India's Energy Transition:

Subsidies for petrol, diesel and electric vehicles

ISSUE BRIEF

IISD
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Global Subsidies Initiative

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Published by the International Institute for Sustainable Development.

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July 2019

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Acknowledgements

The authors of this issue brief would like to thank the following individuals and institutions for the valuable comments and recommendations that they provided as peer reviewers of this publication:

- Bharath Jairaj, Parul Kumar, Deepak Krishnan and Tirthankar Mandal, World Resources Institute, India
- Shirish Garud, The Energy and Resources Institute, India

We would also like to thank colleagues Christopher Beaton, Richard Bridle and Vibhuti Garg for their input on the draft. This publication was made possible thanks to the generous support of the governments of Sweden and Denmark. The opinions expressed and the arguments employed in this brief do not necessarily reflect those of the peer reviewers and funders, nor should they be attributed to them.

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List of Abbreviations

ASCM	Agreement on Subsidies and Countervailing Measures
CEEW	Council on Energy Environment and Water
CO2	carbon dioxide
EV	electric vehicles
FAME	Faster Adoption and Manufacturing of (Hybrid &) Electric Vehicles
FY	financial year
g CO_2-eq	grams carbon dioxide equivalent
GDP	gross domestic product
GHG	greenhouse gas
GSI	Global Subsidies Initiative
GST	Goods and Services Tax
IISD	International Institute for Sustainable Development
INR	Indian rupee
kW	kilowatt
NEMMP	National Electric Mobility Mission Plan
OMCs	Oil Marketing Companies
R&D	research and development
RBI	Reserve Bank of India
T&D	transmission and distribution
USD	United States Dollar
VAT	value added tax

1.0 Introduction

In the India's Energy Transition, 2018 Update, the Global Subsidies Initiative (GSI) of the International Institute for Sustainable Development (IISD) and the Council on Energy, Environment and Water (CEEW) published updated estimates of energy subsidies in India for financial year (FY) 2017, including partial data on the scale of subsidies for FY 2018. An important finding was that subsidies for electric vehicles (EVs) and hybrids,[1] while modest, were increasing, while subsidies to oil, petrol and diesel were on the decline.

Since publication, two major policy developments have taken place. First, when faced with rising world oil prices in October 2018, the Government of India reduced the excise tax on fuel by INR 1.5 (USD 0.02)[2] per litre and required state-owned oil marketing companies (OMCs) to reduce their margin by INR 1 (USD 0.01). This decision was partially reversed in the 2019-2020 Union Budget. Second, the government announced phase two of its flagship EV subsidy program, the Faster Adoption and Manufacturing of Hybrid and Electric Vehicles (FAME) scheme, or FAME II.

This paper examines how the latest government support for EVs compares with subsidies for conventional vehicles and their main fuels.[3] What is the likely impact of these latest policy developments on the achievement of government objectives in the transport sector?

KEY FINDINGS

- The rising trend for EV subsidies in India has been strengthened by the addition of INR 10,000 crore (USD 1.4 billion) for FAME II from FY 2020 to FY 2022.
- Subsidies for oil, petrol and diesel, which had been declining since FY 2014, have seen a sharp increase: cuts to excise and OMC margins resulted in foregone revenue and market price support of INR 26,957 crore (USD 3.9 billion) from October 2018 to June 2019.
- The funds would have been better spent supporting India's transition to EVs and renewable energy rather than sheltering petroleum-reliant technology from the volatile international oil market.
- EVs can reduce toxic air pollution relative to conventional vehicles and, importantly, shift emissions out of cities with benefits for livability and health. The benefits of EVs will improve as India transitions away from polluting coal-based electricity.
- Shifting fuel taxes and subsidies to renewable energy would have a triple benefit for air pollution: lower incentives for using petrol and diesel, reductions in air pollution from coal-fired generation and improved environmental credentials of India's EVs.

[1] The term "EV" in this brief refers to all vehicles with significant battery capacity, including hybrids.

[2] Exchange rates: INR 1 = USD 0.017 in FY 2014, USD 0.016 FY 2015, USD 0.015 in FY 2016, USD 0.015 in 2017, USD 0.016 in FY 2018 (Reserve Bank of India) and USD 0.014 in FY 2019 (US Federal Reserve Bank).

[3] This brief examines support programs for EVs and equivalent conventional (internal combustion engine) vehicles and their main fuels, petrol and diesel. It does not address other options for transitioning to a cleaner transport sector such as reducing demand, non-motorized alternatives, public transport, efficiency or emissions standards for conventional vehicles, or other fuels (such as compressed natural gas, hydrogen or biofuels).

2.0 Context

Like most countries, India is heavily reliant on fossil fuels in the transport sector. This has led to challenges with air pollution, energy security and greenhouse gas emissions, which are likely to increase as demand for transport and energy rises.

Petrol and diesel account for over 90 per cent of final energy consumption in India's transport sector (International Energy Agency [IEA], 2015). With a growth rate of 6.8 per cent, transport is India's fastest growing energy-consuming sector, around 90 per cent of which is due to road transport (IEA, 2015). Private vehicle ownership is currently lower than other emerging economies (India had 22 cars per 1,000 inhabitants in 2017 compared to 164 per 1,000 in China) (Abbas, 2019). By 2040, car ownership is expected to increase by 775 per cent and demand for transport fuel is forecast to quadruple (IEA, 2015).

According to the World Air Quality Report 2018, seven of the world's top 10 (and 20 of the top 30) most polluted cities are in India (IQAirVisual, 2019; Thornton, 2019). In Delhi, for example, vehicle emissions have been found to be the major contributor to rising air pollution compared to other sources such as industry, households, thermal power plants and agriculture sources (Nagpure et al., 2016). Air pollution was estimated to have caused 1.24 million deaths in India in 2017 alone; i.e., 12.5 per cent of total deaths. The majority of these (54 per cent) were attributable to ambient air pollution (India State-Level Disease Burden Initiative Air Pollution Collaborators, 2019).

India's oil import dependence reached an all-time high of 84 per cent in 2018-19 (PTI News, 2019). Around half (47 per cent) of India's oil use is consumed in the transport sector (IEA, 2019). The government has set a target to reduce import dependency by 10 per cent by 2022 by encouraging alternative fuels (Ministry of Petroleum and Natural Gas, 2018).

In 2013, road transport contributed to approximately 10 per cent of India's total GHG emissions by the energy sector (Garg et al., 2017). Diesel constituted the largest share of emissions at 62 per cent, followed by petrol at 23 per cent, aviation fuel at 9 per cent and the remainder, 6 per cent. Transport sector CO_2 emissions grew 70 per cent between 2005 and 2013 (Garg et al., 2017).

As one means to address these issues, the Government of India is encouraging the adoption of electric vehicles (EVs). India's first national policy on EVs was the 2012 National Electric Mobility Mission Plan (NEMMP) 2020.[4] The Mission Plan aimed to bring about a "transformational paradigm shift" in the automotive and transportation industry and provides a framework for promoting the adoption of electric mobility to achieve several objectives:

- Enhancing national fuel security
- Providing affordable and environmentally friendly transportation
- Achieving global leadership in automotive manufacturing.

The government's commitment to promoting EVs is also articulated in the draft 2018 National Auto Policy. EVs are cited as a means to achieving one of the major objectives of the policy: clean, efficient and sustainable mobility (Ministry of Heavy Industry and Public Enterprises, 2018). The central government also views EVs as a major market opportunity, both domestically and internationally. The draft policy seeks to enhance the contribution of the automobile sector to GDP, increase automobile exports by 30–40 per cent of overall output over the next decade, generate skill development and employment, and drive R&D.

