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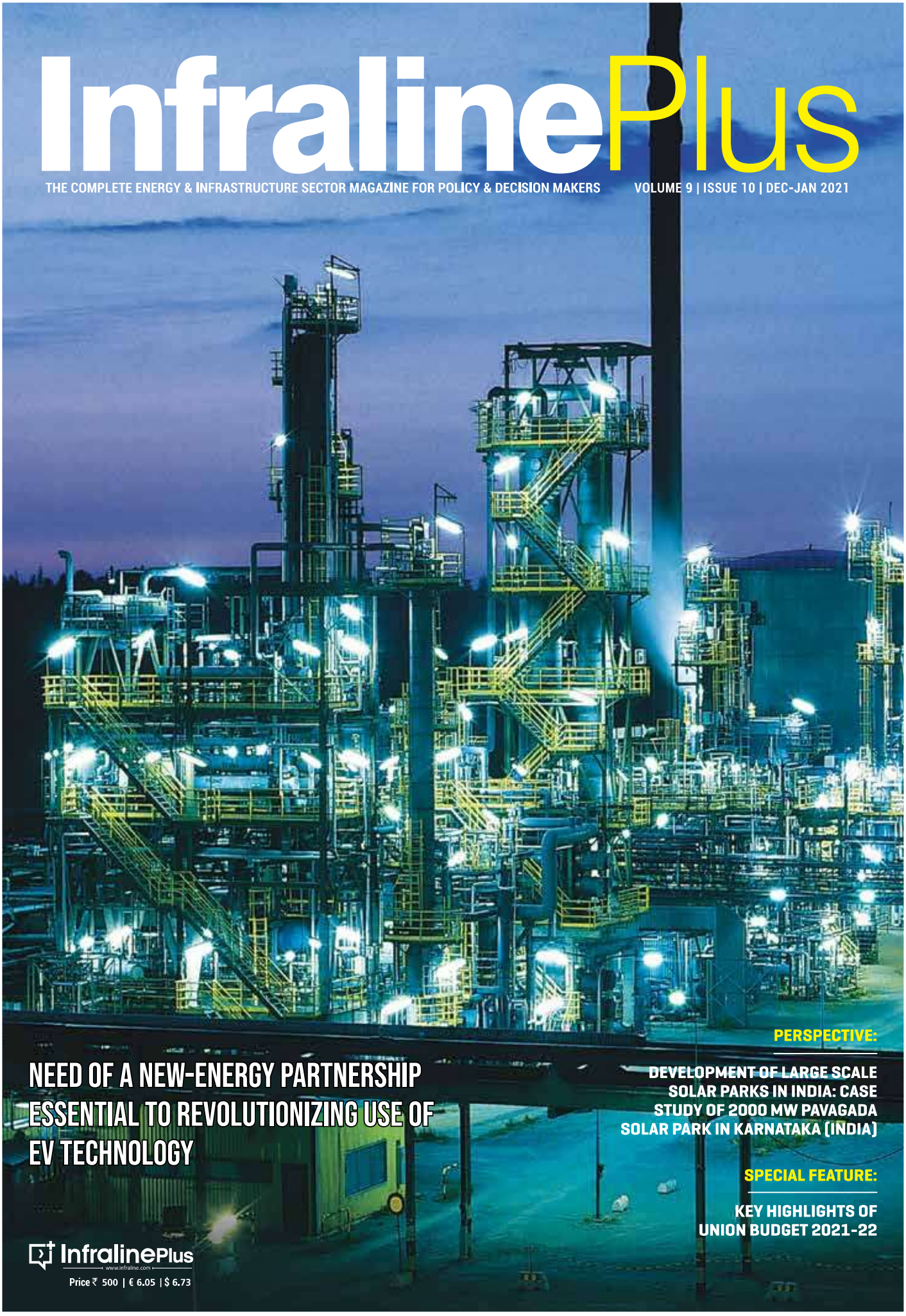

## NEED OF A NEW-ENERGY PARTNERSHIP ESSENTIAL TO REVOLUTIONIZING USE OF EV TECHNOLOGY

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# A NEW ENERGY PARTNERSHIP: DO EVS SPELL THE END OF CONVENTIONAL ELECTRICITY?

