the year

We are very much focussing on innovating indigenous 'Make In India' products for the sector. The product line includes:

- BMS (Battery Management System) of HV (high-voltage)
- EVSE (Electric vehicle supply equipment)
- Universal fitment approach for swappable batteries and chargers
- Develop a steadier SCM (supply chain management) and supplier base in India
- Improved service SLA (service level agreement) and TATs (turnaround time)

Product launch/ facility development plans

We aim to set up a new EVSE facility in Himachal Pradesh. The company is also working on its plans to develop its newly expanded Li-ion battery plant.

We are working on a product portfolio for low-speed e-3W products and we are committed to ensuring deeper market penetration in this segment.

To provide reliable and all-weather batteries for tractors, we are working on a new range of Li-ion batteries for tractors and enable the industry's transition from lead-acid batteries.

Industry-readiness for ACC manufacturing

The PLI scheme announced by the Central government for manufacturing ACC batteries, looks like an interesting prospect in the right direction and it will shape rapidly. An early investment into the same will enable the creation of steady supply chain management and vendor base. The government's key focus has been on the indigenization of fuel cells, and will only accelerate the overall growth of the industry.

We, at Okaya, are keeping a close eye on the development within the same and will only venture in the direction when the time is right. For now, we are in process of exploring new innovative battery technology other than lithium-ion.

Way Ahead

EV charging station networks in India seem to be more important than introducing more EVs in the country. There is a need to increase charging stations in India as government is planning to shift towards green energy, which can only be possible by using EV. Government is also implementing different policies to construct charging stations.

Moulin Oza
Assistant Editor
ETN

FY 2021 - The year of expansion for EV component market

The Indian government has taken steps to create an enabling ecosystem for EVs through the efforts of battery manufacturing, EV charging infrastructure, and promoting local supply chains. The focus should now be on speedy implementation.

Electrification of vehicles is the future of the automobile industry. While the current electric vehicle sales in India remain less than 1 percent of the total vehicle sales as of FY 20, experts contend there is a massive scope of growth. Studies indicate, the Indian EV component market will reach estimated $12,957 million in 2026, reaching a CAGR of 28.3 percent from 2019-26 (GMK Research).

The above prediction is attested by the positive EV sales witnessed last year. This, even though Indian automobile sector was grappling with a slowdown well before COVID-19 disrupted it further. The EV sales continued to rise across electric 2W, 4W, and e-buses segments.

Several factors have been responsible for the growth in the EV segment, the most prominent factors include:

- Aggressive policy push by the government of India in the form of Faster Adoption and Manufacturing of (Hybrid &) Electric Vehicles in India (FAME) scheme. Currently implemented FAME – II scheme along with other supportive policies expect to push EV penetration in India up to 30 percent for private cars, 60 percent for commercial cars, 40 percent for buses and 80 percent for e-2W and e-3W by 2030.
- Phased Manufacturing Programme (PMP) that encourages localization of products and creates opportunities for setting up infrastructure across the EV value chain.
- Emergence of viable business models such as battery swapping, which address the issues of high upfront cost of EVs, range anxiety and concerns of battery reliability and charging infrastructure in collaboration with private partnership.
- Production Linked Incentive (PLI) scheme for setting up domestic manufacturing in India for integrated battery and cell manufacturing giga-plants. The government announced PLI for 13 key sectors (including Advanced Chemistry Cell battery manufacturing, automobiles and auto components) and committed ₹1.97 lakh crore for over five years starting this financial year.

Image for representation only

EV components sector set for expansion

In the Union Budget announced earlier this month, FM Nirmala Sitharaman did not announce any new policy directly impacting the EVs and EV component sector, however, industry frontrunners believe government's focus on infrastructure development, revision in duties, PLI scheme, voluntary Vehicle Scrappage Policy, increased outlay for MSME, and thrust on Innovation and R&D will serve as key enablers for EV and its component market.

"I believe 2021 will be a bounce back year for automobile industry, which will be largely supported by EVs," said Raminder Singh, MD of Schaltbau India. Schaltbau manufactures electromechanical components and critical safety applications such as main contactors for battery charging traction drive in EVs, charging stations for e-mobility, in battery test benches, etc.

Mr. Singh emphasized that despite challenges of COVID-19 during 2020, the sales numbers of EVs were high in India. This was supported by many initiatives by the government, EV manufacturers and other stakeholders, and is expected to bring optimization of costs in the sector.

"The theme of EVs is setting into the minds of people," Singh added. He was optimistic that FY 21 will lay a very strong foundation for EVs that will enable market expansion of EVs in the years to come.

Revised duties to boost local manufacturing

In the Budget 2021-22, FM Sitharaman also announced revision of duty on select auto parts. The FM proposed to hike customs duty

on auto parts - like ignition wiring sets, safety glass, parts of signaling equipment - from 7.5-10 percent to 15 percent. Including parts of electrical lighting, windscreen wipers, instrument panel clocks, defrosters, and demisters.

Commenting on the revised duty structure, Deepak Jain, President of the Automotive Component Manufacturers Association (ACMA) said, "Increase in basic customs duty on select auto components will encourage local manufacturing of such items."

The government mentioned, the said changes in basic customs duty were proposed for creating level-playing field for the benefit of MSMEs and other domestic manufacturers.

"The auto component industry is dominated by MSMEs, and this will provide them the necessary succour as the industry recovers," Mr Jain noted.

The MSME sector has been allocated ₹15,700 crore this year, double compared to the previous year.

Incentive-based vehicle scrappage policy

EV automakers suggest the voluntary vehicle scrappage policy will not only help in curbing air pollution on Indian roads, but the gains from the policy can also be maximized if incentives are put in place for replacing old vehicles with electric ones.

"The new scrappage policy will help accelerate the EV adoption in India," said Inderveer Singh, Founder & CEO of EVage – the Chandigarh-based commercial e-4W manufacturer. The industry is now awaiting the details of the policy from the Ministry of Road Transport and Highways.

Expansion of public bus transit a plus for EVs

The budget 2021 announcement an outlay of ₹18,000 crore for public bus transportation services, along with the deployment of 'MetroLite' (light urban rail transit system) and 'MetroNeo' (unique eco-friendly mass transit system) for ease of mobility across Tier 2 cities and peripheral areas of Tier 1 cities.

"The allocation of ₹18,000 crore for the public bus transport services has come as a sigh of relief for the bus makers," said Nishant Arya, Executive Director of JBM that specializes in manufacturing diesel and e-buses in India.

"The proposed PPP model will in turn help the sector to create employment as well, and overcome the adverse effect of the pandemic," Arya commented.

Industry veterans anticipate the thrust on public transport services could potentially open up possibilities of providing last mile connectivity around Tier 2 and peripheral areas of the cities via e-autos and e-rickshaws, if the required support is provided by the government in setting up charging and swapping infrastructure.

Image for representation only

Reducing import dependence via PLI

India being a price sensitive market, the high upfront cost of EVs has been a major barrier to widespread adoption of EVs in the country. Lithium-ion batteries that power EVs, make up nearly 60 percent of the EV cost (along with the battery management technology). Currently, India does not have manufacturing capability for such products yet, and domestic EV component manufacturers rely heavily on imports from China. China, is the world's top producer of Li-ion cells accounting for majority of the existing capacity.

In November 2020, the cabinet approved the PLI scheme for faster growth of manufacturing capabilities in India in the ACC battery manufacturing and automobile and auto component sector. The EV industry is hopeful of becoming a net-exporter and reducing its import dependence through this scheme.

At present, the Indian auto component industry exports over 25 percent of its production; if there is effective implementation of the scheme, it could help India capture a significant portion of the global trade.

The industry is now awaiting the details of the PLI scheme for the auto and auto-component sector.

Trends that will shape the EV market

Majority of the industry players believe the initiative towards local manufacturing of battery cells will stimulate growth in the EV market in India in the years to come.

"Overall growth of EV market will bring in benefits for manufacturers of other components of the propulsion chain," pointed Raminder Singh. The other most important factor will be the development of safety standards for each class of EVs. "This will bring in not only safety but also quality and low life cycle costs for EV owners," he added.

Shraddha Kakade
Assistant Editor
ETN

Image for representation only

Indian RE sector pursues development, the *Aatmanirbhar* way

India is set to venture into a very dynamic phase of energy development, and the improved emphasis provided in the Union Budget 2021-22 certifies its role in India's ambitious zero emission power generation plan by 2030.

The global dependency on renewables is rapidly increasing as countries continue to capitalize heavily in cost-effective sustainable energy solutions. The past few years have observed not just stiff competition among companies in this sector, but also a growth of the installed capacity of solar PV.

The government of India had set an ambitious target of installing 175 GW of RE capacity by 2022, which has been increased to 450 GW by 2030, as committed by the Prime Minister in the UN Climate Action summit. It is a gruelling target and total investment requisite to accomplish the initial target of 175 GW only has been projected at over $150-200 billion.

India has witnessed astonishing success in its recent energy development, but several challenges remain. The performance of the industry has been unfavourably affected in 2020 due to COVID-19 and related issues.

The industry is stressed with issues like the lack of clear regulatory framework in the sector at both Centre and State levels, swiftly falling tariffs, a shortage of long-term competitive finance options, and high and ambiguous taxation structures. The poor financial health of the Discoms, who are major purchasers of this power, has further lowered the charm of the industry in the eyes of international and domestic investors and lenders due to their poor track record of payments and frequent changes in State level policies - particularly relating to rooftop and open access projects. As India recovers from a COVID-19 induced slump in 2020, it is re-entering a very dynamic period in its energy development.

The overall share of renewable energy (including large hydro projects) in the country's installed power capacity mix stood at 138.27 GW,

Programme/Scheme wise Physical Progress in 2020-21 & Cumulative upto Jan, 2021

	FY–2020-21		Cumulative Achievements
Sector	**Target**	**Achievements (April–Jan 2021)**	**(as on 31.01.2020)**
I. GRID-INTERACTIVE POWER (CAPACITIES IN MWp)			
Wind Power	30000.00	939.90	38683.65
Solar Power – Ground Mounted	90000.00	2448.84	34561.33
Solar Power - Roof Top	2000.00	1717.44	4232.74
Small Hydro Power	100.00	75.29	4758.46
Bioness (Bagasse) Cogeneration)	200.00	173.37	9373.87
Biomass (non-bagasse) Cogeneration / Captive Power	50.00	97.24	7772.05
Waste to Power	30.00	21.00	168.64
Total	**14380.00**	**5473.08**	**92550.74**
II. OFF-GRID/CAPTIVE POWER (CAPACITIES IN MWEQ)			
Waste to Energy	10.00	10.34	208.53
SPV Systems	500.00	122.09	1100.48
Total	**510.00**	**132.43**	**1309.01**
III. OTHER RENEWABLE TECHNOLOGIES (Capacity in Nos.)			
Biogass Plants (in Lakhs)	0.60	0.10	50.50

Source: Ministry of New and Renewable Energy

with a total share of 36.7 percent at the end of 2020, as per data from the Central Energy Authority (CEA), the Ministry of New and Renewable Energy (MNRE).

Prime Minister Narendra Modi at the 3rd Global RE-INVEST 2020

Indian PM echoes optimism

Speaking at the 3rd Global Renewable Energy Investment Meeting and Expo (RE-INVEST 2020) through video conferencing, Prime Minister Narendra Modi expressed happiness that in the RE sector, within a short time the progress from megawatts to gigawatts in generation capacity and 'One Sun, One World, One Grid', are becoming a reality. He added that in the last six years, India is traveling on an unparalleled journey. He pointed out that India's generation capacity and the network is being expanded to ensure all citizens of India have access to electricity to unlock their full potential. He showcased that today, India's renewable power capacity is the 4th largest in the world and is growing at the fastest speed among all major countries. The RE capacity in India is currently 136 GW, which is about 36 percent of our total capacity.

He also stated that India's annual RE capacity addition has been exceeding that of coal-based thermal power since 2017. He highlighted that in the last six years, India has increased installed RE capacity by two and a half times. Investing in RE early on, even when it was not affordable, has helped in achieving the scale, which is bringing costs down. He said India is showing to the world that sound environmental policies can also be sound economics. The government has ensured that energy efficiency is not limited to one ministry or department, instead, it has been turned into target for the entire government. All government policies have a consideration of achieving energy efficiency.

After the success of Performance Linked Incentives (PLI) in electronics manufacturing, the government has decided to give similar incentives to high-efficiency solar modules. Ensuring 'ease of doing business' is the government's utmost priority and dedicated project development cells have been established to facilitate investors. India has huge RE deployment plans for the next decade and is likely to generate business prospects of the order of around $20 billion per year.

Finance Minister Nirmala Sitharaman at the Lok Sabha during the Budget Session

Union Budget 2021: focus on clean energy

The 2021-22 Budget tabled in the parliament by Finance Minister Nirmala Sitharaman, allocated ₹220 billion (~$3.08 billion) for power and renewable sector.

Some of the major budget outlays in the power sector include the ₹26 billion (~$356 million) for solar power and ₹11 billion (~$150 million) for wind power.

The largest outlay was for the Integrated Power Development Scheme (IPDS), which received a whopping ₹53 billion (~$724 million). One of the main programs of IPDS is smart meter installations.

Production linked incentive scheme

Speaking of the *Aatmanirbhar Bharat* vision and the PLI scheme, the FM noted that for a $5 trillion economy India's manufacturing sector would have to record a double-digit growth on a sustained basis. To achieve this ambitious goal, the government has announced the PLI Scheme for 13 key sectors (including Advanced Chemistry Cell battery manufacturing, automobiles, and auto components) and committed ₹1.97 lakh crore for over five years starting this financial year.

"This initiative will help bring scale and size in key sectors, create and nurture global champions, and provide jobs to our youth," Sitharaman emphasized.

Power infrastructure reforms

Highlighting a need for a framework to give consumers alternatives to choose from among more than a few distribution companies, and expressing concern over the viability of the distribution companies, FM proposed to launch a revamped reforms-based result-linked power distribution sector scheme with an outlay of ₹3,05,984 crore over the five years.

The scheme will provide assistance to Discoms for infrastructure creation, including pre-paid smart metering and feeder separation, upgradation of systems, etc., tied to financial improvements.

Hydrogen economy

In November 2020, PM Modi in the 3rd Global RE-INVEST Meet announced plans of a Comprehensive National Hydrogen Energy Mission. The FM announced a proposal to launch a Hydrogen Energy Mission in 2021-22 for generating hydrogen from green power sources.

Non-conventional energy

With the objective to boost power generation from the non-conventional energy sector, the FM proposed an additional capital infusion of ₹1,000 crore to Solar Energy Corporation of India Limited and ₹1,500 crore to the Indian Renewable Energy Development Agency Limited (IREDA).