The central government does not have a formal target for EV adoption. However, it joined the EV30@30 campaign, which sets a target of achieving least 30 per cent of new vehicle sales being electric by 2030.[5] Policies are also being considered to require that all new two- and three-wheel vehicles sold must be electric within six to eight years from 2019 (Shah, 2019b) and taxi firms to convert 40 per cent of their fleet to EVs by 2026 (Reuters, 2019).

State governments are also aggressively promoting EV use and manufacturing. States with formal EV policies are Andhra Pradesh, Delhi, Gujarat, Karnataka, Kerala, Maharashtra, Uttar Pradesh, Uttarakhand and Telangana. As one example, the objectives of Delhi's EV policy are: improved air quality, reduced noise pollution, enhanced energy security and reduced GHG emissions (Government of National Capital Territory of Delhi, 2018). Andhra Pradesh's policy, on the other hand, is primarily focused on creating a manufacturing hub in the state (Department of Commerce and Industry, 2018).

The EV industry is currently in its early stages, with only two electric car manufacturers, approximately 10 in the two- to three-wheeler segment and three to four in electric buses. The majority of other auto manufacturers active in India are now looking at introducing EV models (Innovation Norway, 2019). Conventional vehicles dominate auto sales (Table 1).

[4] Before NEMMP, EVs were supported through central government programs for alternative transport, research and development, and state-level programs (Department of Heavy Industries 2012).

[5] The campaign, launched in 2017, currently has 11 member countries. See https://www.iea.org/topics/transport/evi/.

Table 1. Sales of conventional and electric vehicles in India (FY 2018)

Category	Conventional	EVs
4-wheel	4,144,400	1,200
3-wheel	635,700	850,000
2-wheel	20,192,700	54,800

Sources: All vehicles: SIAM, 2019b; EVs: SMEV, 2019b.

More than 95 per cent of the EVs on Indian roads are low speed (less than 25km per hour) electric two- or three-wheelers that do not require registration and licences (SMEV, 2019). The two- and three-wheeler vehicles do not depend on charging infrastructure but have swappable batteries that can be charged in the home.

The four-wheel EV segment is largely restricted to cars. Electric buses are only beginning to be used in some cities (Bhavnani, Shekhar, & Sharma, 2018). Charging infrastructure is still limited. In 2019, there were 350 publicly accessible chargers in India, in comparison to 200,000 in China by the end of 2016 (Ghosh, 2019).

The low penetration of EVs other than three-wheelers is likely due to (Government of National Capital Territory of Delhi, 2018):

- High upfront purchase price of advanced EV vehicles[6]
- Failures and short lifespan of lead-acid batteries used in the cheaper EV two-wheelers
- Almost non-existent public charging infrastructure
- Lack of products comparable to conventional vehicles in terms of price and speed
- Relatively low levels of investment in EV manufacturing capacity.

These issues are being targeted through central and state government EV policies and subsidies (see Section 4).

[6] EVs can use traditional lead-acid batteries or "advanced" battery technology, such as lithium-ion. Lead-acid batteries are cheaper to buy than advanced batteries but tend to be heavier for the energy provided and do not last as long.

3.0 Support for Conventional Vehicles, Petrol and Diesel

The central government's support policies for the manufacture of conventional vehicles are also available to manufacturers of EVs. Given the absence of specific support policies, they are listed here to illustrate government support for the vehicle industry in general but have not been quantified. The government does, however, subsidize petroleum, which was quantified in the IISD and CEEW report and is updated in Section 3.2.

3.1 Support for the Vehicle Industry

Central government support policies for vehicles include tax breaks, research and development (R&D) funding and export credits. The major R&D subsidy is the National Automotive Testing and R&D Infrastructure Project, which establishes R&D centres at a total cost of INR 3,727 crore (USD 559 million) to help the industry achieve global standards. Seven testing and research centres have been established in the country since 2015 (Department of Heavy Industries, n.d.).

Tax and duty concessions include the Merchandise Export Incentive Scheme (MEIS) that provides automobile manufacturers with a duty credit on vehicle exports. In addition, 20 tariff headings have been considered as "sensitive items" to be maintained in the negative list for India in most of the trade agreements. Section 35 (2AB) of the Income Tax Act, 1961 provides weighted tax deduction of 150 per cent of expenditure incurred by a company on scientific research by in-house R&D centres for approved activities, falling to 100 per cent after 2020 (PTI, 2019b).

Each state also offers additional investment incentives for industrial projects in areas such as subsidized land cost, reduced stamp duty on sale and lease of land, electricity tariff reductions, concessional rate of interest on loans, investment subsidies, tax incentives, backward areas subsidies and special investment incentive packages for megaprojects (Make in India, n.d.).

3.2 Petrol and Diesel Subsidies and Taxes

IISD and CEEW's update of estimated energy subsidies in India identified 15 subsidies applicable to oil, petrol or diesel (four consumer subsidies, 10 producer subsidies and one applicable to both consumers and producers) (Soman et al., 2018). In FY 2014, these subsidies totalled INR 63,000 crore (USD 10.7 billion), with the largest single subsidy being under-recoveries for below-market pricing of diesel. The subsidies declined to INR 2,697 crore (USD 405 million) in FY 2018 (Soman et al., 2018). The sharp decline was partly a result of lower international oil prices and partly the result of policy change.

Prices for petrol were liberalized in 2010 and those for diesel in 2014. Since then, there have been no direct subsidies for these fuels. In addition to removing direct subsidies, the central government phased in fuel excise taxes and equivalent customs duties for imported petrol and diesel, in addition to the cess and tax on crude oil.[7] Most states also levy a value added tax (VAT), averaging around 20 per cent (Petroleum Planning & Analysis Cell [PPAC], 2019b). Diesel VAT is significantly lower for most states. Several states also charge an additional cess.

In October 2018, the combination of removal of subsidies, increased taxation and rising international oil prices resulted in petrol and diesel reaching the highest prices encountered since market-based pricing was adopted (Dutta, 2018). The central government responded by reducing the excise duty by INR 1.5 per litre and ordering oil marketing companies (OMCs) to absorb part of the price rise by cutting their margin by INR 1 per litre, leading to a price reduction from the centre and OMCs of INR 2.5 per litre.

The reduction in excise duty in October was forecast to reduce central government revenues by INR 10,500 crore (USD 1.6 billion) in FY 2019 and was aimed at reducing retail prices (PTI, 2018). The excise cut was kept in place until 5 July 2019, leading to total foregone revenue of INR 16,174 (USD 2.3 billion) (Table 2). We estimate the reduction in the OMC margin resulted in an additional INR 10,783 crore (USD 1.5 billion) as a form of income and price support in FY 2019.[8]

The fuel price cut appears to be a subsidy (see Box 1), based on the government's stated objective to "extend an immediate relief of INR 2.50 on both petrol and diesel to the consumers" (Business Today, 2018) (Box 1). Inflation is likely to have also been a factor, noting the price cut was announced a day before the inflation-targeting Reserve Bank of India (RBI) decided on monetary policy (Srivastava & Singh, 2018).

In response to easing international oil prices, the 2019-2020 Union Budget raised excise and the Road and Infrastructure Cess each by INR 1 per litre on petrol and diesel (Sitharaman 2019). In addition, a customs duty of INR 1 per tonne was placed on crude oil. These changes resulted in a price increase of INR 2.5 for petrol and INR 2.3 for diesel, effectively reversing the price cut provided in October 2018 (Times of India, 2019b). However, the OMC margin reduction was not reversed, while the central government increased its revenue by raising the cess and customs duty on crude oil.

