

## Climate Change Targets: Implications Of Indian Urban Transport Policies

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### Abstract

*Climate change is a growing challenge for all nations and the transport sector largely contributes to emissions directly impacting it and making it imperative to ensure considerable changes and improvements within the sector to ensure that the Sustainable development goals are met. The need of the hour is to encourage low-carbon land based transport and at the same time evaluate and ensure policies to facilitate the same. India, being signatory to the 1.5 degree Paris Agreement, needs policy level synchronization to achieve these targets. This paper examines the implications of the Urban Transport related policies in India in force since the Paris Agreement in achieving this goal. A Multi-impact integrated framework called A-S-I (Avoid-Shift-Improve) is used to examine these policies and evaluate their benefits against desired outputs. The findings reflect that the potential of the policies in meeting the targets is slim as they fail to largely address the key elements within their policy package. Further, the recent policies despite being a move towards electric transport, are largely focused at private transport that goes against the very agenda of moving people and not vehicles. Recent roll back on schemes that facilitated public transport provision have been a move backward from the intentions desired. Conscious efforts within the Indian transport policies with a view to overcome the barriers to low-carbon land transport, encouraging schemes and programmes promoting public transport and a comprehensive approach with a combination of measures are required to align it with its climate targets.*

**Keywords:** climate, transport policies, urban transport.

### Introduction

Transportation accounts for 26% of global CO<sub>2</sub> emissions and is one of the few sectors where emissions continue to grow with transport-related emissions expected to increase 57% worldwide by 2030. Transport sector also accounts for 23% of the greenhouse gases related to energy as per the International Energy Agency (IEA, 2013). Much of transportation related emissions are estimated to be from urban transport as urban travel is largely oil based and automobile dependent as indicated by Sims et al. (2014). Urban transport emissions have gained significant attention of climate change professionals, politicians and the community as it is associated directly with public health issues and with larger economic costs and productivity of cities, resulting in slowing down of economic growth and human capital (Tol, 2018). At the same time, there is a constant pressure for economizing fuel to enhance economic productivity (Greene, 2009). Growth in urbanization in the next three decades highlights the critical role of urban transportation in achieving climate change goals (Mehrotra et al, 2011). The Paris Agreement (2016) aims to pursue efforts to limit the temperature increase to 1.5 °C to substantially reduce the risks and impacts of climate change and indicates the fundamental change needed in all urban transport systems to halt and reverse the urban transportation related emissions through electrification of all land-based passenger transport and by decarbonizing electric power.

India is committed to enhance its existing policies and launch new initiatives to reduce urban transport emissions and implement climate resilient infrastructure reflected necessary action as stated in it's Independent National Determined Contributions (INDC's) submitted to the United Nations Framework Convention on Climate Change (UNFCCC). In this submission India has listed its existing and past federal (Government of India) policies and schemes related to urban transport – National Urban Transport Policy (NUTP), Smart Cities Mission, Jawaharlal Nehru National Urban Renewal