"We have already acknowledged that solar energy has huge promise for India. To build up domestic capacity, we will notify a phased manufacturing plan for solar cells and solar panels," she added. To encourage domestic production, the FM also proposed to raise duty on solar invertors from 5 percent to 20 percent, and on solar lanterns from 5 percent to 15 percent.

Minister R K Singh signals positive growth

Affirming that the Union Budget 2021-22 will pave the way for comprehensive growth in the economy, R K Singh, Minister of Power - New and Renewable Energy and Skills, Government of India, has said that the country's energy consumption touched an all-time high of 1.89 million GW in January and this is a sign that India's economy is on a path of growth.

"In October 2020, the country's energy consumption increased by 13 percent (1.86 lakh GW) over the previous year. In January this year, it reached an all-time high of 1.89 million GW. This is an indication that our economy is on a growth path," ANI cited Singh, as part of the government's effort to reach out to the masses regarding the Union Budget.

"Another important fact is that the Ministry of Power has generated 28 million new beneficiaries in the last 20 months through schemes like Saubhagya. For the first time since independence, all the villages and houses in the country have been brought under the power grid. These 28 million consumers are involved in measures to reinforce the economy in various ways," the minister stated.

"Numerous steps have been taken to reinforce the country's energy supply chain. Steps will be taken to set up more substations and upgrade existing ones. India's growth rate in the RE sector was one of the highest in the world. India has become one of the most attractive destinations for investors. Over the past five years, the country has received $64 billion as an investment in the power sector," Mr. Singh expressed.

R K Singh, Minister of Power - New and Renewable Energy and Skills

Industry outlook for 2021

To learn more about the industry's viewpoint on clean energy sector development in the year 2021, ETN connected with few of the seasoned industry players.

SIMARPREET SINGH
Director
Hartek Group

Expectations for the year 2021

The transmission and distribution (T&D) segment will witness a decisive shift towards extra-high voltage transmission lines and substations, bearing in mind the proactive approach of the Power Grid Corporation of India and the massive investments being pumped in by the government in T&D projects like the Green Energy Corridor. The upgrade to substations in the range of 400 kV and above will be taken up on a war footing.

Things will fast return to normal in 2021 as far as solar projects are concerned, with the restoration of supply chains and revival of pent up demand. Some experts even expect a strong rebound of rooftop solar installations on account of these factors by June. This comeback will largely be driven by the increase in demand for rooftop solar installations from commercial and industrial consumers, a trend that will catch up in the coming months.

Product/Technology/Policy to stimulate sector growth

Customized plug-and-play rooftop solar kits will go a long way in driving the adoption of rooftop solar. Hartek Solar is among the first companies to introduce these kits based on a unique remote sensing technology made commercially feasible for small-scale plants by linking remote sensing with consumers' Wi-Fi or GPRS SIM card to get alerts on cleaning and maintenance as well as real-time data on energy generation and savings.

Another revolutionary technology that will shape the growth of the T&D industry in the coming years is artificial intelligence (AI) based applications and smart grid technologies. As far as policies are concerned, we feel that attractive net metering policies will prove to be a game-changer in pushing the demand for rooftop solar in the residential segment. Making rooftop solar installations mandatory for new buildings will prove decisive in enabling the rooftop solar segment to grow at a faster pace than utility-scale projects, considering the massive urban expansion taking place in India.

Growth plans for the year

In the T&D space, our flagship company Hartek Solar, will be targeting high-voltage and extra-high voltage substations based on the latest cutting-edge technologies in a big way, apart from executing gas-insulated substations and digital substations equipped with smart grid technologies, SCADA, and other automation devices. We will also add to our solar EPC portfolio through large projects in mega solar parks. Sustainability being at the core of our strategies, we aim at strengthening our rooftop solar portfolio as well. Our rooftop solar division has executed 40-MW projects. We are looking to double it by the end of this year.

Product launch/ facility development plans

While we are already contributing towards the country's clean energy ecosystem through our rooftop solar solutions, we are aggressively working on smart grid systems based on the latest automation technologies. These real-time interactive technologies based on automated and computerized applications optimize the physical operation of appliances and consumer devices and minimize downtime. They not only detect faults and identify faulty equipment but also reduce the need for manpower and bring down the costs, aided by lower operation and maintenance expenses, besides ensuring a faster response.

Industry-readiness for ACC manufacturing

The industry in India is slowly but surely bracing for Advanced Chemistry Cell manufacturing, with the Niti Aayog issuing a draft request for proposal to prospective bidders who can manufacture ACCs. ACC refers to the new generation advanced storage technologies that can store energy either as electrochemical or as chemical energy and convert it back to electric energy as and when required. With the Central government approving ₹18,000 crore production-linked incentive to this effect, many manufacturers have started evincing interest in this upcoming technology to avail the benefits of the subsidies offered under the scheme.

ANIMESH DAMANI
Partner
Artha Energy Resources

Expectations for the year 2021

Considering the way 2020 has happened, a lot of projects were delayed or postponed due to the COVID-19 pandemic. I feel 2021 will be a very prosperous year for the solar sector in general, a lot of the backlogged projects will be seeing commissioning in the first quarter of this calendar year. Currently, the commercial and industrial segment has rebounded strongly and is leading the growth of the rooftop solar segment.

Considering the extreme price volatility in solar panels and shipping prices, we hope for more stable pricing in 2021. Lastly, we hope the Central government repeals the cap of 10 kW that has been put on net-metering. We hope for a net-metering policy that is a catalyst for growth in the roof-top solar segment and compensates the utilities for using their infrastructure when solar generation is exported.

Product/Technology/Policy to stimulate sector growth

The government should revise the entire rooftop policy in a way that promotes the development of roof-top solar while also compensating utilities for using their infrastructure when solar generation is exported. Caps decided by contract demand and sanction load should be removed to allow the sector to flourish. We need to be focused and not give up on our target of 40GW of rooftop solar capacity.

Also, it would be exciting to see the costs of energy storage dropping this year, and in the next two years it will be a more commercially viable and attractive alternative to net-metering.

Growth plans for the year

Our target for this year is to expand into six States, at the same time expanding into sectors like cold storage, automotive, steel manufacturing, hotels, FMCG, pharmaceuticals, and other commercial spaces. We aim to build about 3.5-4 MW capacity in 2021. We look forward to adding 4-5 MW operational capacity in wind and solar through acquisitions.

Product launch/facility development plans

We have a couple of launches this year under the pipeline to be revealed in the latter part of the year.

Industry-readiness for ACC manufacturing

At present, I am not sure if India is ready for Advanced Cell Chemistry manufacturing. There is still a lot of work that needs to be done on the policy front. There has been a dearth of major policy announcements from the government to stimulate investment in this area. Moreover, raw material linkages are particularly important. Acquiring raw materials through discoveries in India or assets abroad is of paramount importance. Hence, raw material linkages and policy announcements that focus on building and growing the entire vertical supply chain are the principal factors that will pave the way for the industry to step-in. Without these, our industry readiness will be not for 'Make in India' but 'Assemble in India'.

Something to learn from the solar program is that we are never focussed on setting up an entire vertical supply chain, nor focussed on creating demand that would buy out any production coming out from this supply chain. The Chinese were able to do this efficiently, and today supply 90 percent of the world solar modules. If India does not wish to lose this race as well, it is high time we see serious intentions from the government.

Way forward

As the world pursues ways to fast-track the pace of transformation in the energy sector, India is in a distinctive position to innovate a new model for low-carbon, inclusive growth. Government policies to speed up India's clean energy transition can lay the foundation for long-lasting prosperity and superior energy security. ETN

Moulin Oza
Assistant Editor
ETN

SAVE THE DATES

2nd Nov | Monday
Pre-Conference Workshop / Masterclass
IESA Annual Members Meeting

3rd Nov | Tuesday
Atmanirbhar Bharat – Energy Storage & EV Manufacturing
CXO Roundtable
IESA Industry Excellence Awards
Virtual Exhibition

4th Nov | Wednesday
Stationary Energy Storage India (SESI)
Women in EV & Energy Storage Forum
Country/State Roundtable
Virtual Exhibition

5th Nov | Thursday
e-Mobility (Electric Vehicle & Charging Infra)
Buyer-Seller Forum
Country/State Roundtable
Virtual Exhibition

6th Nov | Friday
Energy Storage & EV R&D Summit
Energy Storage & EV Investment Summit
Start Up Competition

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MONTHLY MARKET INTELLIGENCE REPORT

Storage IQ India covers Indian Power & eMobility sector monthly updates and analysis. on energy storage and electric vehicle market. Get the latest developments on policy and regulatory announcements by state and central government, ongoing tender details, & status, upcoming meeting dates, regular news updates, and IEX prices. Government initiatives, notices, battery raw material price trends, partnerships, investments etc. are monitored and presented in this monthly Storage IQ. Get expert analysis by subscribing to this monthly report.

WHAT'S IN THE MONTHLY REPORT

Section 01

STATIONARY ENERGY STORAGE MARKET

- Central & State Policy/Regulations/Notifications announced in that respective month along with IESA analysis
- Forthcoming meeting dates
- Tender Dashboard
- Other important updates

Section 02

ELECTRIC VEHICLE MARKET

- Central & State Policy/Regulations/Notifications announced in that respective month along with IESA analysis
- Forthcoming meeting dates
- Tender Dashboard
- Other important updates (EV/Charging/Battery swapping)

Section 03

MANUFACTURING AND GENERAL INFORMATION

- Government Regulation and analysis with IESA responses
- Raw material prices – Monthly Trend
- IEX Prices – Monthly Overview

Section 04

OTHER UPDATES

- Industry news
- Updates on Innovative Start Ups, Investment & Partnership
- Beyond Batteries (Hydrogen & Fuel Cell, thermal storage, mechanical storage) Updates
- Safety & standards/Recycling & Second Life Policy Updates

Monthly Analyst briefing call

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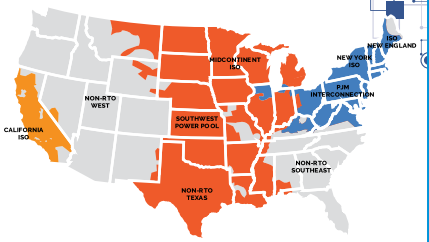

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Making inroads towards clean power generation

India has observed surprising triumphs in its recent energy development. The government of India had set an ambitious target of installing 175 GW of renewable energy capacity by 2022, which has been increased to 450 GW by 2030, as committed by the Prime Minister in the UN Climate Action summit.

The overall share of RE (including large hydro projects) in the country's installed power capacity mix stood at 138.27 GW, with a total share of 36.7 percent at the end of 2020, as per data from the Central Energy Authority (CEA), the Ministry of New and Renewable Energy (MNRE).

The 2021-22 Budget tabled in the Parliament by the **Finance Minister, Nirmala Sitharaman** allotted ₹220 billion (~$3.08 billion) for the development of the power and renewable sector.

India has huge plans for the emerging electric vehicles and their technologies in the country. The country has great expectations of achieving a high level of penetration in e-mobility by 2030. EVs in India have opened gates to significant business opportunities for automobile companies within the country and globally.

The EV market is expected to be a ₹50,000 crore opportunity in India by 2025, and it is projected to drive higher electrification of the vehicles in the medium term in the wake of COVID-19 pandemic.

Emerging Technology News (ETN), powered by the India Energy Storage Alliance (IESA) hosted the 'Roadmap 2021: Driving towards cleantech and e-mobility' conference on January 27, 2021, to discuss and learn more about the industry growth plans for the current year, and also brainstorm over the appropriate pathway to accomplish the ambitious goals this year in the august presence of H.E Upendra Tripathy, Director General - International Solar Alliance, Dr. Rahul Walawalkar, President - IESA, Nishant Arya, Executive Director - JBM Group, and Tobias Winter, Director - Indo-German Energy Forum.

Speaking at the conference, **H.E Upendra Tripathy** shared his views on the sector outlook for the year 2021. He expressed, that the prospects looked good for ISA and that it was optimistic about developments taking place.

H.E Upendra Tripathy
Director General - International Solar Alliance (ISA)

"For the seven programs that we had, we sent a different mission team to different member countries to deliberate on how this technology can be implemented in the year 2020. Due to the COVID-19 pandemic, 2020 was a difficult year, but we are optimistic about 2021 being a good year. The way the cost of solar is coming down it is heartening to see how solar energy is making inroads and looking at the sun as a promising source of clean power generation. The cost would stay the same for the next 30 years.

"Today, technology has helped harness the sunlight to an optimal level and make the most of the abundantly available natural heat and light. Next year will only attract more investment in solar and renewables as the COVID-19 curve flattens globally. The capital infusion, the declining cost will help to make 2022 a business-friendly year.

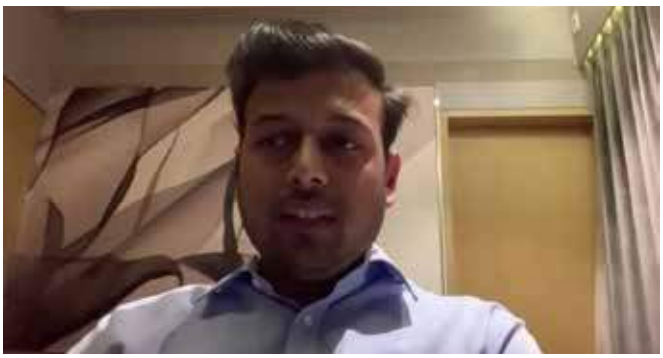
"We are talking about 'One World One Sun One Grid' (OSOWOG) on a large scale, we are trying to utilize every accessible latitude and longitude. We are also trying to employ and exploit the best of the technology and it will be a new driving-idea for 2022. We seek inclusive human growth in the 21st century and World Solar Bank aims to be a facilitating agency for the same. Demand aggregation in different solar applications is of top importance as well as market development for easy-access."

Dr. Rahul Walawalkar
President-India Energy Storage Alliance (IESA)

Accentuating upon the need for adoption of new technologies, robust policy framework, and substantial sector transformation, **Dr. Rahul Walawalkar** said that "I look at 2021 as the year of adoption of new technologies and government framework. To a large extent, the industry leaders are showing keen interest in taking the lead in implementing the same. The next 12-18 months is crucial for

adoption as the prices fall. At IESA, we are happy with global financial institutions that are pooling in funds for financing of stationary storage and e-mobility in India. While the market is signalling positively, we need to look at the complete supply chain."