[7] 20 per cent oil industry development cess and a National Calamity Contingent Duty (NCCD) of INR 50 per metric tonne.

[8] The OMC margin reduction is defined as income and price support and not foregone government revenue, given that OMCs are expected to absorb the loss and cross-subsidize from other business activities. While reduced revenues by the state-owned OMCs will result in lower dividends and taxes to government, which does directly impact the central government's budget, this is hard to calculate. Therefore for the purposes of this brief, the full value of the OMC margin reduction is considered as a subsidy in the form of income and price support. Income and price support is a subsidy category that reflects instances when the government creates a transfer of financial benefits that are borne by non-state actors, such as a fuel blending mandate or policies that fix prices at certain levels.

Table 2. Excise tax and OMC margin reduction, October 2018 to June 2019

	INR crore	USD million
Excise reduction		
petrol	4,496	643
diesel	11,678	1,671
excise subtotal	16,174	2,315
OMC margin		
petrol	2,997	429
diesel	7,786	1,114
OMC subtotal	10,783	1,543
Total	**26,957**	**3,858**

Source: Authors' calculations based on fuel consumption data for October 2018 to May 2019 from PPAC 2019a and an estimate of average monthly fuel consumption for June 2019 (based on the 2019 average).

BOX 1. IS INDIA'S FUEL EXCISE REDUCTION A SUBSIDY?

The World Trade Organization (WTO) Agreement on Subsidies and Countervailing Measures (ASCM) says that a subsidy is a "financial contribution by a government or any public body" (Article 1.1(a)(1) (World Trade Report , 2016). The different forms of financial transfers are (i) direct transfers of funds, including potential transfers, such as loan guarantees (ii) foregone revenues that are otherwise due (iii) goods and services provided by the government other than general infrastructure (iv) any form of income or price support.

Aspects of this definition can be challenging to implement in practice. For example, in order to determine the foregone tax revenue that is "otherwise due" it is necessary to take some kind of normative benchmark for the "appropriate tax." Typically, this is done by referring to the government's own identification of the appropriate tax rate, by referring to taxation rates on like products or the actual taxation rate in cases where a temporary exemption has been granted. In the case of fuel taxes in India, there have been regular adjustments to the tax levels since 2014, making it hard to identify a clear "normative benchmark" as to what constitutes a reasonable level of taxation.

Some countries subsidize while others tax fuels. The United States price is considered by some to be a benchmark minimum price for a non-subsidized and low taxing road transport policy, although not covering social and environmental costs. India's petrol and diesel prices at USD 1.07 and USD 1.00 per litre respectively, are higher than the United States' prices, indicating a higher level of taxation. However, fuel taxation is a common form of revenue in many countries. When comparing India's retail prices for petrol and diesel with its neighbours and peers, India's prices are in the middle of the field (see Figure 1).

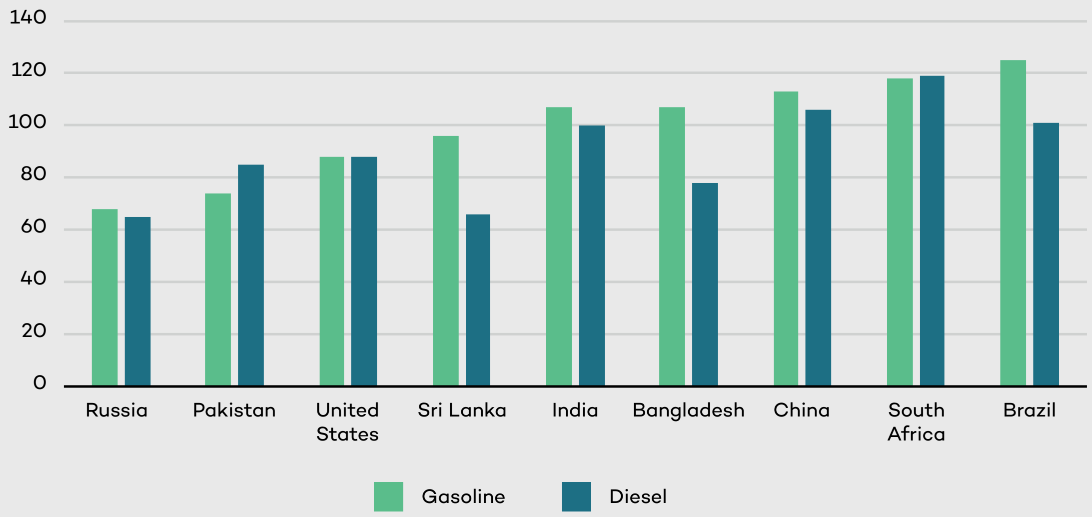

Figure 1. Retail prices for petrol and diesel in November 2018 (US cents per litre)

Source: By authors using data from Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), 2019.

However, the government and OMCs made clear in their announcement of the cuts that the intention was to give relief to consumers, despite a reduction in revenue. In announcing the excise cut, the Finance Minister is reported to have said that the centre's revenue would decline INR 10,500 crore because of the excise duty reduction (Mishra, 2018). Similarly, the OMCs were aware of the impact on their revenues. One media report cited a senior executive at a state-run oil firm saying, "The annual impact on (fuel retailers) would have been to the tune of INR 9,000 crore. However, given that it is already October, the impact will be in the range of INR 4,500 crore."

Thus the policy falls into the category of a "financial contribution by a government body" and involves "foregone revenues that are otherwise due" and "income and price support."

Whether a policy is classified as a "subsidy" is a technical definition, but not entirely academic. Evaluation of the subsidy status of the policy provides insight into whether the government is favouring the subsidized good over alternatives and the consequences of that policy. In the case of the fuel excise reduction, the question for India is whether the price relief for consumers is worth the loss in government revenues and the signal it sends to consumers and investors that fossil fuels will be price controlled.

As part of its October 2018 price reduction, the central government requested that state governments cut their VAT on diesel and petrol by INR 2.5 per litre (USD 0.03) in order to deliver an overall cut of INR 5 per litre for consumers (Business Today, 2018). Fifteen states complied with the request: Arunachal Pradesh, Assam, Bihar, Chhattisgarh, Goa, Gujarat, Haryana, Himachal Pradesh, Jammu and Kashmir, Jharkhand, Madhya Pradesh, Uttar Pradesh, Uttarakhand and Tripura. Maharashtra reduced VAT only on petrol.

In February 2019, the VAT rate on petrol varied from 0 in Lakshadweep to 35.2 per cent in Telangana, with most states levying around 20 per cent (PPAC, 2019b). VAT for diesel is significantly lower for most states.

4.0 Support for Electric Vehicles and Electricity

IISD and CEEW's update of estimated energy subsidies in India identified five subsidies for EVs at the central level (Table 3; for detailed subsidy descriptions, see *India's Energy Transition: Subsidies for Fossil Fuels and Renewable Energy 2018 Annex Update*). The following sections provide updates on the subsidies and budget estimates, where available. Recent state subsidies are identified but not quantified.

Table 3. Central government subsidies identified for EV in India's Energy Transition 2018 Update (INR crore)

Subsidy	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019
Faster Adoption and Manufacturing of (Hybrid &) Electric Vehicles (FAME)	not in place	not in place	75	144	165	195
Concession of excise duty on EVs	2	4	9	4	not in place	not in place
Exemption of customs duty on EV parts	not calculated					
Modified Special Incentive Package Scheme (M-SIPS)	not calculated					
Concessional GST on EVs	not in place	not in place	not in place	not in place	15	not calculated
Total (INR crore)	2	4	84	148	180	195
Total (USD million)	0.3	0.6	12.9	22.1	25.2	27.3

Note: For detailed subsidy descriptions, see India's Energy Transition: Subsidies for Fossil Fuels and Renewable Energy 2018 Annex Update

Sources: Soman et al., 2018; updated for FAME for FY 2018 and FY 2019 from Government of India 2019.

