

ALWAYS TRAVEL GREEN

A variety of electric cars has entered the market in India – priced from Rs 80 lakh to less than a tenth of that price. Charging stations, where the cars can top up batteries, are sprouting and the plan is to have one every four kms in the larger cities. The cars can also use domestic connections and the cost is said to be below Rs two per km.

The trend in India follows that in most parts of the world, where the electric car is fast gaining ground. Sales in January 2020 are reported to be over 150,000 and all major manufacturers are now in the field. The journal, *Nature Sustainability*, carries a review to see if this is really good for the environment. Florian Knobloch, Steef V. Hanssen, Aileen Lam, Hector Pollitt, Pablo Salas, Unnada Chew-preecha, Mark AJ Huijbregts and Jean-Francois Mercure, from Radboud University, the Netherlands, University of Cambridge, University of Exeter and University of Macao, compare the “life-cycle greenhouse gas emissions” of using electricity, or fossil fuels, to drive personal transport and household heating, worldwide.

The study covers 59 regions of the world, and they find that in 53 of them, which account for 95 per cent of global transport and heating demand, the use of electricity can better the use of fossil fuels in the net emissions of greenhouse gasses, even with the existing methods of generating electricity. The troubling part of the finding is that among the six regions where this is not true, India figures as the leader.

The electric car has been actively encouraged and incentivised in India. The Union department of heavy industry under the National Mission for Electric Mobility, has formulated a scheme known as Fame – Faster Adoption and Manufacturing of (Hybrid &) Electric Vehicles in India – and the Union power ministry has issued guidelines for setting up charging facilities that are efficient and economical. Under the aegis of Fame, in 2015, car rallies were flagged off in three cities in India, to promote “electrification of automobile transportation”. As the event was planned to take place just a week before the international summit in Paris to combat climate change, this newspaper (2 December 2015) had carried a piece that questioned whether electric cars were in fact economical for India.

While the electric car emits no direct greenhouse gases, it can be only as green as the electricity it consumes. In most countries now, a good proportion of electricity is generated from hydroelectric, wind driven and nuclear sources of energy. In India, however, and Australia and Indonesia are similar, most of the electricity is generated in power plants fired with coal, petroleum or natural gas, the bulk being coal. And the coal in India is notoriously poor, emitting more pollutants, like sodium dioxide, in addition to carbon dioxide, for every calorie of heat, than better quality coal.



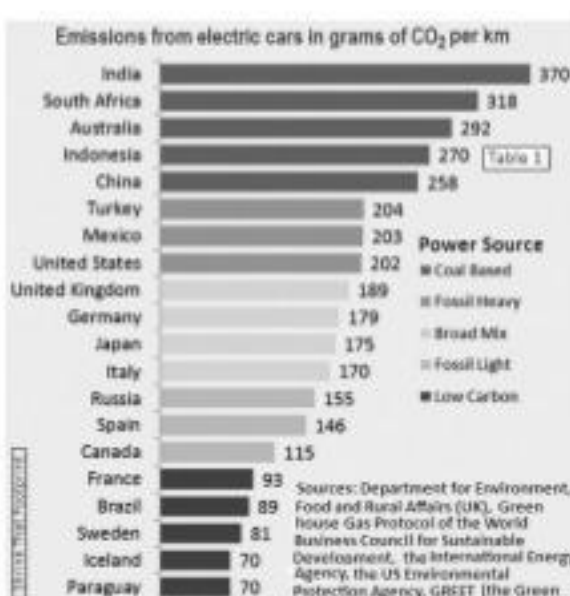
Not quite so green

India's power generation technology has a long way to go before electric cars become an environment-friendly solution

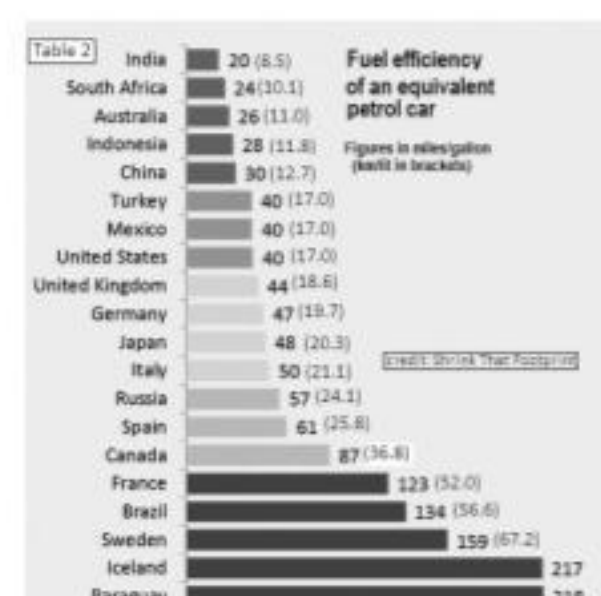
The review in 2015 had noted that while the use of the electric car was environment friendly when electricity came from non-polluting sources, the efficiency dropped when the sources were more dependent on fossil fuels. Comparisons made are shown in the Tables 1 and 2. Table 1 shows that with heavy coal dependence, poor quality of coal, transmission losses and so on, the emissions when electric cars are used in India were more than twice the emissions in European countries, Canada and Japan, over one and half times that in the US and even China.