In the following piece, **Mr. Aditya Ramji - Institute of Transportation Studies, University of California - Davis, and associated with the Centre for Technology and Policy (CTaP), IIT-Madras** tries to address the mind-boggling question of whether ascent of EVs (electric vehicles) will bring an end to the era of conventionality in electricity.

"What a strange statement. How is this non-polluting?" - this was the first comment on a tweet I had shared in January 2018, with a photograph of an electric car in Delhi as part of the first public EESL tender in India. Of course, what ensued was a quick debate and it ended with what I presumed was consensus. But since then, much has been debated about the electrification of transport.

From electric debates about the future of the grid to questions of whether EVs are truly low carbon given the source of electricity, it has once again put the need for a low carbon electricity grid in focus. The evolving narrative around electrification of transport has almost become synonymous with renewable energy, especially solar, with a growing view that it can power EV charging, and thus, make it far "cleaner" than its ICE counterparts. There are also those who believe that an EV transition is pointless without cleaning up the grid. It is probably important to understand this in three parts. First, we need to understand whether EVs are still "cleaner" in emissions terms given today's electricity mix; second, is RE integration for EV charging as simple; and third, does an EV transition necessarily mean the end of conventional electricity sources such as coal?

**How clean is your EV?**

Multiple studies have shown that given India's current electricity grid mix, EVs are still cleaner, and there is a case for this transition. A recent analysis by CEEW in its report "India's Electric Vehicle Transition: Impact on Auto Industry and Building the EV Ecosystem" (October 2019), estimates ICE emissions at 130 gCO2 per km, while for an EV it is estimated at 122 g CO2 emissions per km as of today. It also further goes on to estimate that in 2030, with current trends (22% renewables penetration), the EV will further improve to 104 gCO2 emissions per km.

A simpler back of the envelope calculation also brings us to the same conclusion. Consider a typical Indian ICE gasoline vehicle with a mileage of 15 kmpl. Converting this to fuel consumption per kilometer, we get about 0.07 litre per kilometer, which leads to 0.16 kg CO2 emitted per kilometer (similar estimates corroborated by a 2015 WRI report). Now, if we look at the EVs on road in India, the average efficiency is about 8.1 km / kWh, which gives us 0.12 kWh / km. Considering the current grid emission factor for India of 0.91 tCO2 / MWh (CEA, 2018-19), we get an emissions of 0.11 kg CO2 per kilometer. A simple sensitivity analysis will show us that up to an efficiency as low


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as ~6 km/kWh, an EV is still cleaner than its ICE counterpart, given today's grid emission factor.

EVs: Coal vs Renewables

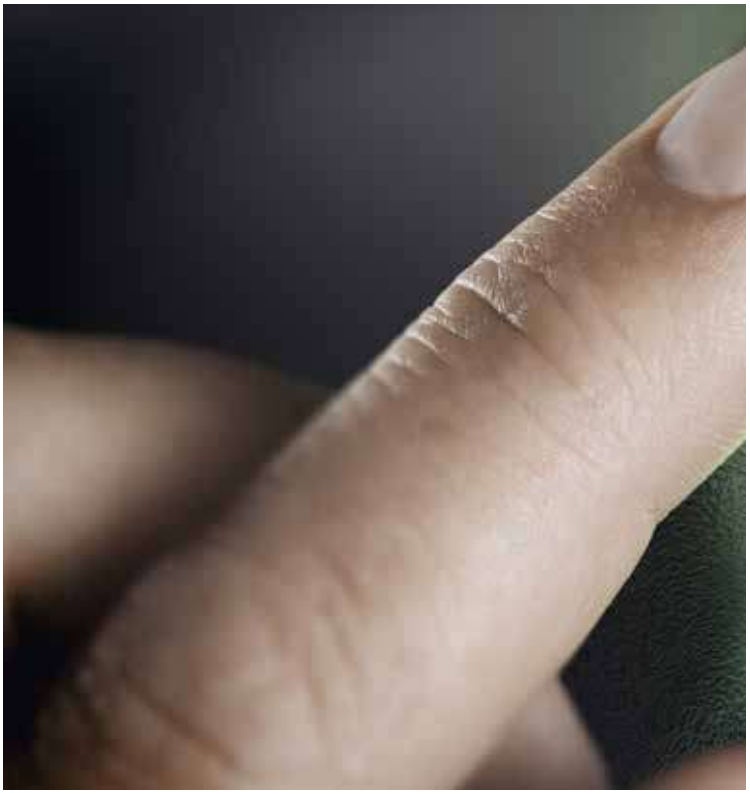
We need to probably acknowledge that the transition to renewables along with the EV transition is a sufficient but not necessary condition. Today, a shift to EVs while reducing other SOx and NOx emissions, also shifts the tailpipe emissions to the electricity grid. It is probably easier to manage a few thousand point-sources of emissions, i.e., utility power plants, as compared to managing millions of vehicle tail-pipes.