4.1 Central Government

The central government's flagship EV program is the FAME Scheme, which is also its only direct subsidy that specifically targets EVs. The total allocation of the first phase (FAME I) was INR 895 crore (USD 134 million) between April 2015 to March 2019 (Press Information Bureau, 2018). Of this, INR 597 crore was outlaid from FY 2016 to FY 2019 (as per Table 3) and the remainder was rolled over into FAME II (Table 4).[9]

The largest component of FAME I was demand incentives, which provided the purchaser of electric and hybrid vehicles an upfront reduction in purchase price by the dealer at the time of purchase. FAME I subsidized the purchase of 2.6 million electric and hybrid vehicles (Press Information Bureau, 2018). The majority of these were two-wheelers with lead-acid batteries and mild hybrid[10] cars (Rokadiya & Bandivadekar 2016). In addition, 455 electric buses were subsidized for nine cities in a pilot scheme launched in 2017 (Press Information Bureau, 2018). Only vehicles manufactured or assembled in India were eligible for the incentive.

The second phase, FAME II, will be implemented over three years from April 2019 (Table 4). The total allocation is INR 10,000 crore (USD 1.4 billion), of which INR 8,596 crore (USD 1.2 billion) is to incentivize vehicle purchases, INR 1,000 crore (USD 140 million) for charging infrastructure and the remainder for program administration (Government of India 2019).

Table 4. FAME II subsidy allocations over forward estimates, FY2019 to FY2022 (INR crore)

Component	FY 2020	FY 2021	FY 2022	Total
Demand incentive	822	4,587	3,187	8,596
Charging infrastructure	300	400	300	1,000
Administration, publicity and communication	12	13	13	38
Subtotal (new funding)	**1,134**	**5,000**	**3,500**	**9,634**
Committed expenditure of phase I	366	0	0	366
Total	**1,500**	**5,000**	**3,500**	**10,000**
(USD million)	(210)	(700)	(490)	(1,400)

Source: Government of India, 2019.

The incentive for purchase of most vehicles is INR 10,000 (USD 140) per kilowatt (kW) based on the size of their batteries (Government of India, 2019). Buses for state transport units receive INR 20,000 (USD 280) per kW. To be eligible, EVs must be registered, use advanced battery technology (such as lithium-ion rather than lead-acid) and be priced below a given threshold (Table 5). The number of vehicles to be supported in each category is capped.

[9] There is a discrepancy in FAME I funding: INR 597 crore was outlaid from FY 2016 to FY 2019 and INR 366 crore was rolled over into the FAME II allocation. This totals INR 945, but the total allocation for FAME I was INR 895 crore. The reason for this discrepancy could not be discovered.

[10] Mild hybrids (also known as battery-assisted hybrids) are vehicles propelled by an internal combustion engine but also have an electric motor that allows the engine to be turned off whenever the car is coasting, braking, or stopped, yet restart quickly. The battery is recharged by the vehicle, not plugged in. Strong hybrids have a battery and electric motor sufficiently powerful to propel the vehicle.

Table 5. Demand incentives for EVs and hybrids under FAME II

Electric (E) or hybrid vehicle	Maximum # vehicles to be supported	Approx. battery size	Max. ex-factory price		Total fund support	
		KWh	INR	USD	INR crore	USD million
E 2-wheeler	10 lakh	2	1.5 lakh	2,100	2000	280
E 3-wheeler	5 lakh	5	5 lakh	7,000	2500	350
E 4-wheeler	35,000	15	15 lakh	21,000	525	73.5
Strong hybrid	20,000	1.3	15 lakh	21,000	26	3.64
E Bus	7,090	250	2 crore	280,000	3545	496.3

Source: Government of India, 2019.

The central government offers generous concessions on tax, duty and cess for electric vehicles (Table 6). In January 2019, the central government reduced the rate of customs duty for disassembled EVs and parts from 15–30 per cent to 10–15 per cent (Times of India 2019a). The 2019-2020 Union Budget provided exemptions for parts for exclusive use in electric vehicles: e-drive assembly, on-board charger, e-compressor and charging gun (Sitharaman, 2019). The budget also proposed to reduced the GST for EVs from an already discounted rate of 12 per cent to five per cent (Sitharaman, 2019).

The government also announced that it will waive registration fees for EVs: the registration fee of two-wheelers is INR 50 (USD 0.70) and for private four-wheeler, INR 600 (USD 8.40) (Dash, 2019a).

Table 6. Tax reductions for EVs, as of July 2019 (per cent)

	Conventional vehicles	EVs
GST	28	5*
Customs Duty: Disassembled vehicles and parts	15–30	0–15
GST Compensation Cess**	Up to 15	0

*Notes: *Proposed in 2019–2020 Budget. **Compensation cess is levied by the government to re-distribute GST income between producing and consuming states. Before imposition of the GST, sales tax was a source of income to states that produce vehicles. The GST, which subsumed sales tax, is instead paid to the state where vehicles are purchased. The cess redistributes these funds.*

Sources: Dash, 2019b; Modi, 2019; Mukherjee, 2019; SIAM, 2019a; SMEV, 2019; Sitharaman 2019; Times of India, 2019a.

The 2019-2020 Budget also provides an income tax deduction of INR 150,000 (USD 2,100) on the interest paid on loans taken to purchase EVs (Sitharaman 2019). This amounts to a benefit of around INR 250,000 (USD 3,500) over the loan period to taxpayers who take loans to purchase an EV.

4.2 State and Territory Level

Eleven states and territories support the adoption of EVs through subsidies for manufacturers, consumers, and charging infrastructure, or through government procurement (Table 7). Common state- and territory-level incentives for manufacturers include capital investment subsidies, lower stamp duty or land tax, low-interest loans, loan guarantees and concessions on the provision of infrastructure such as power or water. Common subsidies for consumers include purchase incentives and concessions on road tax, VAT and registration.

Table 7. Presence of key types of government support for EVs in Indian states and territories

Recipient:	**Manufacturers**			**Consumers**			
Type of support:	**Direct**	**Taxes and fees**	**Govt procurement**	**Direct**	**Taxes and fees**	**Charging infrastructure**	**Reduce electricity tariff for charging**
State							
Andhra Pradesh		✓	✓		✓		✓
Chandigarh					✓		✓
Chhattisgarh							✓
Delhi				✓	✓	✓	✓
Goa					✓		
Gujarat						✓	✓
Haryana					✓		✓
Madhya Pradesh							✓
Maharashtra	✓			✓	✓	✓	✓
Karnataka	✓		✓		✓	✓	✓
Kerala		✓	✓		✓		
Punjab					✓		✓
Rajasthan					✓		
Tamil Nadu					✓		
Telangana			✓			✓	✓
Uttar Pradesh			✓	✓			✓
Uttarakhand		✓	✓		✓		
West Bengal			✓				

Notes: Government procurement can be a subsidy if the government pays above market rates for purchases or requires a threshold amount of domestic content (Steenblik, 2007). Even if these requirements are not met, large purchase of EVs by governments provide demand support for manufacturers.

