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Financial Incentives for Promotion of Electric Vehicles in India- An Analysis Using the Environmental Policy Framework

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ABSTRACT

India has seen some of the most damaging social and environmental effects of air pollution in recent times. It has also committed at the COP 21 in Paris to help reduce global warming. Following this voluntary agreement, India plans to increase the share of electric vehicles to 30% of total vehicles sold by 2030 to reduce air pollution. This paper studies the major financial incentives and policy measures undertaken since 2015 as part of the EV policy and views it through the lens of the Environmental Policy Framework, which considers five major types of instruments: Regulations and Standards, Green Taxes, Incentives, and Subsidies, Carbon Credits and Voluntary Negotiations. Another instrument called 'Information Dissemination Measures' is added to this framework to help evaluate the current EV policy. We find that while there are good financial incentives, to begin with, charging infrastructure and research in battery technology needs to be increased in India. There is also an urgent need to improve communication and awareness about EVs and their role in the reduction of pollution to help overcome the hesitancy in adopting this new technology.

INTRODUCTION

Global Warming has a direct connection with air pollution, especially with the emission of greenhouse gases. India has witnessed some of the most damaging environmental and social effects of air pollution in recent periods. It is estimated that about 1.2 million people in India died prematurely in 2019 from diseases directly related to air pollution (IEA 2021), making it the fifth leading cause of death in the country. Six of the ten most polluted cities in the world are situated in India (IEA 2021). In most cities, particulate matter concentration has constantly exceeded international and local standards, thus having an adverse effect on the quality of air inhaled by citizens. Close to half of India's population lives in areas having less than seven months of 'clean air days' as defined by the Central Pollution Control Board (CPCB) of India. The push for a better standard of living by increasing industrial activities has increased Carbon Dioxide emissions by over 55% in the last decade and is expected to go up by another 50% by 2040, thus making India one of the largest contributors to growth in carbon dioxide emissions worldwide (IEA 2021). It is in this context that India has committed to the Paris Agreement under the United Nations Framework Convention on Climate Change (UNFCCC 2015) (also called the Paris Agreement 2015 or COP 21) to reduce the emissions intensity of its GDP by 33-35% by 2030 from 2005 levels. It has also committed to reducing global warming to below 1.5 degrees Celsius compared to pre-industrial levels. Currently, India is considered the only G-20 nation to be on track to achieve the renewable energy targets commensurate with a reduction of 2 degrees of global warming (Dubash et al. 2018).

About a third of the air pollution is caused due to transportation. Almost 40% of Nitrogen Oxides and 14% of Carbon dioxide emissions in India are due to transportation sector activities (Climate Transparency 2020). Efforts towards electrification of road transport and commissioning stringent emission norms can contribute significantly towards the reduction of sulfur dioxide, nitrogen oxides, and particulate matter emissions. This has a positive impact on the achievement of Sustainable Development Goals as agreed at the UN. The overall move towards electrification of vehicles can help in the achievement of SDG 7 (Affordable and sustainable energy), SDG 11 (Sustainable cities), and SDG 13 (Combat climate change and its impacts).

Technology is expected to play an important role in countering climate change and measures to mitigate the pollution. In its report, 'Air Pollution and Climate Policy Integration in India-Frameworks to deliver co-benefits, the International Energy Agency (2021) has suggested linkages between mitigative technology in certain sectors and environmental benefits as shown in Table 1.

Table 1: Mitigative technology and effect on emissions.

Sector	Technology interventions	Benefits: reduction in emission
Power	Use of renewable sources; air pollution control measure	Sulfur dioxide, nitrogen oxides, particulate matter, carbon dioxide
Transport	Electrification of road transport; vehicle emission norms	Sulfur dioxide, nitrogen oxides, particulate matter
Households	Use of LPG and PNG for cooking	Indoor air pollution and particulate matter
Industry	Energy efficiency; renewable sources of power; air pollution control measure	Sulfur dioxide, nitrogen oxides, particulate matter, carbon dioxide

(Source: IEA 2021)

India plans to increase the share of electric vehicles (EVs) to 30% of total vehicles sold, by 2030 in its effort to meet the EV 30@30 agreement. By 2040, 15% of four-wheelers and more than half of the two and three-wheelers in India are expected to be electric. The sale of electric vehicles in India has grown seven-fold from 22,000 units in 2015-16 to 155,400 units in 2019-20. Over 90% of these vehicles are electric two-wheelers (Society of Manufacturers of Electric Vehicles, n.d.). However, even with this growth, the sale of electric vehicles represents less than 1% of the total vehicles currently sold in India. This implies that unprecedented and imaginative measures will be required to meet the target of EV 30@30 policymakers. The initial push toward the adoption of EVs in India started with the National Electric Mobility Mission Plan launched in 2013 with the aim of having sales of 6 to 7 million electric and hybrid vehicles by 2020 (Dixit 2020). Thereafter, the government launched the Faster Adoption and Manufacturing of (Hybrid &) Electric Vehicles in India (FAME-India) Scheme in 2015 to give a clearer vision to the EV adoption plan.