"This is a great opportunity for developing the local supply value chain. We need to start focusing on the adoption on an accelerated scale. One of the key missing blocks is financing, as financial institutions are yet to kick-start the same. The scale at which projects are happening in India is less attractive and they need to be revamped and fast-tracked. Just like the telecom transformation that took the industry by storm same has to be replicated in the stationary storage and e-mobility sector."



Nishant Arya
Executive Director - JBM Group

Emphasizing on the emergence of e-mobility in the country and the critical role of battery technology, **Nishant Arya** said that, "We have come to realize that it's each ones responsibility to ensure a sustainable world around us, which took a pandemic to make us understand the same. E-mobility has been a way of life for some years now as the world takes cognizance of how important it is to maintain sustainability for the future. Today, with various parameters diversely benefitting the sector, we at JBM are committed to being aatmanirbhar (self-reliant) and make indigenous manufacturing a major industry in the country."

"With the right foundation and high investment, there is a need for specific and upgraded skill development, which will give a good fillip in moving forward. It is important to educate customers for the benefit of going green and switching to EVs, and as a country how well-equipped we are to transition to sustainable transportation. The ambitious RE target combined with striving e-mobility ambition can be a game-changer for the industry as well as ancillary service providers. It is important to understand that the way we are moving ahead, the battery will play a critical role in the imminent future and the chemistry-agnostic structure will prove to be critical."

In the recent years, India has developed into a lucrative business destination for global conglomerates to venture into the RE and e-mobility sector. Expounding on the lines of this sentiment, **Tobias Winter** said that "The renewables and e-mobility companies have done exceedingly well over the years and that is visible with the growth in adoption globally and in India. I have been excited about the energy transition in India for a long time. The availability of sun throughout the year, and generation of solar energy coupled with advanced energy storage has been quite amazing. We are optimistic that India is actually on its way to surpassing Germany in renewable power generation, and achieving the Paris Agreement commitment well before the promised period."

Tobias Winter
Director - Indo-German Energy Forum (IGEF)

"We see a lot of discussion in India on battery storage development. Companies like Tesla are investing in Germany for developing battery storage as well. One thing that will generate demand is to understand that renewables are capable of delivering a 24x7 power supply, and upkeep the government's vision. In Germany, the electricity market is quite unregulated. The deregulation of the market is quite necessary and it will happen over a while."

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"Profit is fuel for business; Purpose gives it direction"

Dr. Shalini Sarin, Executive Director – Elektromobilitat India shares her mantra for success, what it takes to be an entrepreneur in the energy business and the opportunities ahead for women in clean energy ventures.

The year 2020 would be etched in our memory forever, though most of us would love to forget it. However, the outbreak of the pandemic and the associated changes it forced in our behavior, have brought forward certain narratives to mitigate the impact of climate change. One such narrative is electric mobility.

You are an entrepreneur, HR leader and serve as a strategic advisor to several organizations working in the areas of clean energy, energy efficiency and electric mobility; tell us about how your journey started.

I worked as an HR professional for over three decades. While, I was heading HR at Schneider Electric, I also got exposed to clean energy and energy efficiency solutions at Schneider. I was also responsible for the access to energy business for Schneider in India where I learnt a lot and got attracted to development work in energy. Later, I moved to Philips at their global HQ and got similar experience at a global level in HR and in access to energy or lighting in specific. This started my learning and journey in the clean energy space, and am now helping set up the center for clean energy at Plaksha.

After returning back to India, I knew I want to be close to clean energy, hence ventured in the EV charging infrastructure with a startup.

'Profit with Purpose and Passion' is your personal mantra, help us understand more about it and how has it has shaped your business and personal life.

When working with large corporates like Schneider Electric and Philips, I was also fortunate to get an opportunity to collaborate with the development sector to create and deploy solutions for the underserved markets. This exposure helped me to learn that corporates and social sector both have a lot to learn from each other. 'Profit' is not a bad word, in fact, it enables the business to sustain for a long time and is the fuel for any business. While 'purpose' gives direction and meaning for the business to exist, businesses addressing social needs or enhancing value of life based on ethical practices, without exploiting the planet or people, create 'value'.

'Shared value' business models create value for society while reinforcing business objectives.

DR SHALINI SARIN

They encompass a wide range of business activities, such as creating ethical supply chains, developing socially beneficial products, and generating sustainable social investments.

You started a new venture Elektromobilitat India and serve as its Executive Director and Mentor; how has been the journey been of founding your own venture and leading it? What are some distinct leadership capabilities women leaders bring to an organization in your view?

As a first-time entrepreneur, one is never prepared enough when it comes to starting a venture. This calls for a different muscle, where besides an analytical mind and knowledge about the sector, there is need for courage, risk-taking, experimentation, collaboration and much more. Women are at an advantage as they are more collaborative and have abilities to bring different stakeholders to work together for a common cause.

EV mobility aligns with my passion for clean energy and I realize that electric cars and chargers will not be enough to propel this transition from ICE to EVs. It requires all ecosystem partners to work together for faster adoption such as power provider, land, charging infrastructure (which includes hardware and software), operators, charging behavior from 10-minute charge to 30-minute charge, enough footfall of EVs to make the model viable, cost of EVs and a host of other things.

Tell us more about your work with startups in the social sector and social impact ventures. What kind of impact will clean energy ventures have on our communities in the years to come?

Social investment provides repayable finance that aims to achieve a social and financial return. By looking for social investment opportunities within the business and its operations, companies can create value for society, reinforce business objectives and create value for shareholders. It is sustainable and gives opportunities for them to engage deeply in social causes.

There are several ventures creating an impact in the clean energy space like Frontier Markets and Dharma Life working with women entrepreneurs in access to energy and clean cooking; Barefoot College in training solar technicians; Women on Wings is enabling women entrepreneurs; SEWA, SMV Green, Villgro and several others helping with the micro finance or self-help groups to support service and last mile distribution of solar or distributed energy solutions.

Clean energy ventures will benefit women immensely as they are the worst impacted with its absence – like promoting clean cooking instead of the use of firewood it causes health issues due to smoke. Similarly, access to light not only enhances the productive day but also adds to the safety and security of movement. I see energy playing a pivotal role in transport and appliances too, in the next phase of the development of renewable energy.

What would you like to share with women entering in the renewable, clean energy and clean transportation sector? What are some opportunities you see emerging in these field?

India needs environmentally friendly means of shared transport systems. It is only possible when renewable energy is hip locked with electric mobility. There is need for women entrepreneurs to be encouraged to join both in supporting technology and use of it. A pilot project to support women entrepreneurs in Delhi to be e-rickshaw drivers, while owning and managing the vehicle, is underway. Women can play a substantial role in the entire value chain from designing the solutions to safe disposal of batteries, including recycling.

Responsible use of energy is important in our aim for transitioning towards a climate resilient and secure energy future; what is your vision for the future and how do you hope to shape this sector through your efforts and engagement?

Responsible use is not only about the type and power footprint of the appliances, but also to determine whether it is needed in the first place, when to use it and how much. Enabling remote sensing, monitoring and control of appliances further enables automation, helping efficacious use and efficiency of performance. A case in example is to link use of air conditioners with ambient temperature sensors, which automatically adjust the temperature control settings of the AC.

In the area of EV charging there is a huge opportunity for building shared infrastructure for home charging rather than providing a committed resource per vehicle. Master Slave technology exists in AC Chargers, and in extensive use in the western world, where several cars can be charged simultaneously without breaching the grid load limits yet offering flexibility of one meter serving many chargers.

Other inspiring ideas you would like to share with our readers.

Our society will continue needing energy. Thus, developing and investing in sensible greener energy solutions is crucial. There is no doubt that investing in the development of renewable energies is a step in the right direction.

Yet, the balance in this field can be hard to strike. While we are great advocates for green energies, we are also aware that producing any type of energy comes, as any activity, with some sort of negative environmental impact. Clean energies can come with their own caveats: from their intermittence to their recyclability to their impact on biodiversity. Hence my belief is to take a holistic and local approach to energy, as one solution does not fit all.

Shraddha Kakade
Assistant Editor
ETN

Decarbonizing transport with the Vehicle Scrappage Policy

The recently announced voluntary vehicle scrappage policy could be instrumental not only in eliminating high CO_2 emitting old vehicles but also in fast-tracking shift to e-mobility and the circular economy.

The idea of scrapping and recycling old, end-of-life-vehicles (ELV) is fast gaining momentum in India. In the Union Budget 2021-22, Finance Minister Nirmala Sitharaman announced several pathways for reducing air pollution in the country, including a Voluntary Scrappage Policy to phase out old and unfit vehicles. The use of old vehicles is estimated to cause 10-12 times more pollution compared with the new ones. As per the announcement, all the vehicles in India will have to undergo fitness tests at automated fitness centers (after 20 years in case of personal vehicles, and after 15 years in case of commercial vehicles).

Welcoming the Scrappage Policy, Nitin Gadkari, the Union Minister for Road Transport & Highways and MSMEs explained that the policy would cover an estimated 51 lakh light motor vehicles (LMV) above 20 years of age, 34 lakh LMVs above 15 years, and 17 lakh medium and heavy motor vehicles above 15 years, and currently without valid fitness certificates.

Mr. Gadkari also mentioned that the scrappage policy would lead to new investment of around ₹10,000 crore and create 50,000 jobs in the economy. While the details of the policy are expected to be out by mid February, industry stakeholders and climate experts have both hailed the policy announcement alike.

Customized Energy Solutions expert, Harsh Thacker said that the announcement of Vehicle Scrappage Policy is likely to provide a boost to vehicle sales across all the segments, especially two-wheelers.

"The Federation of Automobile Dealers Associations has estimated that it will lead to scrapping of over 80 lakh vehicles across the country, however, other auto experts have estimated that this number can be much higher if the policy is implemented efficiently," Mr. Thacker added. He highlighted that as the percentage of EV models increase, the scrappage policy is likely to have a positive impact on EV sales too.

Air pollution on streets of Delhi
Source: Wikimedia Commons

Disposing old vehicles

Old, legacy vehicles are used widely across India. While a quantitative assessment of legacy fleet is a challenge in India, a joint study conducted by CPCB (Central Pollution Control Board) and GIZ (Deutsche Gesellschaft für Internationale Zusammenarbeit) in 2016, revealed that India would have over 2 crore end-of-life-vehicles by 2025 – with 2Ws accounting for about 80 percent of the total ELVs.

Further the International Energy Agency (IEA) estimates that global 4W fleet is expected to double by 2050. This trend will also reflect in India, which means a rising number of old, obsolete 4Ws could pose a serious public health concern unless policies are put in place and effectively implemented.

Studies indicate, old diesel trucks used in India for transportation of goods and cargo, meeting BS (Bharat Stage) Emission Standard I norms emit 36 times more particulate matter (PM) compared to BS VI compliant trucks.

Existing measure to tackle air pollution

In April last year, India officially shifted to the BS VI vehicular emission norms from the then existing BS IV.

BS VI is equivalent to EURO6 norms – European emission standards that regulate gasoline and diesel vehicles and puts tough limits on emissions to produce ever-lower levels of the exhaust pollutants that impact air quality.

While the hasty jump into BS VI norms caught the auto manufacturing industry unprepared, sending major automobile manufacturers scrambling to launch their vehicles with BS VI-compliant engines or upgrade their existing models with BSVI powertrains – what it did ensure was that there were strict parameters of emissions allowed out of a motor.

With the introduction of BSVI norms, India joined the small band of Asia-Pacific nations, including Japan, South Korea, Hong Kong, Australia, New Zealand, Philippines and China implementing tougher emission norms.

Further, the National Clean Air Programme (NCAP) launched by the government of India to meet the target of 20-30 percent reduction in particulate matter pollution by 2024 has witnessed several cities implementing clean air action plans to meet the National Ambient Air Quality Standards. These States have also included phase-out strategies for old vehicles as an air pollution mitigating strategy. In some other States, judiciary has directed action to curtail air pollution – for instance Supreme Court in Delhi, and NCR region, High Court of Kolkata and National Green Tribunal in other regions have issued certain guidelines to cap the age of the old vehicles for a phase-out.

States of Maharashtra and Karnataka have also put in place a 'green tax' that increases as the vehicles ages with the aim to disincentivize old vehicles.

Reusing auto waste

While the Scrappage Policy will be instrumental in eliminating high CO_2 emitting old vehicles, it would also help reuse a great part of the heaps of auto waste. For instance, auto parts including steel, plastic and other metals and materials, can be recovered and brought back in use after a vehicle is scrapped. The Vehicle Scrappage Policy can build this circularity.

Studies indicate scrappage of vehicles could also benefit the market for spare parts to meet the demand for specific spare parts for the on-road fleet. The used-vehicle market may require certain spare parts of vehicles and models that may not be in industry in anymore.

According to an estimate by the Federation of Indian Chambers of Commerce (FICCI), ELVs have the potential to generate 8 million tons of steel than can be extracted in India by 2025. This can be a significant opportunity for India as we are major consumers of steel – a good percent of which is used by the automobile sector – thereby substituting imports and improving the country's balance of payment.

Boost in the sale of EVs:

What several experts and industry leaders believe is that the implementation of Vehicle Scrappage Policy could also have a positive impact on the uptake of EVs in India if the right incentives are put in place.

The Ministry of Road Transport and Highways (MoRTH) was to announce the details of the scrappage policy within 15 days of its announcement in the budget session.

ETN connected with leading industry players for Budget 2021-22 reactions, following are their views on the Vehicle Scrappage Policy.

DEEPAK PAHWA
Managing Director
Bry-Air (Asia)

"The old vehicle scrappage policy will lead to a boost in demand for new cars. This step will help the automotive industry bounce back after witnessing a significant down in the revenue sheets. The government has taken a strong decision to hike the basic customs duty on certain auto components as this measure will encourage local manufacturing in India."

KENICHI AYUKAWA
President
Society of Indian Automobile Manufacturers (SIAM)

"A good macro-economic growth will translate to good demand for auto sector. The industry awaits the details of the Vehicle Scrappage scheme, and requests that fitness testing and certification should be much earlier and at frequent intervals to ensure safety, environmental friendliness, and fuel-saving."

CHETAN MAINI
Chairman & Co-founder
SUN Mobility

"Implementation of the Scrappage policy is a good move, which can be further enhanced by providing additional incentive for replacing old vehicles with electric ones, instead of other ICE vehicles, for driving mass EV adoption."

GURPRATAP BOPARAI
Managing Director
ŠKODA AUTO Volkswagen India Pvt Ltd

"Increased outlays in the road sector, infrastructure development and introduction of the voluntary vehicle scrappage policy will not only create a safer and environment-friendly auto sector but also drive replacement demand in the sector."