Sources: Andhra Pradesh Electricity Regulatory Commission, 2019; Chandigarh Joint Electricity Regulatory Commission, 2019; Chhattisgarh State Electricity Regulatory Commission, 2019; Department of Commerce and Industry, 2018; EAI, 2018; Government of Kerala, 2018; Government of National Capital Territory of Delhi, 2018; Gujarat Electricity Regulatory Commission, 2018; Haryana Electricity Regulatory Commission, 2018; Joshi, 2018; Karnataka Electricity Regulatory Commission, 2018; Madhya Pradesh Electricity Regulatory Commission, 2019; Mandela, 2018a, 2018b; Narasimha, 2019; Punjab State Electricity Regulatory Commission, 2019; Telangana State Electricity Regulatory Commission, 2018; Uttar Pradesh Electricity Regulatory Commission, 2019; Vernma, 2018.

State- and territory-level incentives have not been quantified, consistent with the approach taken in Soman et al. (2018). However, they may offer a significant benefit to EV consumers. A study from 2016 found that the purchase incentive offered by Delhi at the time comprised 21 to 38 per cent of the total subsidy benefit to EV buyers in the National Capital Territory (Rokadiya & Bandivadekar 2016).[11] Reductions in road tax and VAT can also provide a significant concession for EV buyers (Table 8).

[11] The amount varied depending on the type of EV purchased. The other subsidies considered were FAME I and central government concessions on excise, customs duty and cess.

Table 8. Concessional rates of VAT and road taxes offered by Indian states, as of May 2019

Subsidy	Conventional vehicles	EVs
Road taxes*	2.5–20%	0–10%
VAT**	12.5–14.5%	0–5.5%

*Notes: * includes completely and partially knocked down units; Exempt in Maharashtra, Karnataka, Rajasthan and Goa, taxes 4–10 per cent in other states; ** Exempt in Karnataka, Rajasthan and Chandigarh, reduction in Delhi, Haryana, Maharashtra, Punjab and Tamil Nadu.*

Sources: Dash 2019; Modi, 2019; SMEV, 2019.

Delhi's purchase incentives have changed since the 2016 study mentioned above but they are still substantial (see Table 9 for examples of state and territory level subsidies). The direct subsidies are provided in addition to VAT concessions and exemption from road tax, registration charges, one-time parking fees and permit fees for several classes of EVs.

Table 9. Support measures for EVs offered by Delhi

Vehicle type	Subsidy
Two-wheelers	Purchase incentive: equivalent to 50 per cent of the FAME subsidy. "Top-up Incentive" up to 50 per cent of the FAME subsidy for EVs with swappable batteries.
Auto rickshaws ("e-autos")*	Loan subsidy scheme: 5 per cent of the purchase price (net of FAME subsidy) to a maximum of INR 12,500, and 5 per cent interest subsidy with the loan amount capped at INR 2 lakh over three years. Scrapping incentive: up to INR 15,000 per vehicle to de-register and scrap conventional auto rickshaws more than seven years old.
e-rickshaws	Loan subsidy scheme: as for e-auto (above). For buyers who want to arrange their own finance: Delhi will provide 10 per cent of the purchase price to a maximum of INR 20,000 and 5 per cent interest rate subsidy with the loan amount capped at INR 1.8 lakh over three years.
Buses	"Reasonable incentives" to operators of private stage carriage vehicles of all sizes to ensure that EVs make up least 50 per cent of Delhi's public transport by 2023.
Goods carrier (three-wheeler)	Purchase incentive equivalent to 50 per cent of the incentive offered under FAME available for the first 5,000 eligible carriers registered.

*Note: * Auto Rickshaws are passenger three-seaters, three-wheelers that generally use compressed natural gas. E-rickshaws are four seaters operating with a battery and a maximum speed limit of 25 kilometres per hour.*

Source: Government of National Capital Territory of Delhi, 2018.

4.3 Impact of Subsidies on Affordability of EVs

Together, subsidies offered by the central and state governments make a considerable difference to affordability of EVs in India. A study published in 2016 found that the major subsidies available at the time[12] brought the purchase price of EVs close to or below the purchase price of similar conventional vehicles (Table 10). Interestingly, the major subsidy benefit for EV cars was from the excise exemption (32 to 45 per cent of the total subsidy benefit), while FAME I offered the greatest proportion of subsidy benefits for scooters (~40 per cent of the total).

12 FAME I, excise and customs duty exemption, infrastructure cess exemption, Delhi's VAT exemption and a direct purchase incentive offered by the Delhi Pollution Control Committee (replaced by the subsidies outlined in the Delhi EV Policy 2018).

Table 10. Cost of electric or hybrid vehicle in India compared to conventional equivalent with and without selected central and state subsidies, 2016 (per cent)

	Mild hybrid	Strong hybrid	Full EV	High speed scooter**
Without incentive	+14*	+23	+51	+26
With incentive	+5	-1	+1	+7

*Notes: * "+" indicates that the total cost of ownership was higher than the conventional equivalent, "-" indicated it was lower. ** The authors of this research note that it may be inappropriate to compare the low-speed electric scooters with conventional scooters due to differences in output characteristics.*

Source: Rokadiya & Bandivadekar, 2016.

4.4 Electricity Subsidies

Electricity transmission and distribution (T&D) is heavily subsidized in India with a major subsidy in the form of distribution companies selling electricity at below-market rates to eligible consumer groups (including households and the agricultural sector). The quantifiable subsidies for T&D jumped from INR 40,037 crore (USD 6.6 billion) in FY2014 to INR 83,313 crore (USD 12.9 billion) in FY2017 (Soman et al., 2018). The single largest subsidy was the under-recovery of costs by distribution utilities for keeping below-market prices for certain categories of consumers (INR 81,000 crore, or USD 12,568 million). In Jharkhand for instance, as per the latest tariff order, the cost of supply of electricity is INR 6.32/ KWh but the average tariff is INR 5.10/KWh implying that subsidy is lowering the price by approximately 20 per cent (Jharkhand State Electricity Regulatory Commission, 2019).

The subsidized tariffs afforded to consumers by these policies will reduce the cost of recharging swappable batteries for two- or three-wheelers or plug-in EVs. The extent of the benefit of lower electricity prices to owners of EVs in eligible household segments is unknown. Similarly, it is not known whether lower electricity tariffs were a factor in determining whether such households switched to EVs—or indeed, the extent to which households eligible for electricity tariff reductions use EVs at all. Some states do attempt to target subsidies so that they are only received by households with low consumption profiles or in possession of Below Poverty Line (BPL) cards, but many also offer subsidies to every household's initial block of consumption or set volumetric consumption thresholds that are fairly high (Mayer, Banerjee, & Trimble, 2015).

The central government stated in its draft amendments to the Tariff Policy that the applicable tariff for charging stations will be less than or equal to the average cost of supply. As noted in Table 7, some states offer specific low tariffs for EV charging. However, these low tariffs are likely to be a challenge for electricity distribution companies as EVs increase. A wide network of EV charging infrastructure and increased home charging would require a strong distribution grid network that can support the high voltage supply demand, which in many states would require upgrade of existing distribution infrastructure, hence a large investment (Agrawal, 2018). If distribution companies cannot recoup these expenses from tariffs, they may be reluctant to invest in the necessary upgrade.

5. Discussion

The following sections discuss two main questions:

- Is the trend of rising support for EVs and declining support for petrol and diesel continuing?
- What is the likely impact of FAME II and the fuel excise reduction on the achievement of government objectives for EVs?

5.1 Comparison of Support for EV, Petrol and Diesel

Central government subsidies to EVs increased dramatically between FY 2014 and FY 2018, as shown in Soman et al. (2018). In FY 2014, EV subsidies were only INR 2 crore (USD 280,000), or 0.003 per cent of the amount of fuel subsidies. By FY 2018, EV subsidies had increased to INR 250 crore (USD 35 million) while subsidies to oil, petrol and diesel declined to INR 2,697 crore (USD 378 million) (thus EV subsidies were around 9 per cent of amount of the fuel subsidies).