This study analyses the incentives and measures undertaken as part of the overall policy to help increase the adoption of EVs in India. These measures are analyzed using the Environmental Policy Framework and its components to understand the balance of different types of policy instruments.

This introductory section is followed by the literature review and conceptual framework of environmental policy. Thereafter, the financial incentives and other measures are identified in the subsequent section. The findings are linked with the conceptual framework in the Analysis section. The conclusions and recommendations follow the analysis.

PAST STUDIES

Toxic emissions from ICE vehicles are a major contributor to air pollution (Khurana et al. 2020). EVs can reduce air pollution, noise pollution, and greenhouse gas emissions from transportation activities, in addition to being energy efficient (Brady & O'Mahoney 2011, Figenbaum et al. 2013, Hawkins et al. 2013). EVs can contribute to the reduction of oil demand, emission of carbon dioxide, and dependence on non-renewable sources of energy. They could facilitate a shift toward clean energy production, thus having a positive impact on the pollution levels in the country (Gomez Vilchez et al. 2013).

Despite the doubling of absolute carbon dioxide emissions, India is likely to meet its obligations made in Paris 2015 by the year 2030. On a per-capita basis, these emissions would be lower than current world averages. However, these forecasts assume that there will be a reduction from the current electricity demand estimates and a faster transition to energy from renewable sources (Dubash et al. 2018).

Tarei et al. (2021) identified five categories of factors that create barriers to the adoption of EVs: infrastructural issues, financial barriers, behavioral issues, technical factors, and external influences. An environmental policy aimed at encouraging the adoption of EVs can help overcome these barriers. Further, the sale of EVs increases not just with incentives, but also with a range of attractive cars to appeal to the social needs of customers (Figenbaum et al. 2013).

The components of each country's EV policy must be considered by looking at the characteristics of the economy and behavior patterns of the population (Rietmann & Lieven 2019a). An ideal policy mix would consist of tools to incentivize production and adoption of EVs on one hand and ban or disincentivize production and use of polluting vehicles on the other hand. It would be easier to target two-wheelers in the EV market due to their relatively low prices and to benefit the users of two-wheelers, who are more exposed and affected by air pollution (Shashidhar 2021, Vidhi & Shrivastava 2018).

Monetary incentives, regulatory measures, and infrastructure development have a positive correlation with the increase in the market share of EVs (Shekhar et al. 2019). Subsidies or tax benefits can provide the initial push to reduce air pollution (Wang & Fang 2018) and switch to EVs, followed by an increase in charging infrastructure (Rietmann & Lieven 2019b). An appropriate mix of policy tools is required for this change, which includes standards and norms in tandem

with incentives, or a 'carrot and stick' policy (Arimura 2008, Gomez Vilchez et al. 2013).

In addition to command-and-control tools and market-based incentives, there can be information-based instruments to help encourage eco-innovation. These information-based instruments could be voluntary in nature, such as the disclosure of emissions, potential environmental threats, etc. (Liao 2018). Leurent and Windisch (2011) found that in addition to command-and-control tools and market-based incentives there is another category called 'communication and diffusion instruments' that creates public awareness about EVs and encourages behavioral change. It consists of marketing and publicity activities and tries to understand and address the consumers' uncertainty about the use of EVs and related infrastructure.

Consumers' intention to adopt EVs is affected by attitude, usefulness, ease of use, and financial incentives among other factors. However, uncertainty or negative views of the consumer could impact the decision to buy an EV (Jaiswal et al. 2021). The purchase intention of an EV also depends on the buyer's attitude and impact on self-image. Advertising campaigns could appeal to the potential buyers' concern for the environment, and the possibility of being seen as high-status people and new technology adopters (Khurana et al. 2020). The Indian market is cost-sensitive, and ownership of cars represents a higher social status (Parmar et al. 2021).