Shraddha Kakade
Assistant Editor
ETN

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Charging infrastructure gets a foothold in the country

N Mohan - Deputy GM, Head of EV Charging Infrastructure - EESL, outlines the finer details of a blueprint in the making, to profitably set up charging stations in the country.

EV adoption in India is caught in chicken-and-egg warp, leaving it to the government to take the lead and promote an EV ecosystem. And hence, Energy Efficiency Services Ltd (EESL) launched the national e-mobility program in 2018 with a goal to provide impetus to Indian manufacturers in the e-mobility space by gaining efficiencies of scale, creating local manufacturing facilities and growing technical competencies for the long-term growth of the EV industry in India. This has been achieved by aggregating demand for EVs and charging infrastructure from various government departments for which 200+ Public EV Charging Stations (PCS) have already been installed, around 1514 EVs and 463 captive chargers deployed across the country.

EESL is a joint venture of four public sector undertakings, NTPC Ltd, POWERGRID, Power Finance Corporation and REC Ltd. Convergence Energy Services Ltd (CESL) is a hundred percent owned subsidiary of EESL, created primarily to focus on EVs, charging infra and decentralized solar power projects.

N Mohan
Deputy GM, Head of EV Charging Infrastructure - EESL

Decarbonization, decentralization, digitalization

A glance at the conventional energy market, relative to the transforming future market, shows centralized power generation facilities veering to demand side power transactions. Future energy transactions are conducted from the position of a strengthened democracy with greater public participation and local energy ownerships. The distribution utility would now act more as an operator due to multiple decentralized generation facilities, which could independently service multiple sectors - such as the business, the industrial or the household sector.

The case for RE is compelling with the lowest bid received for solar till date at ₹2 per kWh and even lower bids being possible. This is particularly relevant as TERI predicts the cheapest variant of coal in the near future to be in the range of ₹6.98 per kWh. India shows a commendable record of shifting to green energy with about 50 percent of power capacity addition in India since 2015 being renewable. This places the country in a favorable position to link RE with EV charging infrastructure (EVCI). Both State and Central governments encourage integration of renewables with EVCI in their EOIs and subsidy schemes.

Zero tail pipe emissions from EV transport can significantly reduce carbon emission on a country wide scale. The high savings compared to ICE vehicles will drive a clear demand from e-commerce companies and logistic applications for e-mobility. Electric buses being more subsidy-driven will be popular as a city bus services to an extent. In the car segment the initial demand will be driven by commercial fleet operators and app-based taxi services, incentivized by State and Central subsidy. In the 2W and 3W segment, ride economics will pull off around 80 percent conversion. The e-3W electric rickshaw category is a success story in India even without a subsidy in place.

In a study done by researchers based at Cambridge University, it was ascertained that EVs have lower lifecycle emissions compared to ICE vehicles. In addition, if the source of electricity generation is renewable, there is a significant opportunity to further lower emissions.

- Lifecycle emissions (global average of 59 countries)
- Petrol car: Average 305 gCO2eq/vehicle KM
- Electric car: Average 213 gCO2eq/vehicle KM
- Electric car: 75 gCO2eq/vehicle KM (largely renewable- and nuclear-powered, Switzerland)

Charging infrastructure will evolve as per each EV segment: the pickup van and delivery segment will rely largely on their own charging facilities known as the captive charging variety. The FAME II subsidized e-buses with a pre-fixed route will also utilize captive charging at depots and at the destination locations. It is the personal vehicle segment that will drive the demand for public charging stations. The incentives fall under the FAME II scheme, and around 2000 public charging infrastructure stations (PCI) will be set up under subsidy by 2021. The highest segment of EVs - the 2W and 3W - are serviced by the non-formal sector and home charging.

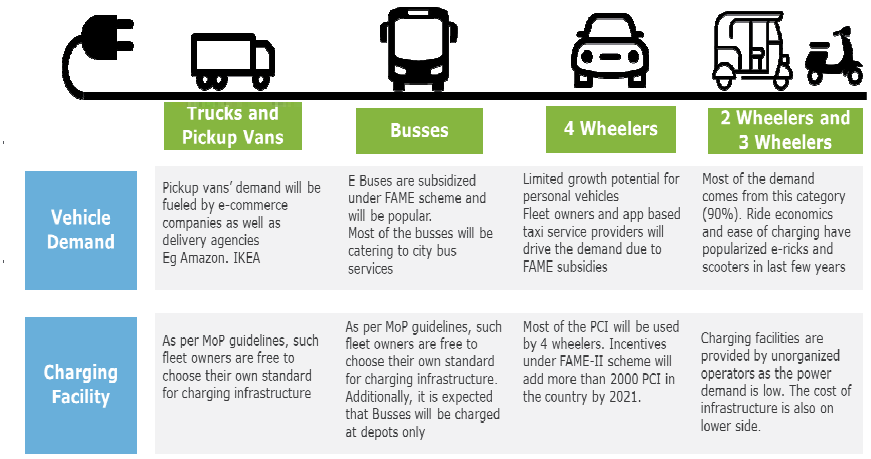


Figure 1: Megatrends changing the EV market

Demand projections for EV charging stations

If one were to estimate a volume close to at least 100 million EV sales, and factor in just the 4W segment, it would translate to 10 million EV sales by 2030. So even considering the absurd assumption of 10 vehicles to one charging station, we would be looking at one million charging points by 2030. These would require a combination of both AC and DC charging ports. Initially at least 30 percent will be DC fast charging stations and the balance 70 percent will be slow charging points.

To promote the early adoption of EVCI, user profiles that rely on different technologies to serve an individual segment's needs should be identified

India is majorly promoting e-mobility, and as with all nascent industries it faces some inherent challenges for development of an EV ecosystem. Listed broadly, one for sure is the high upfront cost of EVs; second is the shortage of EV model types and the third is the lack of charging infrastructure.

Compared with the ICE vehicle, the e-car presently sells at a premium. Thus, FAME II enables financial incentives to OEMs to help reduce the cost of EVs. The subsidy is based on the battery capacity of the EVs. So, for e-2W, -3Ws and -4Ws, ₹10,000 per kWh is the extent of subsidy.

The second major obstacle that limits purchase of EVs is the paucity of options in EV models. ICE vehicle companies are offering top choice with a range of vehicles based on budget. Limited EV model options have OEMs launching newer vehicles in the market.

The foremost point remains the lack of charging infra, presently caught in a chicken and egg kind of scenario. Added to that is the high initial investment involved in setting up public charging stations; high land cost is also a major concern. These are some of the three broad eco-system challenges which need to be addressed if e-mobility has to expand its footprint in the country.

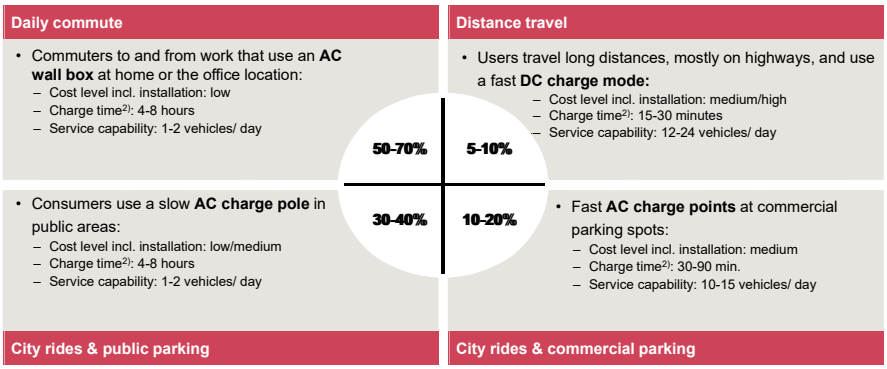
An interesting user profile study of charging patterns was done by consultants. In a daily pattern of users, one sees that close to 70 percent of daily commuters charge at home or at their office locations. Close to 10 percent are distance travel usage profiles who require DC fast charging for a quick tank-up. Around 30 to 40 percent of consumers, who rely on slow or AC charge zones, especially in a public car park, are typically ones who do city rides.

So, from the user profile it is very clear that almost 70 percent still rely on home charging or on work-place charging facilities. The balance 30 percent would have access to a mix of AC slow charging and AC fast charging and DC fast charging modes. The DC fast charging mode would have about 10 percent demand.

The Usage Profile in Figure 2 helps analyse the type of infrastructure needed for EVs and the most profitable locations one could look at for setting up public charging infrastructure (PCI).

In addition to the usage profile study, EESL follows a scientific approach prior to setting up charging stations: a city is demarcated into a grid of 3x3 km as per Ministry of Transport guidelines. A secondary assessment brings up the city layout and points of public interest like bus depots, metro locations, the worship places, the commercial establishments. This clarity obtained from the second assessment leads to a physical survey at the ground level, which constitutes a primary study of the individual sites. Now, the joint survey team is also involved, necessitating a different set of parameters like footfall, the density of the locations, load availability, visibility and proximity to points of public interest.

These parameters are captured in the location assessment study. The feasible locations are demarcated



1) Percentage range refers to the relative share of the respective usage profile in all occurring use cases
2) Recharging 80% battery capacity
Source: PwC, Strategy& Analysis, ABB

Figure 2: Usage profiles and distribution of user segments

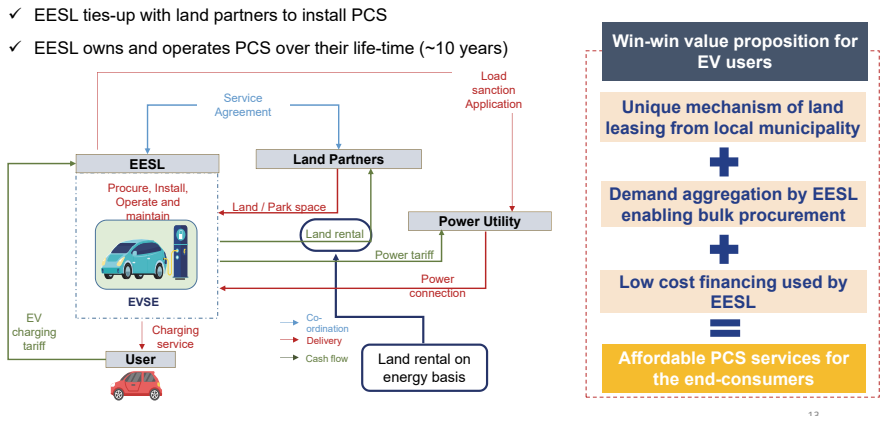


Figure 3: Business Model Design for PCS

into Priority 1, 2 and 3; priority 1 locations requiring minimum cost due to minimum intervention and so on. EESL then takes up the execution and operation and simultaneously evaluates the sustainability of the business. A close connect is maintained with OEMs and fleet operators so that they can use this public infrastructure to help monetize the charging asset quickly.

The need now arises for a study of the locations. If one looks at the usage with respect to utilization time, one can assume around a 10 percent utilization factor in public charging stations of lower capacity chargers. For higher capacity the utilization is around 5–7 percent. The point to note here is that even at 10 percent utilization there is no benefit to pass on in the service fee to EV users. Only at around 40 percent utilization is there scope for reduction in service fee by 44 percent. So, it becomes an important factor to assess locations in order to ensure a high utilization of the PCS and viability in the business model.

Apart from the utilization, the study also helps in ascertaining the costs involved for building these stations. On completing an assessment, one can calculate the cost for construction as well as for the power connection.

As per the business model of EESL for building EV charging stations, the company enters into a service agreement with the land partner. EESL and CESL build the stations with the complete investment whereby the land leasing, installation, operation and maintenance are done by the company. Revenues are realized over a period of time through charging services. Typically, EESL shares a percentage of revenue from the charging station with the land partners. The responsibility of procuring the connection from the utility, building the infrastructure is done by the company. The agreement is signed for 10 years, giving the land partner a better and viable proposition to operate the public EV charging station.

An inherent benefit of the EESL business model is that requirements across States are aggregated to come up with a single procurement, enabling the benefit of economies of scale. The company also works closely with the private land partners, as well as with some of the multilateral funding partners allowing better access to cross financing. These are some of the parameters which help in building the infrastructure more efficiently and consequently provide an affordable tariff for the end customer. So far, EESL has built close to 200 plus public EV charging stations that comprise 375 charging points and around 1226 leased capital charging station points for leased EVs.

If you look at consumption numbers till November 2020, EESL has been responsible for more than 2,66,000 units of electricity being consumed, with the number having reached close to 330,000 units currently. So, basically the company has supported close to 1.5 million km of clean travel. The utilization graph below indicates how replacement has improved over time. When EESL commenced operations in May 2019, the utilization was less than 5 percent, increasing gradually to 10-15 and then to 20 percent month on month.

The real-time impact of the lockdown in April and May of 2020 brought utilization down to under 1 percent when the entire e-mobility fleet operators had halted operations. What is the reason for utilization to have picked up so dramatically over such a short time? This can be ascribed to the study of the most lucrative locations for building EV charging stations. The company has also realised that adhering to a partnership model is a vital element to help improve our utilization, so we consult with OEM partners, EV fleet operators, and startup companies to understand their charging needs. EESL then tries to build the PCIs as per the demand locations

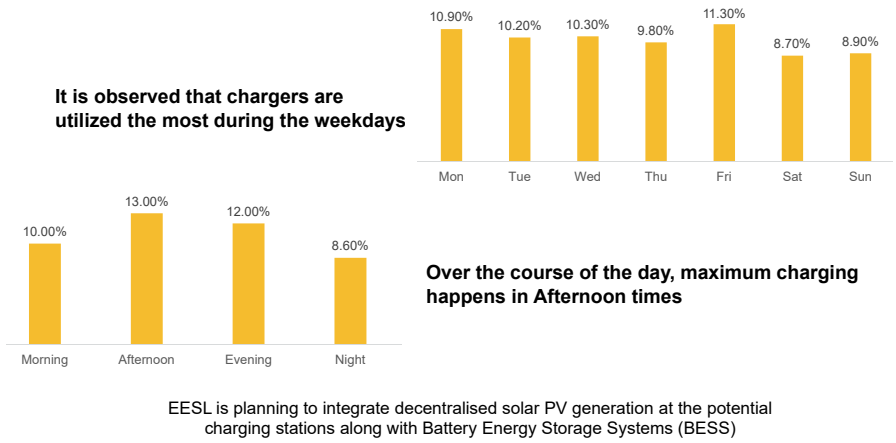


Figure 4: EV charger utilization trends show potential case for RE integration

ensuring an increase in utilization of the charging stations.

With its charging stations built up across India, EESL offers a corporate plan for fleet operators giving them access to the country-wide network of charging stations through a mobile app. This also provides feedback on the EV user's requirements with respect to charging and subscription, and with respect to car requirement and accessibility. In trying to address these concerns, the company gradually realized that once it aligns interests with user requirements, it was able to increase utilization of its charging infrastructure month on month.