Since the above subsidy estimates were published, EV subsidies have further increased, but fuel subsidies, in form of foregone revenue and market price support, have also spiked. FAME II significantly strengthened the trend of rising central government support for EVs, with total subsidies of INR 10,000 crore (USD 1.4 billion) over FY 2020 to FY 2022 (Figure 2). The excise and OMC margin reductions resulted in foregone revenue and market price support of INR 26,957 (USD 3.8 billion) in the nine months from October 2018 to June 2019 (INR 17,436 in FY 2019), almost three times the government's support for EVs over three years.

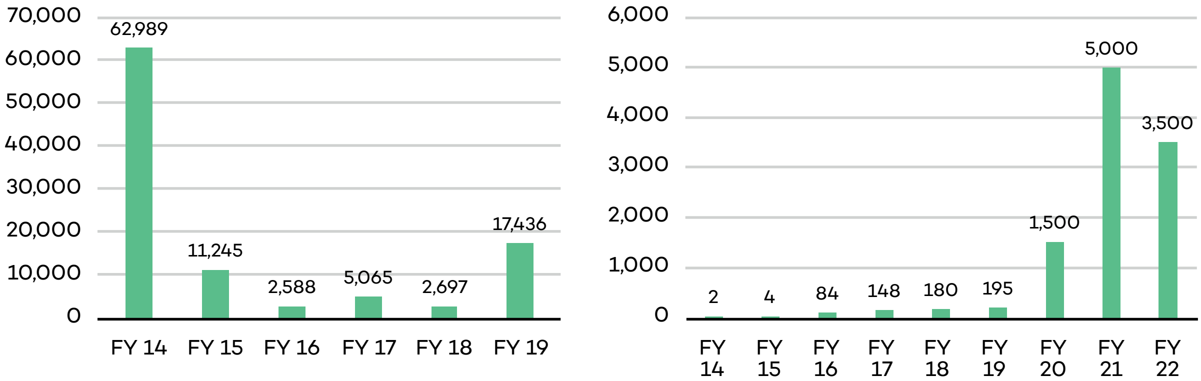

Figure 2. Comparison of support for EVs and oil, petrol and diesel, INR crore

*Note: *The graph contains only partial data for oil, petrol and diesel in FY 2019: the reduction and excise and margin only; partial data is also provided for FY 2020 to FY 2022: FAME II only.*
Source: Authors' calculations using data from Soman et al., 2018 and Government of India, 2019.

The conventional vehicle and fuel industry argue that they pay higher taxes than the EV industry and therefore a reduction in fuel taxes does not constitute a subsidy (Mukherjee, 2019). While this view seems logical, economic theory suggests that polluting goods should be taxed in order to discourage use and ameliorate negative impacts they cause. The negative impacts of transport fuel-induced air pollution and climate change warrant the maintenance of taxes.

The amount of the excise and margin reduction on a per-litre basis is small, only INR 2.5 (not including the VAT reduction offered by some states, which result in a total of INR 5 in those states). But the consequences of the policy are large for two reasons. First, the foregone revenue is substantial and could have been used for other purposes that would accelerate India's clean energy transition. Second, the intervention is a regression into fuel price control. It sends a message to motorists, investors and industry that the government intends to shelter petroleum-product-reliant technology from the volatile international oil market.

5.2 Are Current EV Subsidies Meeting Government Objectives?

Electric vehicles are being promoted in the country with the objective of reducing air pollution and GHG emissions, reducing oil imports, and increasing employment and manufacturing. The following sections assess how EVs and pro-EV policies are meeting these objectives.

5.2.1 Air Pollution and GHG Emissions

In order to assess whether the current policy settings for EVs are meeting government objectives for air pollution and GHG emissions, it is necessary to examine the underlying premise of whether EVs are indeed "cleaner" than conventional vehicles.

Electric vehicles are often thought to reduce air pollution and GHG emissions relative to conventional vehicles because they do not have direct exhaust (tail pipe) emissions. While it is true that EVs do not directly emit exhaust, they are powered by electricity that, in the case of India, is largely derived from coal, which does have emissions. In addition, EV manufacture also requires energy, with associated emissions and pollution.

A fair comparison of EVs and conventional vehicles therefore requires a thorough assessment of all phases of the vehicle's life. The main three phases are:

1. Production
   a) Sourcing of materials: energy and emissions associated with mining and refining any specialist materials
   b) Manufacturing: energy used during vehicle manufacture and assembly
2. Use
   a) Exhaust emissions: gases released from the tailpipe of conventional vehicles
   b) Evaporative emissions: release of volatile hydrocarbons into the atmosphere when conventional engines are heated
   c) Non-exhaust emissions: release of particulate matter from tire, brake, clutch and road surface wear
   d) Emissions associated with energy supply (fuel or electricity production)
3. Disposal
   a) Potential for recycling of materials
   b) Impact of materials disposed in landfill

The following section outlines the current state of research regarding emissions and pollution related to these phases.

5.2.1.1 Production

EVs are more energy-intensive to produce than conventional vehicles, primarily because battery manufacture requires a great deal of energy but also because EVs tend to use more aluminum than conventional cars (which is energy-intensive to produce) (Hawkins et al., 2013). Typically, almost half of an EV's life cycle greenhouse gas emissions potential is associated with its production, with battery production being the single most significant contributor (Hawkins et al., 2013). EV batteries require minerals and rare earths, the mining, processing and disposal of which has been associated human toxicity, freshwater eco-toxicity, freshwater eutrophication, and metal depletion impacts (Hawkins et al., 2012). This is primarily associated with poorly regulated practices, which can be improved with good governance.

5.2.1.2 Use

Studies that only examine the use phase (when vehicles are being driven) are often referred to "well-to-wheel" analyses. They examine emissions associated with extraction (the "well"), processing and transporting of fuels, production of electricity (for EVs), and emissions associated with driving (the "wheels").

A recent review of studies (mostly based on modelling) found that the use phase of EVs was associated with lower levels of most toxic air pollutants compared to conventional vehicles, based on a range of countries and electricity sources (Vidhi & Shrivastava 2018). These studies found that the use of EVs led to a reduction in carbon monoxide, volatile organic compounds, nitrogen oxides, ground level ozone and particulate matter, while sulphur dioxide tended to increase (due to emissions of SO_2 from coal-fired power generation). The amounts varied widely between studies depending on the source of electricity and the study assumptions:

- A study of the Yangtze River Delta region of China found that switching all vehicles to EV without changing the coal-based electricity mix would reduce nitrogen oxides, particulate matter and volatile organic compound by 10 per cent, 0.2 per cent and 7.8 per cent respectively, but increase sulphur dioxide by 3.5 per cent. Decarbonising the electricity mix was projected to reduce air pollution further (Ke et al., 2017).
- In Taiwan (with coal- and gas-based electricity), 100 per cent EV conversion would reduce carbon monoxide, volatile organic compounds, nitrogen oxides, ozone and particulate matter by 85 per cent, 79 per cent, 7 per cent, 39 per cent and 7.2 per cent respectively, while increasing sulphur dioxide by 11 per cent (Li et al., 2016).

While these results are based on countries with a different electricity mix than India, they illustrate that EVs can reduce overall toxic air pollutants compared to conventional vehicles. In addition, EVs also shift emissions out of urban environments where they occur at street level and in the most populous areas. This shift would reduce human exposure to air pollutants.