Bakker & Trip (2013) forwarded six major suggestions for authorities to promote EVs: 1) Subsidies for consumers and EV businesses 2) Charging infrastructure to be set up at strategic locations- these public stations can also increase visibility and awareness, 3) Regulatory measures- these include free or discounted parking fees, permitting EVs on limited-access roads, toll discounts, mandating new housing projects to be EV ready, 4) Creating and spreading awareness through websites or apps with information about charging points, vehicles, etc., 5) Public transport through electric buses, and 6) Coordination between different forms of government, at the local, national and international level to ensure smooth and effective implementation of the EV strategy.

By encouraging newer technologies that reduce vehicle emissions, the quality of life is enhanced and so is the overall development of the region (Vidhi & Shrivastava 2018). While environmental subsidies can have a positive impact on an increase in environmental technology innovation and patents (Xiong & Shen 2020), this increase could be at the cost of the quality of patents and innovations (Han 2021). Among the strategies to reduce the cost of batteries which is one of the most expensive components of an EV, the top four strategies included incentives for cell manufacturing, improving the availability of critical raw material and components to manufacture batteries, laying down standards and quality norms, and development of ancillary industries (Shekhar et al. 2019).

Greater coordination among stakeholders like city planners, municipal corporations, state, and central governments, electricity companies, and EV manufacturers is essential for the success of the EV policy (Bakker & Trip 2013, Shashidhar 2021). Dixit (2020) suggested three types of business models for the early adoption of EVs. The first is the PPP model, where the central government funds the electrification of state bus fleets, and the state government and private sector together collaborate to set up charging infrastructure. The second model is the pure government model, where the government decides to convert its entire fleet of vehicles to electric mode and sets up charging infrastructure using the services of public sector units. The third model is the manufacturer model where the EV seller sees a business opportunity in selling EVs and setting up charging infrastructure to attract users to the charging stations. Examples of all three models are seen in India in different contexts.

CONCEPTUAL FRAMEWORK FOR DEVELOPMENT OF ENVIRONMENTAL POLICY

The conceptual framework for the development of an Environmental policy relies on two major categories of policy tools- Tax measures and non-tax measures. The tax measures include green taxes and incentives, while the non-tax measures include regulations, pollution permits, and voluntary negotiations. Alternatively, policy instruments have also been classified as command-and-control and incentive-based instruments. Literature suggests that an ideal environmental policy consists of some or all of these instruments, in varying proportions based on the need and characteristics of the economy (Arimura et al. 2008, Blackman & Harrington 2000, Braadbaart 1998, Gomez Vilchez et al. 2013, Kolstad 2000, Ligthart 1998, Wilson 1996).

The five types of instruments commonly used in the creation of environmental policy are outlined as under:

Regulations and Norms: These are alternatively called command-and-control measures and include bans and restrictions. If imposed in isolation, they could have a counter-productive effect and may induce polluters to misreport information and sidestep these regulations (Blackman & Harrington 2000, Ishikawa et al. 2012, Kolstad 2000). They also entail a systemic cost of reporting and conveying information (Joshi et al. 2001).

Pollution Permits: The most common permits are called carbon credits globally. They are a category of economic

instruments that allow businesses to buy and sell the right to pollute. Typically, if a business pollutes less than the norm, it earns credits to the extent of pollution saved. It can sell these credits to firms who have polluted more than the norms and by purchasing these credits, the polluting firms avoid being penalized. The major concern with this instrument is that it does not reduce pollution but simply shifts its location.

Voluntary Negotiations: An example of this could be the Paris 2015 agreement, where countries voluntarily decide to reduce pollution. This could be further picked up at the national level by companies wanting to project a more environment-friendly image and agreeing to accept pollution abatement technology.

Green Taxes: Taxes that try to internalize the cost of negative externalities due to pollution are called green taxes (Ligthart 1998). While these taxes are usually imposed on polluters, they can also be viewed as a measure to promote clean technology. For example, EVs can be promoted by levying a green tax on substitute goods, ie. Internal Combustion Engine (ICE) vehicles to make EVs appear more economical. Additionally, this instrument gives the government additional revenue to reduce pollution created by harmful activities.

Incentives and Subsidies: Sometimes called 'negative taxes', incentives, subsidies and tax deductions for reducing emissions, providing cheaper finance, etc. could indirectly help in pollution abatement (Ligthart 1998, Shah 2014)). These benefits could be specific to environment-friendly activities, or they could be generic, which could be used by all manufacturers.