Weekly versus daily charging trends

Studying the utilization trend for a week shown in Figure 4, indicates a linear utilization close to around 8.5 to 10 percent, both on weekdays and weekends. Interestingly however, the utilization trend in a 24-hour timeline indicates bulk of utilization occurring in the afternoon and in the evenings, and on a good note, also in the night time. On conducting a study with regular users such as commercial fleet operators, they said the reason for night time utilization was due to easy accessibility of stations, primarily due to less traffic and more parking spaces.

The high or maximum charging in the afternoon indicates a great potential case for aggregating solar generation along with a battery storage system. So, EESL is planning pilot projects on certain sites to capture solar generation with battery storage, without any incremental cost to EV customers.

Battery storage for RE

A typical schematic of an energy storage system: once we have a multiple source of generation at the public EV charging stations, then integrating the battery would be much easier. Here, the battery would help at least with storing the RE during the generation time and charging EVs as per demand. This prioritizes the usage of battery for the storage of RE power. The excess power required for charging EVs would be supplied by the grid. Such prioritization will happen at select EV charging stations.

An interesting consumer study done by Deloitte focuses on the difference in consumer preferences with regard to purchase of the next vehicle. Up to 50 or 51 percent of respondents have indicated clearly that they would like to go with diesel. When asked the reason behind this preference for an ICE vehicle, the response was due to the price factor. On questioning the consumer regarding willingness to pay extra for an EV, close to 53 percent said, if the price of the EV was less by ₹1 lakh compared to or close to an ICE vehicle, then 53 percent of consumers were willing to opt for e-mobility. So data indicates that price sensitivity is one factor, which will determine if a customer opts for an EV. Once industry achieves a price matching that of ICE vehicles that would be the touch point from where EVs will take off.

On analysing consumer willingness to spend time at EV charging stations, 35 to 50 percent said if the charging time is less than an hour, they were alright to recharge at the charging facility. EESL experience shows that public charging stations are AC fast charging stations, where the consumers normally come for quick recharging. Typically, at these stations the recharging time will be less than 30 minutes. Considering this, customers should find it convenient to utilize public charging stations, assisting in making EV a preferred choice as their next vehicle.

The blueprint that is revealing itself to establish charging infrastructure stations in the country, will build confidence in industry to participate in a huge business opportunity. As it breaks the chicken and egg conundrum, EV adoption in India will take to the highways. ETN

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Fire and gas characterization for Li-ion cell and battery fires

Lithium-ion batteries have the highest energy density of all rechargeable battery chemistries. Batteries of this chemistry have a very good cycle life, rate capability, lack memory effect and are lightweight and occupy less volume compared to other rechargeable battery systems. Commercialization of Li-ion batteries started in the mid-1990s and picked up speed very quickly. Today, Li-ion batteries are used in almost all consumer portable device applications, and their use has been extended to very large systems as those used in aerospace, EVs and stationary grid energy storage. They have also been used in large applications by the US Navy and are being incorporated into commercial marine applications.

The transition from the use of Li-ion in portable applications to these significantly large ones, brings about a lot of challenges. Accidental release of energy packed in Li-ion cells may be prone to fire and smoke, eventually leading to explosions. Even during their initial use in the low power portable applications, recalls from cell and battery manufacturers were not uncommon. So, the use of this battery chemistry in kilowatt-hour (KWh) to megawatt-hour (MWh) sizes, in the various sectors that they have been introduced into, does bring about new concerns for the regulators and safety officers. For instance, the introduction of Li-ion batteries in automobiles has caused mixed reactions from consumers. Consumers interested in a greener environment feel the obligation to procure and use some form of electrified vehicle, while others are concerned about the safety of the more recently introduced technology that powers the vehicles.

EVs can be of different forms from hybrid and plug-in hybrids to pure EVs. In the late 1990s and early 2000, hybrid EVs were mainly powered by nickel-metal hydride batteries. With the increase in the types of electrified vehicles and the proliferation of the Li-ion battery chemistry, more vehicles were fitted with Li-ion batteries. A study by the National Fire Protection Association (NFPA) on vehicle fire incidents showed that in the US, between the period of 2003 to 2007, an average of 287,000 vehicle fires had been reported per year and the vehicle fires constituted 17 percent of all reported fires in the US.

In August 2012, the National Highway Traffic Safety Administration (NHTSA) carried out a study with General Motors (GM) and published a report that indicated that the overall consequences of Li-ion battery vehicle fires are expected to be less than those for the gasoline or diesel vehicular fires, due to the much smaller amounts of flammable solvent released and burning in a catastrophic failure situation. This was also based on the statement that the ignition of flammable electrolytic solvents used in Li-ion battery systems are anticipated to be somewhat comparable to or perhaps slightly less than those for gasoline or diesel vehicle fuels.

In a more recent safety report by the National Transportation Safety Board (NTSB), the following conclusion was stated – 'Fires in EVs powered by high-voltage Li-ion batteries pose the risk of electric shock to emergency responders from exposure to the high-voltage components of a damaged Li-ion battery. A further risk is that damaged cells in the battery can experience thermal runaway, which can lead to hazards such as battery reignition/fire.'

There have been several Li-ion battery vehicle fire incidents reported **(Figure 1)** and these include pure EVs, hybrid and plug-in hybrid vehicles and some electric ships. Fires related to stationary energy storage have also increased in number with as many as 28 energy storage system (ESS) fires reported from South Korea in 2018. The main causes cited ranged from human error in system integration to the lack of test and analysis of the ESS safety control systems. A major issue found with these large ESS is the loss of data when a catastrophic event occurs, which prevents important knowledge from being transferred to the first responders.

Extensive work has been carried out by private and government organizations in characterizing the hazard causes associated with Li-ion cells and batteries in various applications and environments. However, the area of characterizing Li-ion battery fires, which is typically the result of the uncontrolled hazard causes, has not been explored much. Larsson et al have carried out significant work on small Li-ion cells and have been able to identify and characterize the components of the fire and smoke. Yan et al discuss studies carried out on 18650 Li-ion cells and a laptop battery

Figure 1. Electric vehicle fire instances

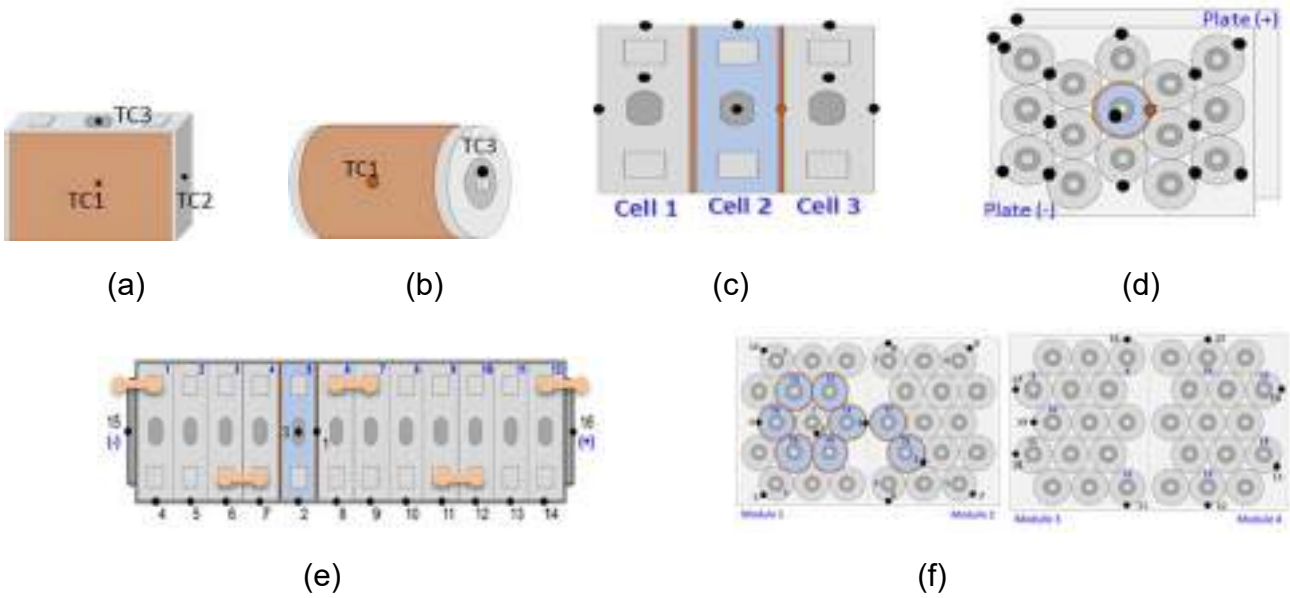

Figure 2. Schematic showing the single cells (a, b), banks (c, d) and module (e) or battery (f). (a), (c) and (e) are for the Li-NMC chemistry and (b), (d) and (f) are for the LFP chemistry

design to understand the failure and propagation of thermal runaway, but the study does not include characterization of the components released during a fire or thermal runaway.

The study carried out at Underwriters Laboratories (UL) included the thermal runaway tests on single cells, a bank of cells and a module or battery. The module or battery design had a configuration where the banks were connected in series. Two different battery chemistries were studied, namely, Li-ion cells with NMC (nickel, manganese and cobalt) cathode and with LFP (lithium iron phosphate - LiFePO4) cathode. The Li-ion cells with the NMC cathode were of 25 Ah capacity and a nominal voltage of 3.8 V; the bank composed of 3 cells in parallel (3P) had a capacity of 75 Ah and a nominal voltage of 3.8 V; and the module was composed of 4 banks in series (3P4S) with a capacity of 75 Ah and a nominal voltage of 15.2 V.

The Li-ion cells with the LFP cathode were of 5.5 Ah capacity and a nominal voltage of 3.3 V; the bank composed of 15 cells in parallel had a capacity of 82.5 Ah and a nominal voltage of 3.3 V; and the battery composed of 4 banks in series (15P4S) had a capacity of 82.5 Ah and a nominal voltage of 13.2 V. **Figure 2** has drawings of the cells, banks and module/battery designs used in this test program. Thermal runaway was initiated by the use of a heating tape wrapped on the side of the cell or around the cells for the single cell test. In the bank and module/battery level tests, more than one heating tape was needed to initiate thermal runaway propagation and achieve worst case fire and smoke. All test articles were tested in a fully charged condition in order to study the worst-case scenarios.

The results of the tests showed that combinations of smoke and fire were observed in all cases. With the LFP test articles, more smoke was observed than fire. The composition of the gases emitted from the test articles provided significant insights about the potential hazards resulting from battery failures.

Table 1 shows the compositions of the various gaseous components and their lower flammability limits (LFL), for the NMC and LFP cells studied. For the single 75 Ah NMC cell (95 Wh), about 41L of gas was released and for the single 5.5 Ah LFP cell (18 Wh), about 3L of gas was released. For the NMC module (1.1 kWh) the total hydrocarbon volume that was flammable was 165L and the volume of hydrogen gas was 83L. For the LFP battery (1.1 kWh), the total hydrocarbons released during thermal runaway (no fire was observed with this battery) was 357L and the volume of hydrogen gas was 196L. The table shows that the volume of some of the combustible gases was several times greater than the LFL.

A challenge with gas composition analysis has been the detection of hydrogen fluoride (HF) gas. It is well known that this is a component of all Li-ion cells manufactured today, since the electrolyte salt and the binder used in making the electrodes contains fluorine. However, due to the nature of the gas, which condenses at ambient temperatures and has high reactivity, it has been difficult to detect and measure in this study.

Larsson et al have measured HF gas in their single cell tests using an open test environment. Besides HF, another toxic gas that has been reported in battery fires is hydrogen cyanide (HCN). Presence of HCN above the toxicity limit was reported from the gas analysis carried out in the Arizona battery ESS. Li-ion cells do not produce HCN so it is possible that this gas is a byproduct of the burning of other components such as plastics used in the manufacturing of the battery ESS.

In summary, the studies showed that toxic and flammable gases are released from Li-ion cells when they experience thermal runaway and fire. The level of toxicity and the combustible nature of the gases depends a lot on the volume in which they are released into and trapped. Hence, one should take the free volume of the location they are installed in to determine the toxicity and flammability of the released

Note: Highlighted values show components that are above the LFL

Component		Measured %	Component LFL
Carbon Monoxide	CO	23.76% **	10.9%
Carbon Dioxide	CO_2	26.65%	N/A
Hydrogen	H_2	36.03% **	4.0%
Methane	CH_4	3.55%	4.4%
Ethylene	C_2H_4	3.20%	2.4%
Ethane	C_2H_6	0.57%	2.4%
Propylene	C_3H_6	2.71%	1.8%
Propane	C_3H_8	0.15%	1.7%
Propadiene	C_3H_4	0.01%	1.9%
-	C_4 (Total)	0.83%	-
-	C_5 (Total)	0.09%	-
Hexane	C_6H_{14}	0.00%	1.0%
Dimethyl Carbonate (DMC)	$C_3H_6O_3$	1.08%	Not specified
Ethyl Methyl Carbonate (EMC)	$C_4H_8O_3$	0.46%	Not specified
Total	-	*100*	-
Individual C4 Components		-	-
Butane	C_4H_{10}	0.04%	1.4%
Butene	C_4H_8	0.60%	1.5%
Butadiene	C_4H_6	0.19%	1.4%
Individual C5 Components		-	-
Pentane	n-C_5H_{12}	0.09%	1.1%

Component		Measured %	Component LFL
Carbon Monoxide	CO	0.0%	10.9%
Carbon Dioxide	CO_2	21.60%	N/A
Hydrogen	H_2	54.00% **	4.0%
Methane	CH_4	6.10% **	4.4%
Ethylene	C_2H_4	3.46%	2.4%
Ethane	C_2H_6	1.13%	2.4%
Propylene	C_3H_6	1.51%	1.8%
Propane	C_3H_8	0.59%	1.7%
Propadiene	C_3H_4	0.0%	1.9%
-	C_4 (Total)	1.67%	-
-	C_5 (Total)	0.16%	-
Hexane	C_6H_{14}	0.05%	1.0%
Dimethyl Carbonate (DMC)	$C_3H_6O_3$	3.35%	Not specified
Ethyl Methyl Carbonate (EMC)	$C_4H_8O_3$	6.32%	Not specified
Total	-	*100*	-
Individual C4 Components		-	-
Butane	C_4H_{10}	0.38%	1.4%
Butene	C_4H_8	0.97%	1.5%
Butadiene	C_4H_6	0.27%	1.4%
Individual C5 Components		-	-
Pentane	n-C_5H_{12}	0.05%	1.1%

Table 1. Composition of Gases for the NMC Cell (Left) and LFP Cell (Right) Released During Thermal Runaway

gases. The nature of the gaseous components depends significantly on the chemistry of the Li-ion cell as well as composition of the electrolyte solvents and salts. A good understanding of the gas composition is imperative for battery installations such as stationary grid ESS, or when vehicle battery charging is carried out in a poorly ventilated area, in order to provide the required information to first responders and fire fighters.