Turning to GHG emissions, EVs can potentially compensate for their carbon-intensive manufacturing phase through lower emissions during the use phase (Ellingsen & Hung, 2018). But, as for toxic air pollutants, the GHG emissions associated with this phase are highly dependent on the source of electricity. There have been no full lifecycle assessments for EVs in India. However, four "well-to-wheels" studies were identified. The results are sometimes contradictory, depending on the underlying assumptions of the researchers.

- The National Electric Mobility Mission Plan cites a government study that found EVs were expected to have 45 per cent lower use-phase GHG emissions compared to contemporary petrol engines for four wheelers in 2020 (Department of Heavy Industries, 2012). The underlying assumptions for the research were not provided and it is not clear how these estimates were derived. The projected GHG reductions are much larger than shown in other studies.
- A 2016 study compared two EVs with seven conventional vehicles (both diesel and petrol), all from the Indian market and based on the domestic electricity supply (Rokadiya & Bandivadekar, 2016).[13] The results showed that the mini EV car would reduce emissions over five years by between one and seven tonnes CO_2 equivalent compared with the conventional vehicles. The larger EV, however, was associated with higher emissions than all but one of the conventional vehicles.
- Patil et al. (2016) found that EVs powered by India's current electricity fuel mix had slightly lower (around 10 per cent) CO_2 emissions than petrol-powered vehicles. However, they concluded that a shift toward renewable sources for power generation and reduction in losses during transmission and distribution would significantly reduce emissions associated with EVs in the future.
- Woo, Choi, and Ahn (2017) compared EV and conventional vehicle emissions across 70 countries using each country's domestic electricity generation mix. They found that, for three vehicle types (compact, luxury and SUVs), EVs in India would have lower CO_2 emissions equivalent conventional vehicles. Only the sub-compact car category was found to have higher emissions than its conventional equivalent (presumably due to the efficiency of the small conventional vehicle).

These studies do not take into account the embedded carbon from EV production (i.e., full lifecycle assessment). When the production phase is taken into account, EVs powered by coal electricity have been estimated to increase lifecycle global warming potential by 17 to 27 per cent compared with conventional vehicles based on an assumption of a 150,000 km vehicle lifetime (Hawkins et al., 2013).

[13] Coal accounts for 74.8 per cent of electricity generation in India, hydroelectricity 9.3 per cent, gas 4.8 per cent, wind 3 per cent, biofuels 2.8 per cent, nuclear 2.6 per cent, oil 1.6 per cent and solar 1 per cent.

However, a recent study in Singapore, which predominantly uses natural gas for electricity generation, found that EV taxis would have the lowest full lifecycle emissions compared to vehicles fuelled with compressed natural gas, diesel and petrol, based on a vehicle lifespan of 1 million kilometres (the average lifespan of taxis in Singapore) (Reuter et al., 2015). Evidently, the results depend strongly on electricity generation sources and underlying assumptions.

Most research has been conducted on electric cars. For two-wheelers—the dominant vehicle type in India (including for EVs)—the same principles apply: the battery makes up around half of the global warming potential of the vehicle, and the emissions during the use phase will depend on the electricity source (Weiss et al., 2015). A review of international literature found that electric two-wheelers resulted in lower well-to-wheels and lifecycle emissions relative to conventional equivalents (Table 11). However, the studies relate to a range of countries with varying electricity sources and India-specific studies would be needed to confirm the results.

Table 11. Well-to-wheel and lifecycle emissions of electric bikes and motorcycles, various studies (kg CO_2-eq. 100 km−1)

Emissions	E-bikes	Mid-size electric*	Mid-size conventionally*	Large electric*	Large conventionally powered*
Well-to-wheel GHG	1.5 ± 1.0	4.4 ± 3.4	7.6 ± 3.3	6.9 ± 5.2	12 ± 5
Lifecycle GHG	2.5 ± 2.0	7.4 ± 6.8	9.6 ± 3.6	11 ± 10	25 ± 18

*Note: *e-bikes: pedal-assisted two-wheelers; maximum speed of ⩽25 km h−1; electric motor ⩽0.25 kW; mid-sized: max. speed of ⩽45 km h−1, electric motor >0.25–4 kW; large: max. speed of >45 km h−1; electric motor >4 kW.*

Source: Weiss et al., 2015.

The emissions profile of EVs (for GHG and toxic air pollution) will improve with an increasing proportion of renewable energy increases in the electricity supply. India is already turning toward renewable energy, with 500 gigawatt (GW) of renewable energy generation capacity to be added by 2028 to achieve its goal of 40 per cent electricity generation from non-fossil fuels by 2030 (Kumar 2019). Therefore electricity-related emissions are expected to decline substantially over this time period. The switch to EVs will allow commensurate reductions in emissions in the transport sector.

The transition to EVs will need to be carefully managed in the context of electricity demand and storage. If EVs are primarily charged at peak evening times, they will add to baseload power demand, which may be fossil fuel-based (hence high in emissions). Alternatively, if EVs are charged during the daytime when solar PV electricity generation is occurring, then EV batteries could become part of the storage solution for renewable energy (Hildermeier et al., 2019)

5.2.1.3 Disposal

Disposal of the battery is the main point of difference between EVs and conventional vehicles. The large majority of EVs on India's roads are scooters with lead-acid batteries. Most (98 per cent) of lead-acid batteries are recycled globally given the high value of lead and its ease of recovery from used batteries (Gupt & Sahay, 2015). In India, around 50 per cent of recycling is done in "backyard" recycling centres without any pollution or toxicity control (Meyer, 2014).

Fewer than 5 per cent of lithium-ion batteries are recycled at their end of life (Church & Wuennenberg, 2019). Lithium-ion battery recycling processes on the market today do not recover the lithium, and instead tend to retrieve only the cobalt or nickel therein. Many actors do not deem lithium recovery economically viable. However, this field is changing quickly, with a combination of demand for minerals and evolving recycling technology driving rapid developments (Gupta, 2019). The appropriate recycling of batteries and other materials will have a major impact on the resource-intensiveness and toxicity associated with EVs and conventional vehicles. As for any industry, setting and enforcing strong standards will prevent negative impacts.

5.2.2 Energy Security and Fostering Local Manufacturing

An increased share of EV in the transport mix will reduce dependence on imported crude oil. However, the reduction in fuel prices with tax exemptions has an opposite effect, as motorists receive price signals to continue using fuel and, more importantly, a message that the government intends to intervene when international oil prices escalate.

Fostering local manufacturing through incentives for domestic production will attract jobs and investment. However, protectionist measures (such as high import tariffs on items also produced domestically) shut out the option of local manufacturers and consumers benefiting from cheaper EV components and vehicles.

The FAME program primarily provides direct subsidies on the purchase of EVs. China—the world leader in manufacturing and sales of EVs—followed a similar approach until recently, when it switched to a system requiring all major manufacturers to produce a quota of "new-energy vehicles," with tradable credits awarded for low-emission vehicle production (Box 2).

BOX 2. ELECTRIC VEHICLES IN CHINA: SHIFTING COSTS FROM THE GOVERNMENT TO INDUSTRY

Electric vehicles have been aggressively promoted in China resulting in over 1 million units sold in 2018, and year-on-year growth of 83 per cent (McDonald, 2019). Chinese central and local governments have provided generous incentives for private EV buyers. In 2017, central and district subsidies totalled between CNY 30,000 (USD 4,450) to CNY 66,000 (USD 9,790) (Zheng et al., 2018). For example, this could be around 30 per cent of the purchase price of the vehicle.*

Between 2009 and 2017, an estimated USD 60 billion was given to consumers and producers from the national and state governments making EVs cheaper than conventional vehicles in some cases (Torrey, 2019). There was no cap on total subsidy expenditure. At an average subsidy of around USD 10,000 per vehicle and sales of 0.77 million units in 2017, the subsidy expenditure of central and local totalled approximately USD 7.7 billion in 2017 alone (Perkowski, 2018).