In addition, there are information and communication-based instruments which help create awareness about polluting activities and environment-friendly measures, which in turn help to enhance or magnify the effect of the above five instruments (Leurent & Windisch 2011, Liao 2018, Shah & Guha 2021). This category of information-based instruments is being added as the sixth set of instruments to the existing five-point framework for this study, to understand the impact of the current policy for EVs in India.

MEASURES TO PROMOTE THE PRODUCTION AND SALE OF EVS IN INDIA

The overall responsibility for planning and implementation of the FAME-India scheme lies with the Department of Heavy Industries. This scheme falls under the National Electric Mobility Mission Plan and aims at promoting the usage of economical and efficient electric and hybrid vehicles. The first phase of FAME ended in March 2019. Thereafter, the second phase, starting from April 2019 has been extended up to March 2022. The scheme targets the promotion of electric buses, three-wheelers, four-wheeler passenger cars, and two-wheelers. The initial outlay for phase II is INR 100 billion, of which about 86% has been earmarked for demand creation through incentives. The breakup of fund allocation is as under:

The second phase aims to support 55,000 electric four-wheeler passenger cars and one million electric two-wheelers (GoI 2019). The demand incentives, which make up much of the budget outlay of the scheme are further broken up across different categories of EVs as given in Table 3.

The basis of the demand incentive calculation in Table 2 is the battery capacity measured in terms of kWh. Currently, the incentives are given at the flat rate of INR 20,000 per Kwh for buses, INR 15000 per Kwh for two-wheelers, and INR 10,000 for all other electric vehicles. There is a cap on the total incentive based on the cost of the vehicle (40% for buses and two-wheelers, 20% for others).

There are further incentives and subsidies granted by central and state governments to manufacturers and buyers of EVs in India. These, and the FAME incentives, can be broadly classified into two categories for ease of analysis- production level and purchase or consumer level. The first category deals with incentives to reduce the cost at the manufacturing level to enable production cost parity with

Table 2: Fund allocation for demand creation of EVs in India.

Sr no	Expenditure head	Fund allocation (%)
1	Demand incentives	85.96%
2	Charging Infrastructure	10%
3	Administrative expenses (Including publicity and Information, Education & Communication activities)	0.38%
4	Other Phase-I related expenses	3.66%
	Total	100%

Source: GoI, Gazette Notification for FAME-II: March 11, 2019.

Table 3: Demand incentive breakup of INR 85.96 billion across categories of EVs.

Category of EVs	INR [Billions]	Number of vehicles to be covered under the scheme
Buses	35.45	7090
4-wheelers (including strong hybrid)	5. 51	55000
3-wheelers	25	500,000
2-wheelers	20	1,000,000
Total	85.96	

Source: GoI, Gazette Notification for FAME-II: March 11, 2019.

ICE vehicles. Purchase-related incentives help to smoothen out any variations that may remain after accounting for production-based incentives. It is possible to argue that some incentives in the former list could easily fit into the latter, or that some incentives are difficult to be strictly classified into any one category. This distinction is made only for ease of understanding. The break-up of production-based and purchase-related incentives are as under:

Production Level Incentives

Demand incentives to manufacturers of EVs based on the FAME scheme as discussed above. The demand incentives based on Kwh of the EVs have increased substantially after 2019.

Manufacturers of components used in EVs can avail of full deduction of their infrastructure-related capital expenditure under section 35AD of the Income Tax Act 1961. While Income Tax Act allows for a deduction of mainly revenue expenditures, this section allows the EV firm to reduce its taxable profits further by subtracting their capital expenditures, thus paying little to zero taxes and improving cashflows.

From August 2019, the rate of GST (Goods and Services Tax) on EVs has been reduced to 5% from 12%. GST on chargers and charging stations has been reduced to 5% from 18%. The GST on the hiring of electric buses by local authorities has been completely exempted. Conversely, ICE vehicles attract GST @ 28%. Further, some states (eg. Andhra Pradesh) offer full State GST refunds to buyers on the purchase of EVs.

The Central Government has announced a Production-Linked Incentive (PLI) scheme in May 2021 to encourage the development of Advanced Chemistry Cells (ACC batteries) and has budgeted for INR 181 billion to be distributed as incentives to eligible manufacturers, thus helping reduce the costs of batteries which makes up almost half the cost of the EV (Shekhar et al. 2020). The scheme would be based on competitive bids and the minimum qualification criteria would depend on factors such as installed capacity, domestic value addition, and minimum investment amount. The commitment would entail setting up an ACC manufacturing facility with a capacity of at least 5GWh and ensuring at least 60% domestic value addition in the next five years (EY India 2021, Mohanty 2021).