The above article is authored by a team of researchers at the Underwriters Laboratories - Judith Jeevarajan Ph.D. (Research Director), Daniel Juarez Robles Ph.D. (Research Scientist), Tapesh Joshi Ph. D. (Research Scientist), and Kanarindhana Kathirvel (Program Manager).

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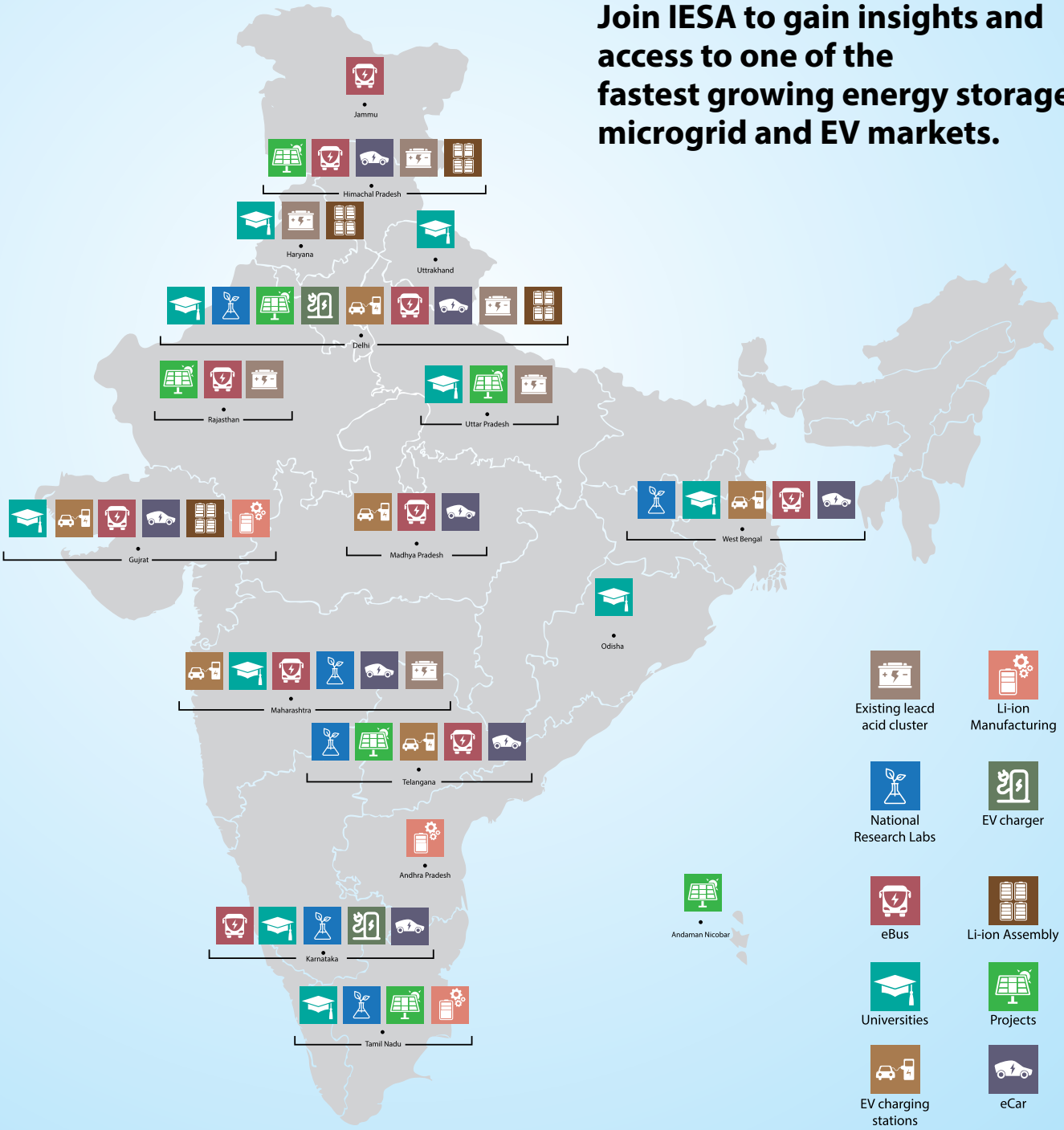

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Bettering battery analysis

Scientists predict that battery analysis in the future will reach newer heights with Electrochemical Impedance Spectroscopy (EIS) combined machine-learning, neural networking, and cloud connectivity.

Battery testers are readily available, but we ask: How well do they work? Not everybody is familiar with the test results given, other than knowing that voltage relates to state-of-charge (SoC) and internal resistance (Ri) to power and loading conditions. Capacity readings are outside the capability of most battery testers.

Capacity is the leading health indicator that governs end-of-life when the battery has faded. Loss of energy storage goes mostly unnoticed while the readings on a battery tester remain unchanged. This leaves service personnel unable to decide if a battery needs replacement or not.

Battery performance and symptoms also change with temperature and SoC level. A good battery with a partial charge performs similar to a fully charged battery that is weak. A battery tester should identify these conditions, but most cannot do this.

A battery is like a 'black box'. The pack looks similar if fully charged or empty, new or faded. In comparison, a car tire distorts when low on air and is replaced when the treads are worn. In spite of this disguise, the battery reveals characteristics that instruments can measure to various levels of accuracy.

SoC is checked by voltage, but inaccuracies occur if the battery has been agitated. Voltage readings after a charge stay high for a time and a discharge depresses the voltage. Normalizing takes a few hours. Most battery testers measure Ri by applying a calibrated discharge pulse and observe the voltage drop. Ohm's Law (V=I x R) provides the Ri by dividing the voltage drop with the applied current.

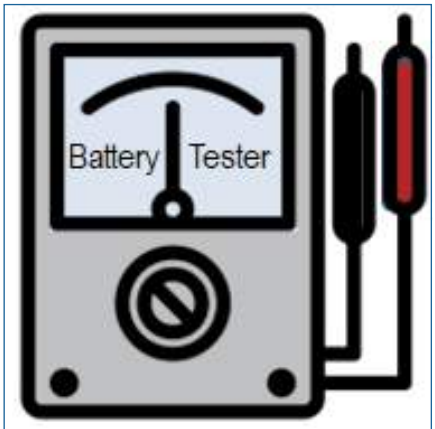


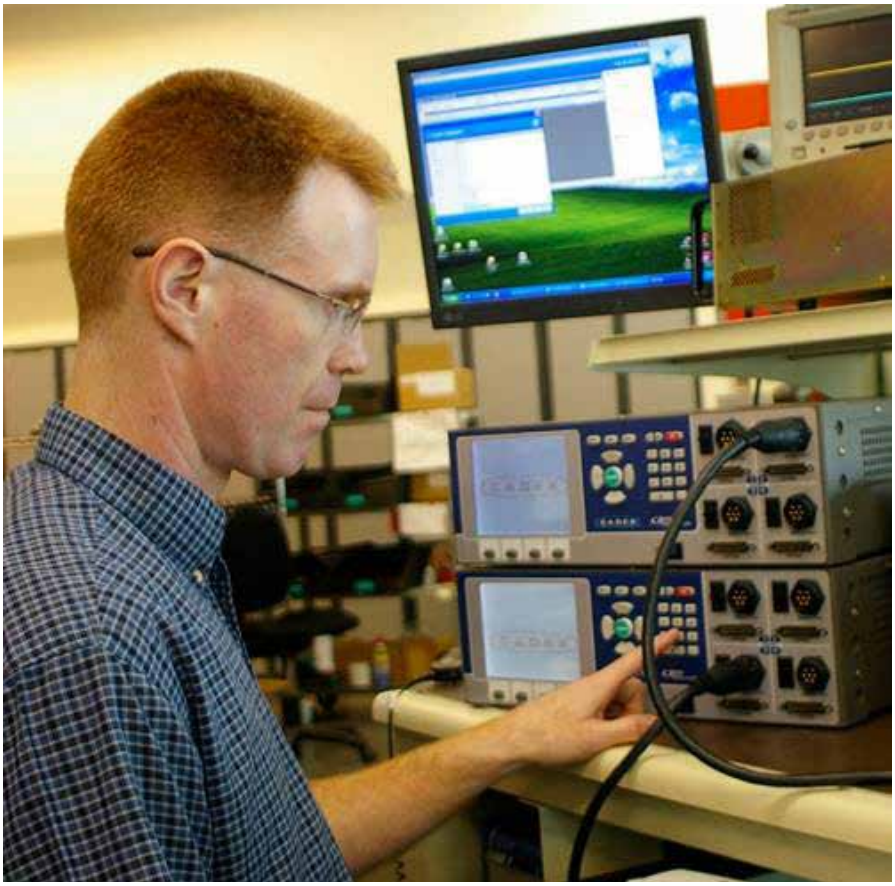
Figure 1: The classic battery tester has limitations. Source: Cadex

The Ri of a battery does not correlate well with capacity. Tests at Cadex labs reveal a correlation between capacity and Ri of only 51 percent. Ri alone does not provide the full picture. Some battery testers also analyze voltage recovery that relates to state-of-health (SoH). A good battery recovers quicker than a faded one. Similarly, these phenomena apply to lead-acid and lithium-based chemistries.

Figure 2 demonstrates the causes of failure for lead-acid starter batteries. At 48 percent, capacity fade is the most common failure mode induced by wearing out of the active material. In comparison, the rise of Ri only accounts for 12 percent. The test-pool also includes batteries that are over discharged (23 percent) and have no fault (15 percent). Mechanical and manufacturing defects are at a low 2 percent.

Better test methods will keep batteries in service longer, as packs are often returned with no specific defect. Customer-induced failures, such as low charge, could be eliminated.

Advance testing for batteries
Source: Cadex



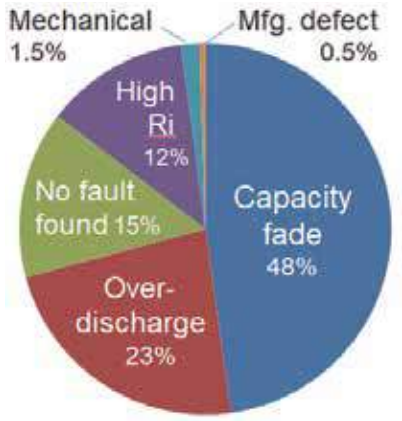


Figure 2: *Failure analysis of 800 AGM starter batteries.*
Source: Johnson Control, Germany

Advanced battery test methods

Battery manufacturers are seeking advanced battery-test methods to improve fabrication and identify user-induced failures. Industries also seek solutions as part of Reliability-centered Maintenance (RCM). Defined by the Society of Automotive Engineering (SAE) standard JA1011, RCM is a maintenance protocol that ensures continued reliability on mechanical parts by observing wear-and-tear. Introduced in the 1960s, airlines were first to adopt the standard to reduce invasive maintenance. The military accepted the system in 1967, which led to civil users in nuclear power plants, oil & gas, subways and hospitals.

Currently, RCM does not include batteries. Part of the omission may be lack of suitable test methods. A Battery Management System (BMS) could be used, but monitoring voltage, current and temperature only detects anomalies. The Remaining Useful Life (RUL) representing capacity is not available. Nor does a data stamp provide a reliable indication as to when a battery should be replaced. Batteries are often swapped too soon; however most stay in service too long.

Checking batteries beyond measuring voltage and Ri, gets complex. A battery resembles a living organism that consists of components which consume active materials, build-up performance-inhibiting films robbing power and undergoes mechanical stress leading to elevated self-discharge. Battery longevity can be defined by these characteristics:

- Capacity fade, manifested by diminishing energy storage
- Elevated internal resistance, reflecting in decreased loading capabilities
- High self-discharge, induced by stress that can lead to safety concerns in Li-ion batteries.

Undetected aging effects may cause thermal runaway, which is a concern especially for Li-ion batteries. Installing RCM for a critical battery system warrants answer to these questions:

1. At what capacity does the battery need replacement?
2. What other battery anomalies must a monitor identify?
3. What is the consequence of a battery failure?

Modern test technologies

Advancements are being made by characterizing various properties of a battery using a technique such as Electrochemical Impedance Spectroscopy (EIS). EIS injects sinusoidal signals of multiple frequencies into the battery and measures the impedance response in the form of a Nyquist plot.

Cadex has secured a proprietary technology to translate the Nyquist plot into battery SoH and SoC. Here is how it works:

The Nyquist plot is fitted with battery models reflecting diverse battery internal properties. The reference images of the model parameters of good and poor batteries had been made available by scanning a large pool of batteries with similar architecture but diverse states of performance. The model parameters are then passed through an advanced data analytics algorithm such as fuzzy logic to determine capacity, Ri and SoC.

Figure 3 illustrates the concept of multi-model EIS technology in a simplified way. Multi-model EIS is also known as Spectro™.

Battery testers using EIS technology developed by Cadex are deployed in the auto industry to check starter batteries. Capacity measurement is preferred because Cold Cranking Amp (CCA) alone does not provide RUL information. CCA readings on most starter batteries stay normal, while the capacity fades without knowing. This often leads to unexpected failures as strong engine cranking does not reflect low capacity.

The Spectro™ technology can also be used to test model-specific batteries in lead-acid and lithium chemistries. Each battery model is first scanned to create a 'golden sample' representing a known good battery. Aging symptoms are analyzed by observing subtle changes of the Nyquist plot against the mirror image of a battery in new condition.

Cloud connectivity simplifies the logistics by downloading model-specific golden samples along with various aged battery data. Spectro™ devices in the form of hand-held testers and BMS installations provide the test results, organized by date and model number, and stored in the Cloud. Big data improves accuracy, processed by machine learning and Artificial Neural Networks (ANN), technologies that Spectro™ provides.