Other pro-EV policies, such as guaranteed vehicle registration (as opposed to entering a lottery for a licence with a conventional vehicle), also helped enhance EV sales in the country. Electric buses have been strongly promoted, with sales in China increasing from around 1,000 in 2011 to 130,000 units in 2016. In 2018, around 99 per cent of the world's 3.5 million electric buses were in China (Perkowski, 2018).

In March 2019 the government implemented a major scale-back on subsidies across EV categories to encourage manufacturers to rely on higher quality and innovation to increase sales rather than government support. Subsidies for pure battery electric cars were halved (see table). Subsidies for vehicles with driving ranges of less than 250km were stopped altogether (McDonald, 2019). The total reduction in subsidies, when fully implemented by June 26, is estimated to be around 67 per cent (Bloomberg News, 2018).

Table 12. Changes in China's subsidies for EV from June 2019

	Driving range (km)				
Year	**100-150**	**150-250**	**250-300**	**300-400**	**>400**
2018**	CNY 30,000 (USD4,450)	CNY 54,000 (USD 8,000)	CNY 66,000 (USD 9,790)		
From June 2019	none	none	CNY 18,000	CNY 18,000 (USD 2,670)	CNY 25,000 (USD 3,710)

*Notes: **Subsidies for 2018 are central and local government subsidies (based on subsidies offered by Beijing, Shanghai, Guangzhou and Shenzhen); exchange rate: 1 CNY = USD 0.1483 (average interbank rate January to May 2019 from Oanda.com)*

Sources: Zheng et al., 2018.

The government intends to eliminate direct subsidies by 2020. To replace them, it is phasing in a tradable credit system that requires all major manufacturers (producing more than 30,000 vehicles) to obtain a new-energy vehicle (NEV) credit equivalent to 10 per cent of their vehicle output in 2019. This can be achieved by manufacturing NEVs or buying credits from other automakers. The credit is accorded to the green credentials of a vehicle and with a range of two to six credits (McDonald, 2019b). Automakers not meeting the credit quota would face penalties and sanctions such as production halts or no approval of new models. The quota would be increased to 12 per cent in 2020 (Bloomberg News, 2018).

The aim of the policy is to attract manufacturers of highly efficient and low-emission vehicles to China, which will get full credits for their vehicles and can sell surpluses to other manufacturers (McDonald, 2019). The policy also shifts the burden of subsidizing innovative new vehicles from the government to industry. In so doing, it represents a "swap" of resources: a charge that is spread across the costs of conventional vehicles is being used to help fund the cost of subsidizing EV production. The reduction in subsidy levels is also expected to impact weak players and result in a consolidation of the industry. The scale-back of support for manufacturers and consumers is also a reaction to companies claiming credits and subsidies fraudulently (Dunne, 2019).

The new policy also encourages local governments to cut back on subsidies and instead to invest in charging infrastructure. Limited infrastructure and charging stations pose a challenge to the EV market in China presently.

*Notes: *Based on the price of a BYD e5 (an all-electric car) of CNY 220,650 with a 400km range car prices: (Pontes, 2019); Exchange rate based on January–May 2019 interbank rate at Oanda.com*

6. Conclusions and Recommendations

Central and state government programs to incentivize the transition to EVs are being undermined by continued government intervention in fuel pricing. The reduction in excise and OMC margin reductions over nine months eclipsed the FAME II allocation over three years (INR 26,957 crore in foregone revenue and market price support on fuel compared to INR 10,000 crore for FAME II).

The excise reductions alone resulted in foregone revenue of INR 16,174 crore (USD 2.3 billion). If the government had instead directed these funds to FAME II, it could have almost tripled the number of EVs and charging stations supported over the next three years. Such a policy would have led to permanent reductions in India's dependency on imported oil and improvements in air quality. Reducing the fuel price, on the other hand, entrenches the use of petrol and diesel by reassuring consumers that the government will intervene to protect petroleum-dependent technologies from high international oil prices.

EVs can already reduce the level of toxic air pollutants compared to conventional vehicles and, importantly, the source of these emissions is shifted away from urban streets. The positive impact of EVs on air quality will become greater as India continues its transition toward an electricity mix powered by renewable energy. Policies are needed to maximize these benefits, including pricing policies that promote EV charging during times when renewable electricity is being generated. In addition, electricity distribution companies need to be supported in strengthening the grid to accommodate a growing supply of renewable sources and growing demand from EVs.

Funds from fossil fuel subsidy reform and taxation can be used in part to accelerate the clean energy transformation. Switching support from fossil fuels to less-polluting alternatives is a powerful financial tool: it harnesses existing resources, halts their role in exacerbating pollution and instead directs them to clean energy solutions (Box 3). Increasing renewable electricity capacity will have a double benefit: fewer coal-based emissions and improved environmental outcomes for India's EVs. Funds from fossil fuel subsidy reform should also be reallocated to adopt better technology on storage, which will improve the capacity of the grid to utilize renewable energy.

BOX 3. FOSSIL FUEL TO RENEWABLE SUBSIDY SWAPS

The swap concept is simple. It refers to redirecting government support from fossil fuels to clean energy. This does not need to involve explicit earmarking (or "hypothecation") of funds: savings from fossil fuel subsidies and spending on renewables could happen independently in the government budget. The core concept of a clean energy swap is that it accelerates the replacement of fossil fuel-based energy systems with sustainable energy through a shift in government priorities as expressed through funding or regulatory changes.

The two key elements are that 1) fossil fuel subsidies are reduced and that 2) this happens alongside measures that increase the deployment of sustainable energy.

Therefore, a renewable energy swap would reallocate finances away from petrol and diesel, toward clean energy and transport technologies.

Further budgetary funds could be liberated by considering revenue-neutral options to subsidize low-emission vehicles. China's new regime of tradable credits for compulsory "new-energy vehicle" manufacturing may not be appropriate for India at this stage, given India's conventional and EV industry are not as advanced as China's.

A "feebate" option may be more feasible, as proposed by government think tank NITI Aayog (NITI Aayog & Rocky Mountain Institute, 2017). A feebate is a policy that imposes fees on inefficient or polluting vehicles while efficient ones receive a rebate (effectively a cross subsidy). Austria, Denmark, France, the Netherlands, Norway, Ontario (Canada), and Singapore have introduced variations of feebates. Its advantages include its market-based design; its potential to be revenue-neutral, size-neutral and technology-neutral. Feebates drive continuous improvement and innovation. Alternatively, a cess could be imposed on diesel cars to accelerate deployment of EVs.

Policy Recommendations

- In the future, resist intervening in fuel pricing including through tax cuts for petrol and diesel.
- Instead, allocate revenue from fuel excise and cess to programs that support India's energy transition, improve air quality and reduce oil dependence.
- Increase the pace of reform in the electricity sector—including decarbonization, enforcing emissions standards and reducing losses from transmission and distribution—so that EVs deliver greater overall benefits for air quality and greenhouse gas emissions.
- Introduce pricing policies that encourage EV charging during times when renewable generation is occurring and support electricity distribution companies to strengthen the grid to facilitate increasing renewable energy and demand from EVs.
- Consider transitioning from FAME to a revenue-neutral, technology-neutral support measure that will foster ongoing innovation.

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