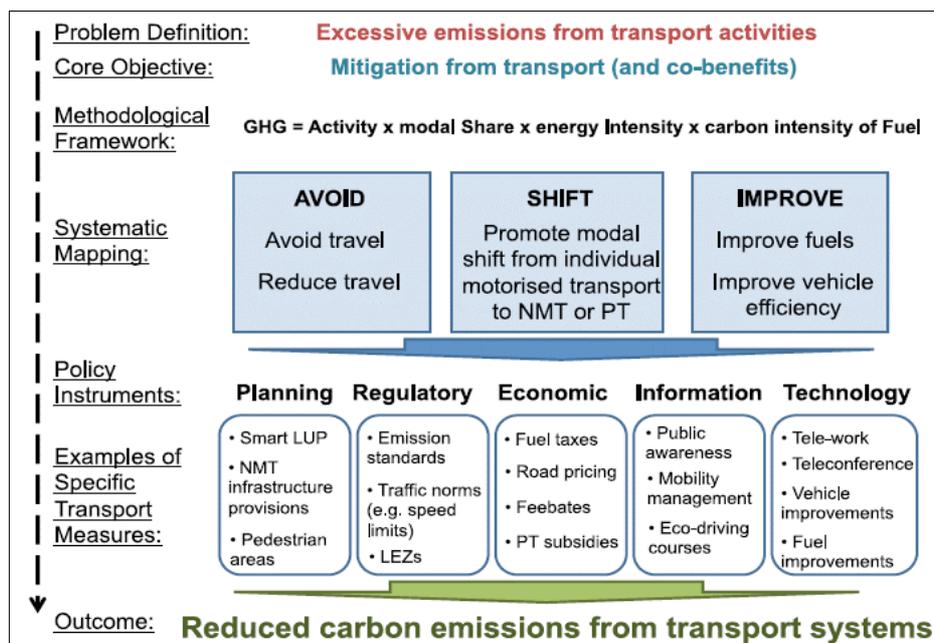
Mission (JnNURM), Atal Mission for Rejuvenation and Urban Transformation (AMRUT) and federally funded urban rail (metro) projects-to help achieve the climate change targets. This paper investigates these urban transport policies and schemes of Government of India (GoI) to assess if these will help achieve India’s INDC’s and the 1.5°C target. The scope of this paper is limited to the GoI policies and schemes and doesn’t include individual state or cities policies and schemes. In addition to the listed policies and schemes in India’s INDC the paper also reviews the Metro Policy, National Transit Orient Development (ToD) policy and Faster Adoption and Manufacturing of (Hybrid) & Electric Vehicles (FAME) schemes of GoI along with its recent Bharat Standard VI (BS 6) intervention for vehicular emissions.

### Methodology

The 1.5°C target provides the overall vision to the urban transport sector to be achieved through various low carbon urban transport strategies. These strategies in the paper are evaluated through the ‘Avoid- Shift- Improve’ (ASI) framework (Dalkmann, H. and Brannigan, C., 2007) that indicates three primary pathways to achieve low carbon urban transport:

- *Avoid* strategies that seek to reduce the need to travel and the trip length by improving the overall efficiency of the transport system and improving land use planning.
- *Shift* strategies seek to improve trip efficiency by promoting modal shift from the most energy consuming urban transport mode (i.e. cars/two wheelers) towards sustainable and low-carbon modes.
- *Improve* strategies focuses on improving vehicle fuel efficiency, low-carbon fuels and energy carriers as well as on the optimization of transport infrastructure.

The ASI strategies would help improve mobility and accessibility in cities and simultaneously achieve the climate change agenda as it is based on the foundation of ASIF (Activity-mode share-fuel efficiency-fuel intensity-fuel type) that includes technology, planning, policy and behaviour components. The ASIF approach summarizes a detailed set of data and estimates used in transport planning and analysis, as well as in traffic control and management. This implies a combination of policies and measures that avoid emissions, shift to less carbon intensive transport modes, and improve the fuel efficiency of vehicles as depicted in Figure 1.



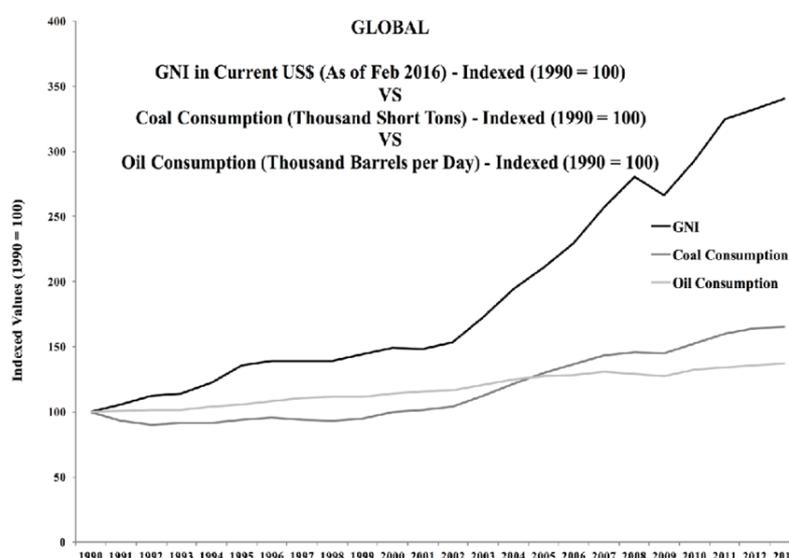
Source: Dalkmann, H. and Brannigan, C., 2007.