Table 2 displays this information in terms of the fuel efficiency of a petrol driven car, if it were to match the electric car. We can see that in the best cases, the electric car works like a petrol car that runs for over 17 km on a litre of petrol. The same electric cars in India, however, behave like petrol cars that use up a litre of petrol every 8.5 km. As many petrol cars do a lot better than that in India, it seemed that switching to electric cars would result in greater GHG emission than reduction!

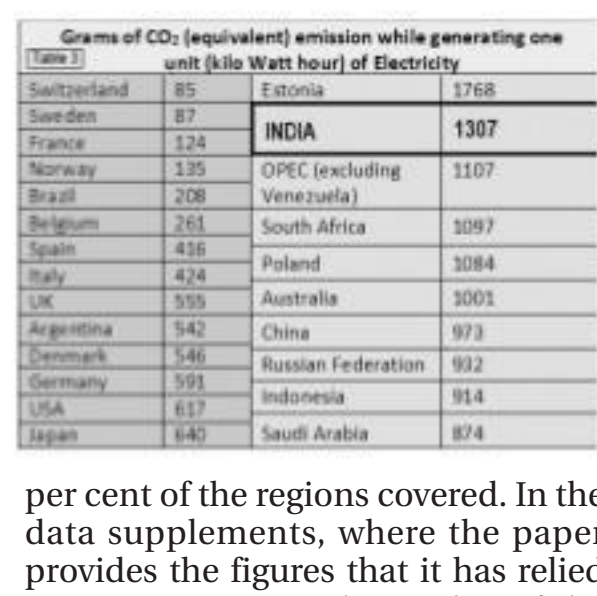
The current review in *Nature Sustainability* has addressed the same concern, to verify if the electric car is more environment friendly, considering the continuing presence of fossil fuels in generating electricity. With improved battery packs and drop in prices, the electric car has become affordable. While the low running



costs are because of the electricity tariff being what it is, it was important to know that the low tariff was not leading to greater emissions when petrol users shift to electricity. While there is a relentless drive to “decarbonise” electricity generation, was the shift to electricity for transport (and domestic heating) premature? The team hence carried out a comprehensive audit of the cost of running an electric car (and heating systems), taking into account the entire life cycle – the “use phase” – arising from the efficiency of the running car and the emissions from generating electricity, and the “production and end-of-life phase” – the emissions for manufacture (and disposal) of the cars and batteries. The study covers



the entire global use space and simulates consumer choices and possible mismatches in the planned expansion of green energy programmes, over time. “Overall, we find that current and future life-cycle emissions from EVs and HPs are on average lower than those of new petrol cars and fossil boilers -- not just on the global aggregate but also in most individual countries. Over time, in increasingly more regions even the use of inefficient EVs or HPs is less emission intensive than the most efficient new petrol cars or fossil boilers,” the paper says. While the study hence gives a somewhat hesitant all clear to most regions in the world, it holds back the same certificate from six of 59, or 10



per cent of the regions covered. In the data supplements, where the paper provides the figures that it has relied upon, it compares the quality of the electricity generated in different countries, by tabulation the “Grams of CO₂ that are emitted for each unit (kilo Watt-hour) of electricity generated. The figures are shown in Table 3 – and the position of India, as the leader, speaks for itself (Estonia, which has a higher figure, has a total population of 1.3 million, less than most cities in India). The conclusion is not difficult to reach – India’s power generation technology has a long way to go before electric cars can be a green solution. The thriving industry, which the government supports and subsidises, is an anachronism that may be a result of lobbying or just gap in understanding.