Consumer Level Incentives

In addition to the demand incentives at the Central level, various states also provide local incentives to make the purchase even more cost-effective. For example, the state of Gujarat offers incentives of INR 10,000 per kWh of battery capacity (maximum INR 20,000) for two-wheelers, INR 10,000 per kWh (up to INR 150,000) for four-wheelers, and a flat amount of INR 50,000 for three-wheelers. Similarly, states like Maharashtra and Delhi also offer substantial incentives to boost the central government measures. Many states in India have started offering incentives that include scrappage benefits in addition to direct subsidies.

According to section 80 EEB of the Income Tax Act 1961, from the year 2019, interest on a loan taken to purchase an electric vehicle is allowed as a deduction from taxable income up to an amount of INR 150,000. The loan must be taken from any financial institution and should be sanctioned between April 1, 2019, and March 31, 2023.

Registration charges for electric vehicles in India have been waived from August 2021 by the Ministry of Road Transport and Highways. EVs have also been exempted from paying road tax (Also called RTO tax) in many states. Road tax varies from state to state and in a state like Delhi, the rate can range from 4% to 15% depending on the type, value, and ownership of the vehicle.

EVs are exempted from payment of green tax on registration renewal (after 8-15 years). For ICE vehicles the current green tax on renewal of registration is in the range of INR 2000-3500 for a state like Maharashtra and up to 50% of road tax in Delhi.

ANALYSIS OF POLICY MEASURES

The push for early adoption of EVs in India is a combination of multiple measures, the foremost being incentives, and subsidies. However, a major boost for this drive came when India agreed in Paris in 2015 to reduce pollution levels, specifically by deciding to have at least 30% of electric vehicles as part of the total vehicles sold by 2030. This gave the economy a vision and target that helped create policies to increase the adoption of EVs. In addition, there have been parallel moves to keep the taxes on polluting ICE vehicles high to act as a barrier for those looking at long-term investment in vehicles. The high taxes on fuels from non-renewable sources (like petrol, and diesel) have also forced consumers to consider cheaper alternatives.

The benefits outlined in the section above can be classified into the six categories of policy tools for environmental protection, as discussed earlier in the conceptual framework section. The GST and Income tax benefits, demand-based subsidies (central and state levels), PLI scheme, and waiver of road tax and registration charges can be collated under the 'Incentives and Subsidies' head. The higher GST on ICE vehicles and high taxes on fuels from non-renewable sources and the higher tax on ICE vehicle re-registration can be categorized as 'Green Taxes', albeit on substitute goods. The

stringent Bharat-VI pollution norms for ICE vehicles could be termed as 'Regulations and Standards'. The government's voluntary commitments regarding pollution reduction at the UNFCCC and the EV 30@30 decision are examples of voluntary negotiations and decisions. These could be followed up by voluntary decisions by major automakers in India to make a quick to gradual switch to EV production and setting up charging infrastructure. While there are no explicit carbon credit schemes in India (Chandra 2021), the awareness program is of extreme importance as it pertains to changing people's attitudes and behavior towards EVs. The budget outlay for Information, education, and communication is only 0.38% of the total funds allocated for demand incentives (Table 1). However, this activity will play a vital role in formalizing the transition to EVs in India.

When viewed through the Environment Protection Framework for policymaking, as discussed in the literature review section, the policy initiatives could be represented as in Fig. 1.

The figure highlights the focus on incentives and subsidies as a major instrument, which is necessitated by the high cost of EVs. India does not have an explicit carbon pricing scheme, though there are implicit mechanisms that penalize or reward carbon emissions. However, these schemes need to be developed further to make a meaningful impact (Chandra 2021). There is also an important role for awareness creation (Leurent & Windisch 2011, Liao 2018) which can be a useful instrument to disseminate information about the benefits of EVs and can also be used to spread awareness of the other five instruments, thus helping increase their effects.