Does it mean that we do not need a cleaner grid? There is no doubt that a growing share of renewables will help decarbonize the transportation ecosystem as the share of electrification increases. The CEEW study (October 2019) also estimates that in a high renewable energy scenario, EV emissions will further improve to ~86 gCO2 per kilometer.

With India's EV transition likely to be focused on public transport including electric two & three wheelers, and taxis, most of the fleet will be charging overnight with some opportunity charging in the day, especially in the case of taxi fleets. For personal vehicles, the probability of overnight charging is far higher, with a reduced dependence on daytime opportunity charging for typical daily use cases. RE power, particularly solar, is available only in the day with a peak in the afternoon. Thus, the quantum of renewable solar power going into a full cycle of EV charging will still be limited. Given the intermittent nature of renewables and its as-and-when available basis for now, the amount of renewable integration will be limited depending on the time of day and charging pattern. Thus, EV charging will likely still rely on coal-based generation to meet a fair share of its electricity requirements. This will remain so, especially in India, until we invest in utility-scale storage and are able to make it commercially feasible.

The current tariff structures for EV charging with Time of Day (ToD) incentives are also targeted at promoting charging behavior towards off-peak hours, which are essentially late evening till early morning in India. Also, as EV technology advances, we are likely to see higher capacity AC and DC chargers in the range of 7 kW and 50 kW, respectively, which could lead to instant power and ramp-up requirements depending on charging behavior, at the least theoretically, in the context of a national or a regional grid. In either case for the foreseeable future, coal will remain a predominant source. In their book "Future of Coal in India: Smooth transition or bumpy road ahead?" (Centre for Social and Economic Progress, 2020), the authors state that even if RE were the only growing sector, it would still mean plenty of coal in 2030 for India.

Thus, the question that bears is whether an EV transition and an RE transition go together. A clear contrast is China and the EU, two leading markets in terms of EV adoption. While China is the world leader in terms of EV adoption, its electricity grid




is still predominantly coal, while the EU which is a far second to China in terms of EV adoption, has made rapid strides in its transition to renewable energy. The evidence probably points to the fact that the two need to happen parallelly, and an EV transition could potentially happen earlier, and that would still be a net benefit from an environmental cost perspective.

EV adoption as an opportunity to 'clean-up' the power sector
Today, with the Indian power distribution utilities riddled with financial woes, electricity demand from EV adoption should be seen as a potential revenue opportunity. With the average capacity utilization of around 55 – 60% for existing coal power plants, meeting additional demand from EV charging could help them improve their fiscal situation and recover investments in current plants, as we add new renewables capacity in the future.

What we need is a transition plan that enables power utilities to understand the evolution of EV technology and user behavior, so that they can better plan capacities and trade-offs between coal and renewables. We need a greater role of sub-national governments, especially states, to plan for future EV adoption and what that would mean for their local grid, in terms of additional electricity demand, additional investment in grid infrastructure and so on. In China for example, the Shanghai Electric Company took up a 'demand response' pilot, that enabled the utilities to coordinate EV charging with the availability of renewable energy, by signaling to EV users on when to charge, to integrate available RE to meet EV charging demand.

Transportation companies and electricity utilities have historically never seen the need to collaborate, but as we transition to electrification of transport, it will have significant implications on plans for the future of our electricity grids, in terms of decarbonization pathways and their associated costs.

A new energy partnership is the need of the hour. Electricity regulators at the center and state level probably need to setup a Strategic Outlook Group (or a dedicated EV Cell) comprising of power sector and automotive experts to review the developments in the EV domain and its interplay with the electricity ecosystem. The EV transition offers us an opportunity to 'clean-up' the power sector, both fiscally and by source.

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