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Managing Covid-19

Vaccination against bacterial pneumonia, seasonal flu and other respiratory illnesses can help combat the Sars-CoV-2 superinfection

ARUN CHAUDHURY

Lessons from past influenza pandemics including the 1918/1919 Spanish Flu have shown that bacterial superinfections causing disruptive lung pathology have been the major cause of mortality, rather than primary viral pneumonia.

Viruses causing respiratory illnesses like influenza, coronaviruses and measles damage the mucosa, the innermost lining of the respiratory tract abutting the airway lumen. Thereafter, bacteria wreak havoc by colonising through the damaged mucosa. The most common bacteria causing these secondary damages include *Streptococcus pneumoniae*, *Staphylococcus aureus* and *Haemophilus influenzae*. In addition, *Neisseria meningitidis* may cause organ-based inflammation. Histopathological examinations of the bronchial and lung tissues from pandemic influenza-affected patients have unequivocally demonstrated bacterial pneumonia as the major cause of mortality. This calls for immediate

action for vaccination against the 23 strains of pneumococcus (*Streptococcus pneumoniae*). With the global cataclysm due to the ongoing Sars-CoV-2 supercontagious infection, a highly thoughtful approach would be to offer vaccine protection to the community and nation. The pneumococcal polysaccharide vaccine, marketed under the name Pneumovax23, is available in India. Furthermore, this vaccine may be administered to anyone including children above the age of two and adults, elderly and the severe elderly. Many of these individuals would have the major co-morbidities including coronary artery disease, chronic heart failure, chronic kidney failure, chronic obstructive pulmonary disease, tuberculosis, diabetes mellitus, malnutrition, sickle cell disease, patients on immunosuppressive therapies including corticosteroids and biologics, chronic smokers, HIV-infected people with diminished CD4 counts, and even severely immunosuppressed patients including those undergoing chemotherapy and with immune-

depleted states such as chronic variable immunodeficiency. A question arises whether individuals merit seasonal flu-vaccination. Unlike in the West, the trend for seasonal flu-vaccination is much lower in countries like India. However, the vaccination against seasonal flu, which is also currently available in India as a quadrivalent vaccine against influenza A and B inactivated strains, shall be an additional prudent step. The chief reasons being that due to global travel, unimmunised individuals will bring back and import the common seasonal flu virus strains to the community. The initial prodromal symptoms of Sars-CoV-2 and seasonal influenza overlap a lot, making it difficult to distinguish between specific viral illnesses. Pending lack of robust viral diagnostics, the only aggressive way is to mass immunise against seasonal flu. Whether vaccination against seasonal flu would ramp up immunity against Sars-CoV-2 is currently unknown. However, the stimulation of innate immunity by inactivated

influenza-based antigen will repose the immune system to a higher state of alertness to new Pathogen Associated Molecular Patterns associated with Sars-CoV-2. The current pandemic is a justifiable social cause to overcome vaccination hesitancy and “anti-vax” hysteria and get these shots, which almost have only mild side effects and indolent course post-vaccination including mild soreness, redness or pain at the site, issues common with any vaccination. The vaccination against bacterial pneumonia induces humoral antibodies in about two weeks. These antibodies persist for a very long time, even years, and provide highly efficient immunity against the common forms of community-acquired and hospital-acquired pneumonia. In the case of illnesses with specific respiratory pathogens, antibiotic-based treatment should be initiated and continued irrespective of the vaccination status. The first empiric antibiotic of choice should be the broad spectrum amoxicillin-clavulanate. Sars-CoV-2 and other influenza viruses are notorious for causing heart rhythm disturbances, also called cardiac arrhythmias. The antibiotic azithromycin, popular in managing upper and lower respiratory tract infections, is notorious for prolonging the QT interval on the ECG, enhancing the propensity for sudden cardiac arrest. Azithromycin has the potential to kill the patient much before the virus and should be avoided for treating acute and critical illnesses resulting from Sars-CoV-2. There is striking similarity between the course of respiratory illness caused by Sars-CoV-2 or influenza with that of measles-associated pneumonia, another persistent cause of respiratory illness in children and adults worldwide. Additional vaccination against measles and pertussis (whooping cough) is a highly important step in the overall management schemes of the current respiratory pandemic. Sars-CoV-2 has a lot of overlap with the disease pathophysiology of Severe acute respiratory syndrome and Middle East respiratory syndrome pandemics. There is a constant tug of war between viral illnesses and inter-