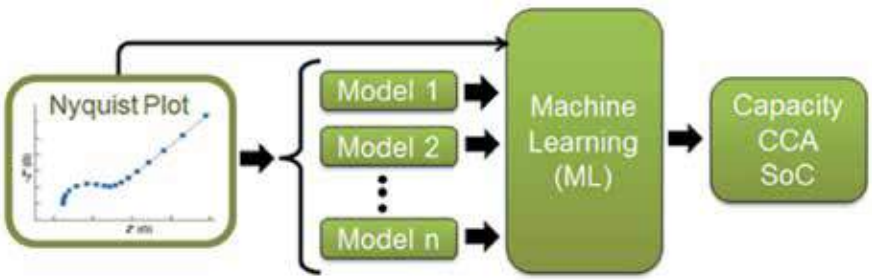


Figure 3: *Spectro™ combines EIS with complex modeling using machine learning with the help of Artificial Neural Network. A sinusoidal signal creates a Nyquist plot that provides SoC, capacity and Ri with complex modeling.*
Source: Cadex

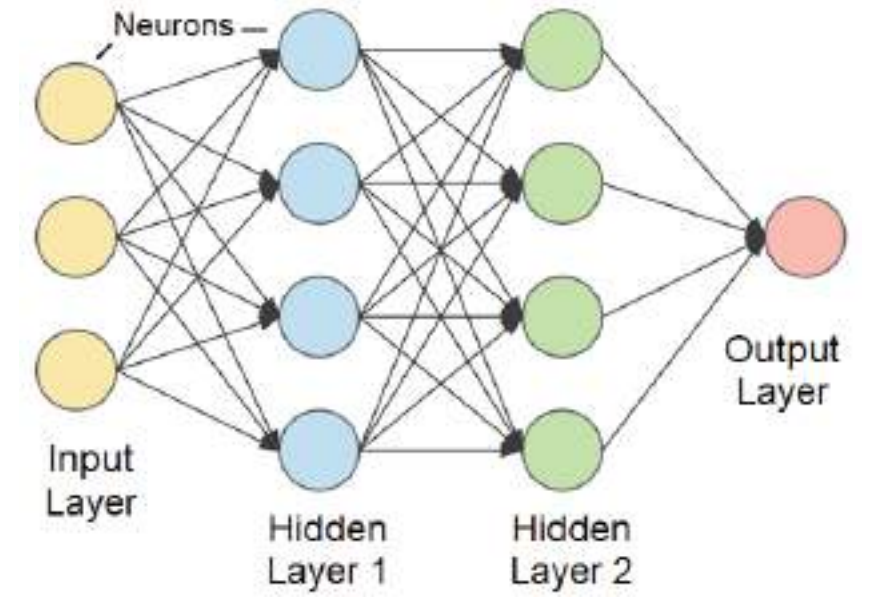


Figure 4: *Artificial Neural Network (ANN) provides categorized output from vast pool of input data*

Figure 4 illustrates ANN that analyzes a vast volume of data and provides a classified output with the help of hidden layers. The connecting units called neurons form a biological brain that simulates animal instinct. One might argue: 'garbage in; garbage out', but volume of user patterns can produce amazing results with ANN.

The Cadex lab is testing the accuracies of ANN and machine learning algorithms such as Gaussian Process Regression to determine battery SoH. The Gaussian method is more effective on the lead-acid battery dataset (~90 percent accurate) and gets consistently better results. These findings are also verified by research scientists at the University of British Columbia.

Typical applications for the Advanced Battery Analytic System (ABAS) are fleet supervision by tracking battery performance in the field with EIS-based testers and EIS-backed BMS installations. With ABAS, the supervisor sets the Target Selector to calculated capacity thresholds for each battery system with the intent to keep the batteries in service as long as possible while maintaining confidence in the system. Such a system utilizes each battery fully while improving reliability and lowering the environmental impact of discarding batteries too early.

Conclusion

The more sophisticated a test method gets, the further technology begins to decipher symptoms. An example is weather forecast that observes changes in temperature, wind speed, and moisture. Face recognition is another example by comparing anchor points. Letter and voice recognition are further applications in which machine learning recognizes subtle nuances to find a collective meaning.

With more advanced estimation tools, no singular reading delivers a finite result. Machine learning improves accuracy without giving explicit instructions. A subset of artificial intelligence, machine learning uses algorithms and statistical models to analyze data and draw inferences from data patterns. Scientists predict that the future of battery analysis lay in EIS with machine-learning and cloud connectivity. Vast data will serve as lookup tables to provide amazingly accurate battery evaluation for major battery models.

Key to advanced battery analysis is reading the 'chemical battery' rather than processing data with peripheral digital engines. Chemical-based battery analysis has not advanced as rapidly as digital technologies. EIS with machine learning, neural networking and cloud connectivity brings battery analysis to new levels. These relevant technologies will also improve fleet supervision for organizations.

Isidor Buchmann
CEO & Founder
Cadex Electronics

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Entering the battery manufacturing space

Yash Roongta, Director – Renon India, shares insights with ETN on the company's venture into the lithium battery space.

Renon India manufactures battery packs for the Indian market. As a startup, what is the expertise and experience that you bring to this enterprise?

Back in 2018, Renon started with the goal to enter into the lithium-ion battery business, since as a group we were already in the energy sector as manufacturers of solar panels for the global market. It made sense for us to pursue a business that complements our existing businesses, because it is a known fact that solar plus storage is going to be a big opportunity for existing players in the energy market.

In two years' time, we did on-ground research in China as well as in India to understand business models as well lithium batteries. From 2018 to 2020, we learned and set up our 200 MWh production line for manufacturing batteries in Surat. Despite the COVID-19 scenario, where everyone was worried about business prospects in the EV market, we started our production of lithium batteries on August 5, 2020, for the storage and mobility markets. Today, we already command a good battery market for solar applications as well as for EV applications.

YASH ROONGTA
Director
Renon India

Personally, as a Mechanical Engineer from BMSCE College, Bangalore, and an MBA from Babson College, Boston, I bring expertise such as product design thinking and building a startup through problem based ideation.

What is the investment that Renon India has made so far and what are you looking at in the long term?

Till now we have invested $2 million in setting up the manufacturing plant, and towards working capital needs.

Electric 3 Wheeler Battery Pack

Bird's eye view of the plant
Source: Renon India

Your aim is to be one of the largest battery manufacturers and battery experts in the country. How well are you established in achieving this goal? In what way do you distinguish yourself from the competition?

To achieve our goal of being the largest battery manufacturer, we started with a pilot plant of 200MWh in 2020, and this year we are expanding our capacity to 500MWh. We have in-house R&D capability to design, develop and validate power electronics and thermal components that go in to lithium battery packs. Over the past year, we have invested a lot of time, energy and money to benchmark the performance at cell and battery level for different applications through laboratory testing as well as on-road testing. I would not say we have become experts in just two years, but we have reached a point where we can proudly offer our products for different applications in the Indian market at the right cost.

Generally speaking, the majority of the battery manufacturers do not focus on quality in production. We have high precision testing facilities to ensure quality in our manufactured batteries. We do extensive research and testing before launching our batteries for any application. Also, we educate the customer about cost versus performance related to lithium batteries so that they can choose the most appropriate batteries that are suit their requirements. This is what distinguishes us from other battery manufacturers.

You have a production plant at Surat, Gujarat. What percentage of Renon's battery pack is indigenously manufactured?

The lithium cell sourcing is done from various countries such as Taiwan, Korea, China, etc., depending

on the cost versus performance requirement from the customer. Rest of the components are designed and developed in-house at Renon. The manufacturing of these components is done locally in Gujarat. So, one could say 50 per cent of the battery pack is indigenously manufactured.

What battery chemistries do you deal with? Could you elaborate on the special features of your battery types?

We deal in both LFP and NMC chemistry because of the wide product range that we offer at Renon. Our batteries are safe and offer reliable performance throughout their life. To name a few features, we offer customisable solutions for EV manufactures in terms of dimension, weight and performance. We also offer customization at BMS level to meet the cost expectations of the customer.

Do you also engage in the battery recycling space?

We have not yet entered into the recycling space, but we are planning to set up a pilot project for recycling of lithium batteries in Surat in the next two years.

What are the other products in Renon India's portfolio?

We offer lithium batteries for applications like solar street light; solar home lighting; solar pumps; e-2W, e-3W, electric bicycle and wheelchair as well as off-grid power back up. UPS and BESS are two applications that we will soon launch in the coming months.

Based on your involvement in the e-mobility space, what do you believe is essential to speed up adoption of green transport in India?

R&D and manufacturing infrastructure is what we need in order to speed up adoption of green transport in India. If we continue to rely on other countries for innovation and material sourcing, we will never be able to make a suitable product that is required for the Indian market.

Kathy Priyo
Contributing Editor
ETN

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An affordable eco-friendly commute

Amit Gupta, CEO – Yulu Bikes, shared with ETN how his company's micro mobility EV is re-defining urban mobility across the country.

What was the vision behind Urban Mobility as a Service?

The aim was essentially to address the rising air pollution and traffic congestion in India. The other idea was to ease travel for commuters especially in the last mile connectivity leg of the journey. Here the Yulu Miracle provides an eco-friendly UMaaS or Urban Mobility as a Service, which is an affordable, sharable and scalable solution for the first mile, last mile and short distance commute.

Tell us about the Yulu Miracle and the running of the fleet.

Yulu Miracle is a unique battery operated, lightweight, easy to ride e-2W that has no legal requirement for a helmet, registration plate, or driving license. It offers individuals an efficient commute option at a very reasonable cost and zero carbon footprint.

Yulu has developed a vertical stack needed to run its EV fleet. From design and ownership of the assets to charging the batteries to on-ground operations, Yulu is self-sufficient.

AMIT GUPTA
CEO
Yulu Bikes

How does the system of renting work? What about battery re-charging?

Yulu uses IoT, ML and AI in its user-friendly app through which the vehicles can be rented on a pay-per-use basis. Users can book a ride via the iOS or Android app and the smart bikes can be unlocked via QR codes. Yulu operates on a virtual docking method, where Yulu vehicles can be picked up or returned by users from its network of parking lots called Yulu Zones.

The Yulu battery is swapped and then re-charged through Yulu Max, a proprietary charging box installed at hundreds of mom-n-pop stores across its operational areas. Yulu's on-ground Ops Team carries out operations through an app, which also shows the set of vehicles that have a battery-charge level below a defined threshold along with their real-time location.

The Yulu Miracle e-bike - the Micro Mobility Vehicle

How is the collaboration with Bajaj defined?

Bajaj Auto Limited (BAL) has joined hands with Yulu to transform the urban commute in India. Our strategic partnership with Bajaj will help us in creating *Aatmanirbhar Bharat* as we come together to develop the largest e-mobility service with the latest techniques and technology. Bajaj Auto, the largest OEM has been helping us to design and manufacture the e-2W - Yulu Miracle for the shared-mobility space. Yulu is solving the first and last mile mobility problem and growing its footprint in a sustainable manner.

What adjustments were necessary to your growth plans in order to ensure profitability in this downturn period?

Given the requirement of social distancing, solo ridership was and will continue to be preferred to group travel and driver led shared mobility options. Yulu has on-boarded significant users post lockdown 3.0, which proves solo ridership is the most preferred choice of users. During the nationwide lockdown, Yulu partnered with many e-commerce companies and hyper-local delivery startups to enable the delivery of everyday essentials to millions of Indians stranded in their homes during the COVID-19 lockdown.

Could you elaborate on the specific product and the business model you have in mind for delivery workers?

Our vehicles are used primarily by young working professionals and college students during the peak morning and evening hours.

Beyond this we have collaborated with various delivery companies for use of our vehicles in the afternoon or our non-peak hours, but when there is a surge in demand of online food delivery business during office lunch hours. We have several curated saver packs for such a customer base. No registration and no driving license also help the gig workers to enjoy affordable and eco-friendly rides.

Please share some features of the Yulu bike as well as technical specs of the battery.

Yulu Miracle is a unique battery operated, lightweight, easy to ride, small 2W. It has a maximum speed of 25 kmph. It has been built keeping in mind the convenience of users on Indian roads, ease of maintenance for the on-ground Ops Team and durability necessary in a shared mobility vehicle. Regular maintenance ensures that the Miracles are in good working conditions at all times. The first batch of Miracles deployed in Bangalore, which have been on the road for over seven months, has shown no sign of reduction in quality.

The weight of the Yulu Miracle is 45kg; the battery power output is 48V 20 aH and requires four hours for a full charge, which allows a range of 60-65 km.

What are the distinctive features of Yulu as a company?

Yulu is a e-mobility firm and a 100 percent EV player with a mission to create sustainable cities of tomorrow by revolutionizing the way people commute. In the past three years we have established brand connect with more than 40+ stakeholders. Yulu has developed a holistic eco-system for ride-sharing by collaborating with OEMs, numerous corporates, co-working spaces, co-living spaces, government authorities and metro authorities in order to provide end to end e-mobility solutions to citizens across locations.

Ride-hailing giant Uber has also partnered with Yulu to build a large-scale shared-mobility business in India. With more than 18,000 eco-friendly vehicles and 2.5 million users, Yulu runs India's largest EV led micro-mobility platform. Yulu's mission is to create sustainable cities of tomorrow by revolutionizing the way people commute through its specially designed battery-powered vehicles and technologies like IoT, ML and AI.

Yulu runs its operations currently in seven major Indian cities - Bangalore, New Delhi, Pune, Mumbai, Gurugram, Ahmedabad, and Bhubaneswar. As a pioneer in this space, Yulu has influenced several policies for micro-mobility in India by working closely with policy-makers both at city as well as at the national level.

During the current pandemic, Yulu has come up with a Time Stamp feature where the user can see when the Yulu bike was last sanitized. Most importantly, Yulu is now available with a multi-lingual language option to serve the diverse user base of the country.

What are plans for the future and where do you see Yulu five years from now?

Our goal is to run the Yulu service in 5-7 major cities in India by December 2021. We envision being present in 100+ Indian cities to become the largest e-mobility player in India. We plan to use a combination of a company-owned - company-operated, as well as franchise-owned - franchise-operated model. Using the scale of the domestic market and strategic partners, Yulu will also launch its services in more than ten countries outside India by forming JVs. ETN

Kathy Priyo
Contributing Editor
ETN

Empowering rural India through community-led microenterprises

Interaction with rural women for encouraging them to cultivate locally grown raw material for processing

To make the economy more sustainable, livelihood technologies, both farm and non-farm must be integrated with decentralized renewable energy technologies. This step will empower local communities to take active role in improving their quality of life thereby strengthening the overall economy. One such attempt is underway in Rikwa Village, Hazaribagh district of Jharkhand.

NITI Aayog, India's apex planning body has designated 19 out of 24 districts in the State of Jharkhand as aspirational districts. The idea behind this classification is to fast track the development of such districts and get them into mainstream development as quickly as possible.

Along the same lines, Customized Energy Solutions (CES) has undertaken an initiative for boosting the economic development in this region. Under its Microgrid Initiative for Campus and Rural Opportunities (MICRO), CES has set up a 5kW solar energy system with a 10kWh lithium-ion battery energy storage system.