The government has also laid out norms for creating charging infrastructure for the EV firms, in line with the budget outlay for this purpose. Lack of charging infrastructure is one of the major barriers to the faster adoption of EVs (Rietmann & Lieven 2019a, Tarei et al. 2021), as there are not enough charging stations or battery-swapping facilities to create confidence in the minds of buyers. In addition, there is a need to create awareness about the benefits of EVs and the continuous availability, source cleanliness, and cost-economy of electricity for users. This may prove difficult for governments as they depend heavily on taxes generated from the production and sale of ICE vehicles and fuels from non-renewable sources. In the short run, such awareness campaigns carry the risk of derailing tax revenue budgets, though, in the long run, these measures could benefit the environment.

CONCLUSIONS

This study shows that three types of policy instruments could play a vital role in helping make the transition to an electric fleet for the economy by 2030: 1) command-and-control measures, 2) economic or financial incentives and 3) information diffusion instruments. Human behavior is an impor-

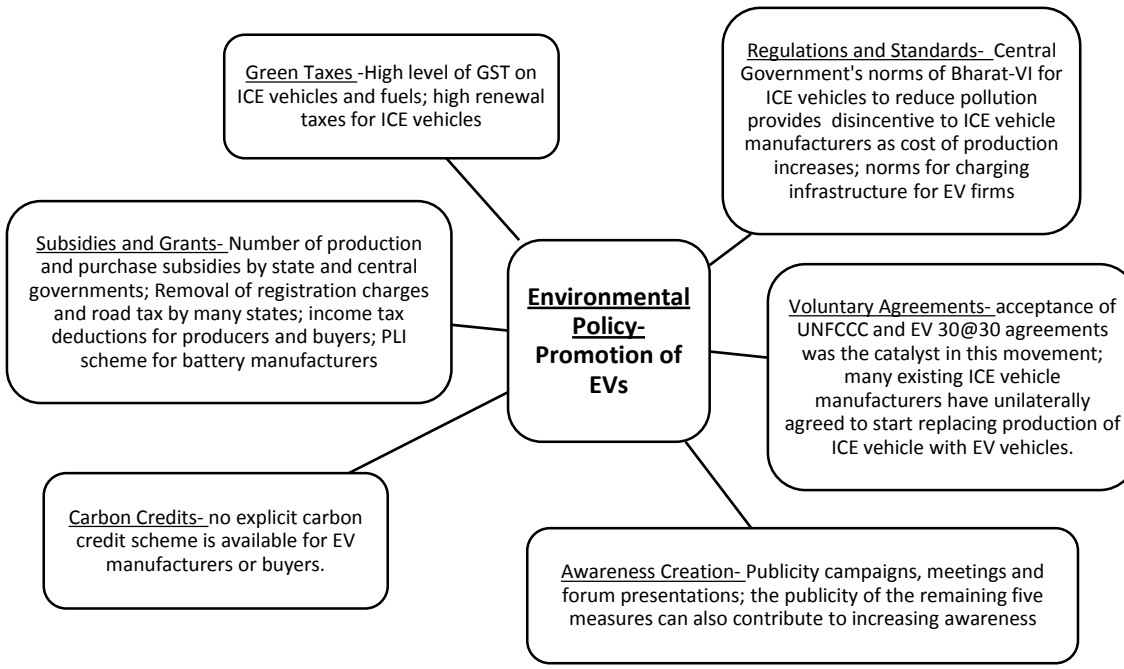

Fig. 1: EV policy initiatives linked to Environmental Policy Framework.

tant factor to be considered in policymaking and effective dissemination of information can help smoothen irrational behavior in relation to the proposed policy. For example, uncertainty about charging infrastructure could impact the buying behavior of consumers. This uncertainty could be countered with information about the number of charging stations, visibility of such stations and large vehicles being charged, and apps and websites giving updated information about charging infrastructure.

EV policy in India is being spearheaded by incentives and subsidies with good support from regulations, voluntary negotiations, and green taxes on polluting substitutes. Many of these incentives and benefits have been introduced in a meaningful and substantial manner only after 2019. Hence, the full impact of these measures on increase in sales of EVs is yet to be observed. However, to speed up the process, these measures need to be supported by awareness campaigns about the benefits of EVs and the pollution caused by ICE vehicles. In addition, information about the existing policy measures could help the consumer choose to move towards EVs as a preferred mode of transport and help the economy move towards reducing road pollution. Before this, the setting up of charging and battery-swapping stations, and research and development in battery technology need to be substantially improved for the awareness campaigns to have a substantial impact.

Post-FAME-II, there has been a substantial improvement in the intent and action of governments. However, there is an urgent need to focus on the creation of charging infrastructure, improve research in developing efficient batteries, and importantly, create awareness about EVs and policy measures to encourage the use of EVs.

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