feron response mounted by the body. One way of hijacking the immune system by Sars and Mers coronaviruses is to delay the interferon response. Thus, a rational pharmacological approach is to provide and administer interferons, medicines that are commonly used to treat hepatitis C (pegylated interferon). In fact, pegylated interferon and ribavirin were earlier used in the management of Mers patients. Though zinc ionophore-based inhibition of RNA-dependent RNA polymerase by hydroxychloroquine is a rational basis for repurposing of this immunosuppressant drug usually used for treating rheumatoid arthritis and lupus, hydroxychloroquine not only prolongs QT interval but also causes dangerous ventricular arrhythmia, including Torsades de pointes. Furthermore, hydroxychloroquine may cause severe hypoglycaemia, thus needing extreme caution in subjects with diabetes mellitus and calling for caution and medical supervision in the ad hoc administration of these medicines. Vaccine protection using available injections against the common bacterial and viral illnesses, adequate hydration to maintain renal perfusion and electrolyte balance, organism specific antibiotics and broad spectrum antivirals like the neuraminidase inhibitor oseltamivir, shall all be cumulatively preventive and curative for primary and serious illnesses, and aid in aggressively preventing progression to critical illnesses from this currently circulating deadly virus. Pneumococcal and seasonal flu vaccination not only prevents progression to dangerous pneumonia, but importantly contributes to prevention of heart failure and acute coronary syndromes. Added to these medical strategies are personal hygiene, maintenance of cough etiquette and frequent respiratory toilette including gargling and steam inhalation. All these while we await the development of a seasonal Sars-CoV-2 vaccine.

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PLUS POINTS

Viable alternative



Indian Institute of Technology-Hyderabad director BS Murty has called upon on the Government of India to consider adopting bag valve mask as an alternative to meet any surge in demand for ventilators to treat Covid-19 patients. While conventional ventilators are expensive, hard to produce, and not portable, Murty and V Eswaran, department of mechanical and aerospace engineering, IIT-Hyderabad, highlight that bag valve masks are small devices, which are used to deliver breathing support in emergency situations. They are inexpensive, easy to produce, and portable and therefore, have every quality that is required in this crisis. They are most common of these devices is the bag valve mask, often called by the proprietary name of “Ambu Bag”, that is used for resuscitation in emergency situations.

The novel coronavirus has varied effects on the people it infects. Some barely show symptoms, while they still pass on the virus to others who may be more seriously affected. Of the 15 per cent of Covid-19 affected patients who may need hospitalisation, around one-third would likely develop respiratory difficulties for which ventilators for assisted breathing will become necessary. The professors note that while bag valve masks are currently hand-powered and therefore not suitable for continuous use as a ventilator, it would be easy to design a similar device powered by an electrical source, which could be a car battery, apart from the conventional power supply. It could be made portable, and therefore adopted in villages and other areas without a power supply and be inexpensive enough to manufacture in bulk.

Elaborating on the advantages of this system, Murty and Eswaran said, “Our estimate of the cost is that it can be manufactured for less than Rs 5,000, or one-hundredth the cost of a conventional machine. The cost of manufacturing six million of these devices will be probably less than that of the inadequate number of 60,000 conventional machines mentioned above. The cost is so low that it can be considered a single-use device that will be given over to single patient, and never used again. It needs to be manufactured, however, on an industrial scale, in millions, within a short time of a few months. There have been several designs proposed within India itself, with IIT-Hyderabad having at least one proposed design.”

The professors also added that this idea was not new. In the last few weeks, many countries have come up with the idea of manufacturing low-cost ventilators and have even started competitions where the winning design would be declared open-source, which are not patented, and can be given free for anyone to adopt. Several designs are already available for 3-D printing, and so can be manufactured on a small scale on a 3-D printer. A ventilator is a device designed to force breathable air into the lungs of patients who are unable to breathe for themselves. Modern ventilators are very expensive and sophisticated devices, which are generally found only in the intensive care units of large hospitals. The most sophisticated computer-controlled ventilators cost around Rs 40 lakh while more modest foreign-made ones cost around Rs 15 lakh with Indian-made ventilators costing around Rs six lakh.

It is estimated that there are around 40,000 ventilators in India at present, mostly in the private hospitals. The Indian industry has a maximum manufacturing capacity of approximately 6,000 units per month, but even the Indian-made devices use a lot of foreign-made parts whose availability would now be uncertain, when every country would be maximising their own ventilator production.

Further, the machines are not portable and are found only in high-end hospitals in large cities, so patients from villages would need to be transported to these cities, which would be a logistical problem of unimaginable complexity. Even if the Indian industry was at peak production, it could manufacture only another 60,000 machines in the next 10 months, at a cost of Rs 3,600 crore.