The project is aimed at working with local communities to understand local vegetation and help them with necessary small-scale decentralized processing machinery/ microenterprises that will be owned and operated by local women entrepreneurs.

Interacting with local team on setting standard operating procedures

Community-led small-scale enterprise

Through this small-scale community managed microenterprise model set in Rikwa village, the energy generated from the microgrid is used to power versatile *daal* (lentil) processing unit for hulling of pulses *(tur, chana, masoor, urad* and *moong).* The plant at full capacity processes 20 tons of pluses a month, generating savings of about ₹100,000 (post deduction of the expenses incurred while operating the plant).

A unique feature about the microenterprise is that it is entirely managed by the women of the Rikwa village. They are engaged at all the levels of activity – starting from curing the raw material, grading, milling, sorting to packaging and storing. A few have also helped with marketing the product at local markets. In addition to generating local employment, the microenterprise has helped in creating an additional source of income for the community, which can be spent on education and healthcare of the children and family. The initiative has also led to the building of morale and self-esteem among the women of the village, who got to experience that they too can run a successful enterprise while taking care of their household responsibilities.

Setting up the microenterprises with the help of local villagers

The story of Kiran Devi

Kiran Devi is one of the women in Rikwa, who's life has transformed since the MICRO initiative was launched in the village. Kiran has been successfully running a small-scale DRE-powered milling machine for processing of lentils. The small-scale agri-processing plant operated and maintained by her, along with other local women, has allowed her to earn an income that is now being utilized for the education of her children.

"We desire to see lives transformed and this program is a step in that process allowing rural women entrepreneurs to not only provide for themselves and their families but also to help their communities through improved access to electrical infrastructure and equipment, and training to effectively use that infrastructure," said Stephen Fernands, President of Customized Energy Solutions.

"We are grateful for the openness of these communities in welcoming us and putting in great efforts to make these initial steps successful."

Microenterprise unique features

- ☑ Locally processed using clean and green energy
- ☑ Unpolished products – retaining maximum nutrients
- ☑ Entire operation from raw material cultivation – drying – processing- packaging and sealing is performed by Women Sakhi Mandals of Jharkhand, effectively using social capital through women led enterprises.
- ☑ Pesticides- and chemical-free product

Capacity building of local communities for operating the set up.

Local team (R to L) – Kiran Devi, Sunita Devi, Manju Devi, Saro Devi and Suman Devi

Way forward

In India, where small farmers struggle to sell their agricultural produce at a reasonable price, it has been observed that small-scale agriculture processing can be a transformational project enabling locals to supplement their agriculture income. If such microenterprises were to be deployed across 700+ districts of India, it is safe to say, the dream of $5 trillion economy would not be a distant dream. ETN

CES MICRO – Microgrid Initiatives for Campus and Rural Opportunities

The MICRO initiative was launched in 2016 for developing real-time monitoring system for microgrids and have analytics driven data insights that can be used for optimizing the life of an asset (especially batteries).

Other unique features of MICRO

- Integrating economic development with microgrids
- Transparency of data between funding agency and project developer (developed real-time data monitoring system in-house)
- Periodic reporting for predictive maintenance to microgrid developers
- Bringing equipment supplier in the frame for any quality or performance concerns
- Aggregation of funding and new site opportunities
- Better return on assets

Nikhil Akhade
Consultant - Emerging Technologies at Customized Energy Solutions

Hydrogen: A step towards carbon-free economy

Hydrogen is gaining heightened interest globally as a strategic solution for advancing energy transition. While the potential of hydrogen in revolutionizing energy landscape is well known, let's examine how the latest wave of enthusiasm is different from the previous ones.

Total global energy demand is expected to increase by more than 50 percent by 2050. Ensuring that this growth is decarbonized will require the wide-scale deployment of multiple new technologies and business models. Among these, hydrogen, the most abundant and lightest element in the universe is set to play a significant role.

Globally, about 70 million tons of hydrogen is produced annually, with the majority used in the petrochemicals industry to either upgrade heavy oils to more valuable products or to produce ammonia-based fertilizers.

While some, mostly higher-purity, hydrogen is transported by truck or pipeline, almost 90 percent is 'captive', being produced at or next to its place of ultimate use either by dedicated production facilities or as a by-product of other processes such as the chlor-alkali industry.

In the context of decarbonization, hydrogen is most often referred to by its 'colour'. Most of the hydrogen used today is 'grey' meaning that it is produced from the reforming of natural gas without the capture of resultant CO_2 emissions. Of most interest however, is 'blue' and 'green' hydrogen. Green hydrogen is produced by the splitting (electrolysis) of water using renewable energy, or to a lesser degree, from other renewable sources such as reformation of biomethane. Blue hydrogen, like its grey cousin, is also produced from fossil resources, however resultant CO_2 emissions are captured for sequestration elsewhere. This CO_2 abatement comes at a price however, with additional costs coming from additional energy requirements and process complexity.

Old alternative sparks new interest

Since the 1960s, there have been several waves of enthusiasm for hydrogen. Every time, huge promises of hydrogen's potential to revolutionize the energy landscape were made. Each of these cycles saw significant investment in research and development, yet, apart from niche segments, commercialization has fallen flat. Why should things be different this time? Historically, much of the cost of generating electrolytic hydrogen has stemmed from embedded CAPEX costs of the electrolyzer and associated equipment. This has limited adoption to high-value or niche applications. Similarly, hydrogen fuel-cells have been cost prohibitive compared to alternative energy-generating technologies.

Over the last decade the landscape has changed dramatically, with costs of both electrolyzers and fuel-cells dropping below $1000 per kW. For hydrogen generation by electrolysis, this has shifted the cost burden from being dominated by fixed CAPEX costs to being governed by electricity prices. While carbon-heavy electricity from the grid can be used for electrolysis, this results in hydrogen with a high CO_2 footprint. The availability of cheap, abundant renewable power has therefore been seen as the key to producing low-cost, green hydrogen at scale. With large-scale renewable power bids now setting records as low as ¢1.3 /kWh, that criterion is almost certain to be met.

Fukushima Hydrogen Energy Research Field (FH2R).
Source: Toshiba Energy Systems & Solutions Corp.

Outlook for hydrogen

For many end-users of hydrogen, the outlook is especially bright with rapid improvements in efficiency, lifetime and footprint of fuel-cells being rolled out by manufacturers such as Ballard who recently launched their 8th generation fuel-cell power module. The year 2019 came to be known as the 'year of

Shell's hydrogen refueling station

the Gigawatt', with over 1 GW of fuel-cell capacity being shipped for the first time and this acceleration shows no signs of stopping. With further cost reductions of 70 percent predicted in the mid-term, the competitiveness of fuel-cells with alternative power-generation technologies will only grow. These developments have led to a recent spate of partnerships worth billions of dollars between fuel-cell manufacturers such as Plug Power and major corporations such as SK Group and Renault.

Advocates of blue hydrogen are often producers and users of natural gas who wish to transition their portfolio to cleaner energy, while leveraging existing assets and infrastructure. The United Arab Emirates has recently announced that it aims to become one of the world's lowest-cost producers of blue hydrogen, with the Abu Dhabi National Oil Co. planning to dramatically increase its carbon capture capabilities. The company already operates a demonstration facility at the Emirates Steel complex that captures 0.8 MtCO2 per year. In Europe, energy giant Equinor plans to commission Europe's first large-scale blue hydrogen facility in Northeast England by 2026.

With energy systems becoming increasingly complex, traditional approaches begin to break down 'at the borders' and new approaches are required. While energy and feedstocks for transport and industry have traditionally been viewed as separate entities, hydrogen is being increasingly seen as a 'convertible currency' between the two. Large-scale production of low-carbon hydrogen in one region and transportation to another is understood as a key enabler of a globalized energy transition.

The Asian Renewable Energy Hub in Western Australia aims to utilize solar and wind power to create hydrogen for export to Asia Pacific regions, while in New Zealand's South Island the potential of a large-scale, renewable hydrogen production facility is being explored. However, it should be noted that other projects such as the Latrobe Valley project in Australia will be producing 'black' hydrogen for export through the gasification of coal.

Scaling hydrogen application

With the potential for the trading and mixing of green, blue, grey, and black hydrogen products it is imperative that systems are in place to certify and track the origin and CO_2 intensity of different hydrogen streams. In Europe, the CertifHy scheme is accrediting the first low-CO_2 hydrogen produced under its mandate. Globally, however, much more needs to be done in this area due to the transnational nature of future hydrogen trade and the multiple sectors it can be deployed in.

The primary role of hydrogen in the energy transition has traditionally been viewed for the decarbonization of road transport. In recent years however, an increasing number of players are advocating its deployment across the energy ecosystem and are developing technologies and business models to capitalize on that ambition. In response to the growing market potential and diversity of hydrogen applications, investment and partnering has grown rapidly, both from large corporations and from recently formed Venture Capital companies such as AP Ventures.

The year 2021 promises to be a defining year for the hydrogen sector. On land, the increasing roll-out of hydrogen trains and buses by Alstom and Wrightbus will continue to normalize hydrogen as an everyday mobility solution to commuters, while at sea the HyShip project aims to prove liquid hydrogen as a viable maritime fuel. In the US, UK and Turkey, projects to blend hydrogen into the natural gas grid will expand, thus bringing hydrogen into residential settings. In the built environment, Tarmac and Hanson Cement are expected to release the results of their project to utilize hydrogen in cement production, while Tenaris will begin its project to use hydrogen to lower CO_2 emission from steel production.

Call it a sceptic or optimist view, hydrogen is becoming a part of our lives and is here to stay. ETN

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RHC IMZADI Consulting offers advisory services to organizations aiming to understand, grow and invest in the area Hydrogen, Clean Energy and Innovation.

(The views expressed in this article are the author's own.)

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ABB India	49
Abu Dhabi National Oil Co.	79
Adani Green Energy Ltd	14
AGL Energy	19
Alibaba Group Holdings	16
Alstom	79
Amazon India	38
Artha Energy Resources	43
Ashok Leyland	49
Asian Renewable Energy Hub	79
Ather Energy	33
Audi	37
Automotive Component Manufacturers Association (ACMA)	47
Bajaj Auto Limited (BAL)	74
Ballard	78
Barefoot College	56
Bharat Electric Vehicle	57
Bharat Electronics Limited (BEL)	12
Bry-Air (Asia)	27
BSES Yamuna Power	49
Cadex Electronics Inc	68
Central Pollution Control Board (CPCB)	57
Chamundeshwari Electricity Supply Corporation's (CESC)	49
Chennai Smart City Ltd.	31
Conoship International Projects BV (Conoship)	20
Convergence Energy Services Limited (CESL)	49
Convergence Energy Services Ltd (CESL)	60
Deloitte	63
Dharma Life	55
Earth Energy EV	31
eBikeGo	49
EESL	49
Elektromobilitat India	54
eMatrixmile India	49
Energy Efficiency Services Ltd.	54
Engie	17
Equinor	79
Essar Power	26
European Commission	7
EV Motors India	49
EVage	28
Federation of Indian Chambers of Commerce (FICCI)	57
Finnfund	49
Fluence	76
Fortum	21
Fortum Charge and Drive India Private Limited (FCDIPL)	49
Fortum India	26
Frontier Markets	55
General Motors (GM)	64
GIZ (Deutsche Gesellschaft für Internationale Zusammenarbeit)	57
Greater Chennai Corporation (GCC)	31
GreenCell Mobility	12
Gujarat State Electricity Corporation Ltd (GSECL)	14
h2e Power Systems	28
Hanson Cement	79
Hartek Group	43
Hero Electric Vehicles	31
Hitachi ABB	49
Hitachi ABB Power Grids	49
Hydro	52
Hydrovolt	22
HyShip	79
Hyundai	38
India Energy Storage Alliance (IESA)	52
Indian Oil Corporation (IOC)	50
Indian Renewable Energy Development Agency (IREDA)	25
Indian Renewable Energy Development Agency Limited (IREDA)	42
Indo-German Energy Forum	52
International Energy Agency (IEA)	57
International Energy Agency (IEA)	15
International Solar Alliance (ISA)	52
Jaguar I-Pace	38
JBM Group	47
Kabira Mobility	31
Komaki	31
Linde	17
Magenta Power	49
Mahindra Logistics	38
Matter	57
MG Motor India	37
Ministry of Heavy Industries and Public Enterprises (MHIPE)	36
Ministry of New and Renewable Energy (MNRE)	41
Ministry of Road Transport and Highway (MORTH)	36
Ministry of Road Transport and Highways (MoRTH)	57
National Fire Protection Association (NFPA)	64
National Highway Traffic Safety Administration (NHTSA)	64
National Transportation Safety Board (NTSB)	64
Nexzu Mobility	34
Niti Aayog	43
Northvolt	22
NTPC	48
NTPC Ltd	60
Odysse Electric Vehicles	31
Okaya Power Pvt Ltd (Okaya)	49
Okinawa Autotech Pvt. Ltd	13
Ola Electric	31
Panasonic Life Solutions India	50
Philips	54
Plug Power	79
PMI Electro Mobility Solutions	12
Porsche	37
Power Exchange India Limited (PXIL)	28
Power Finance Corporation	60
Power Grid Corporation of India	27
POWERGRID	60

Pravaig Dynamics	38
Proterra	16
Rajasthan Electronics & Instruments Ltd (REIL)	13
Rajasthan Electronics and Instruments Limited (REIL)	49
REC Ltd.	60
Renault	79
Renon India	72
SAIC Motor	16
Schaltbau India Pvt Ltd	29
Schneider Electric	54
SEWA	55
Siemens	31
SK Group	79
ŠKODA AUTO Volkswagen India Pvt Ltd.	26
SmartBike	31
SMV Green	55
Society of Automotive Engineering (SAE)	69
Society of Indian Automobile Manufacturers (SIAM)	58
Solar Energy Corporation of India (SECI)	14
SUN Mobility	25
Tarmac	79
Tata Motors	25
Tata Power	50
Tata Power Solar Systems Ltd (TPSSL)	14
Tenaris	79
Tesla	79
Triton	12
Uber Technologies, Inc.	75
UN Environment Programme (UNEP)	50
Underwriters Laboratories (UL)	65
VanadiumCorp	20
Vega Reederei and Partners GmbH (Vega)	20
Villgro	55
Volkswagen Group	21
Wartsila	19
Wrightbus	79
Yulu Bikes	74

Bry-Air	6	Emerging Technology Review	23	IESA Advantage	71
CES Storage IQ INDIA	45	ETN - Subscription Form	39	IESA	67,83
CES	2-3, 21	IESA - Market Overview Report	59, 80	Okaya	84
Earth Day Network	25	IESA - SESI	73	VJTI	8

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