**Figure 1. ASI Framework with Strategies and Instruments to Reduce Carbon from Transport**

The paper critically examines the GoI policies and schemes related to transport on the basis of the ASI framework and the 1.5°C agenda of complete electrification of urban transport and decarbonizing through electric power.

### Paris Agreement and Decoupling

India as a signatory to the Paris Agreement has declared in its Independent National Determined Contributions (INDCs) a reduction of 33-35% in its total CO<sub>2</sub> emission by the year 2030 as compared to its 2005 level. The commitment is to reduce emissions primarily by adopting clean energy to reduce 40% fossil-based electricity generation and increase green cover to reduce 2.5–3 billion tonnes of CO<sub>2</sub> emissions. This aim requires India and other countries to decouple economic growth from use of fossil fuels, an area that is also at the heart of the global climate change agenda. The decoupling process is underway with global data demonstrating relative as well as absolute decoupling (Figure 2). Denmark leads the developed world along with most European nations followed by America and Australia. Due to their sheer size and leadership in the emerging world, decoupling in China and India are the key foci for global policy because a lapse in their performance would make the achievement of Paris Agreement target impossible. However decoupling in India is less obvious though demonstrating potential to go the absolute way (Newman, Beatley & Boyer, 2017; Sharma, 2018).



Source: Graphic by Newman (2017) based on data sourced from the WBG and EIA

**Figure 2. Global Decoupling of wealth from Coal and Oil**

### Role of Government of India–Urban Transport Policies

The statutory authorities for urban development/ land use/ urban transport in India are Local Government Bodies and State Governments as defined by the Constitution of India, except projects related to ‘rail’ and ‘water’ in cities which are under GoI legislative realm as directed by the Ministry of Housing and Urban Affairs (MoHUA), GoI formerly also known as the Ministry of Urban Development (MoUD). This legislative framework limits the statutory role of GoI on urban transport. In the last decade the GoI has issued various policies and implemented schemes to improve urban transport. The MoHUA is the federal authority in India to formulate, implement and monitor such policies and schemes. The MoHUA also support various external assistance programmers for urban transport such as of the World Bank, the European Union and others. Through these initiatives the MoHUA provide funding for planning and implementation of urban transport projects. The MoHUA links these funding with predefined guidelines and legislative urban reforms that cities/sates must achieve to receive funds.

In theory this financial assistance acts as a ‘soft power’ to allure cities and states to implement urban reforms and improve cities aligned with federal government agenda which includes INDC’s. This is

how GoI can target reduction of emission in urban transport to help it contribute to achieve climate change agenda. The next section critically examines the MoHUA policies and schemes under the ASI framework.

### ***Jawaharlal Nehru National Urban Renewal Mission, 2005***

Jawaharlal Nehru National Urban Renewal Mission (JnNURM, 2005) was the first scheme of GoI covering major aspects of urban development with larger scope and budget than any other previous scheme. This scheme was implemented in 2005 for seven years initially but was extended till 2014. The major objective of the JnNURM was to create ‘economically productive, efficient, equitable and responsive cities’. Under JnNURM, GoI provided financial assistance for procurement of buses, in two phases, for improvement of public transport system as indicated in Table 1.

**Table 1. Outlay under JnNURM**

<b>Outlay Component</b>	<b>Amount in Rupees</b>
Phase I (2008-2010) 15485 buses to 61 cities	1547 Cr. for improvement of bus services
Phase II (2013-2014) 7509 buses to 114 cities/city clusters,	1236 Cr , 61.27 Cr for ancillary infra like Depot, workshops, etc
BRTS in 11 cities	2251 to 620 km of BRTS, 250 kms operational
Funding for Roads & Flyovers	2327 Cr
Urban Renewal	97.65 Cr
Development of Parking in Cities	103.36 Cr

Source: MoUD, GoI

Cities have benefited from the scheme and over 9 lakh passengers use the bus service daily in each of these cities. About 20% of these users are estimated to have shifted from cars, two wheelers to intermediate public transport and Non Motorised Transit (NMT). This “shift” was more pronounced in metro cities and hill cities where the travel distances are longer and commuters could “Avoid” long travel times. The specifications were also extended to Bus Rapid Transit System (BRTS) buses, as it had become a popular system among the Indian cities. All these projects have been conceived with pedestrian and NMT facilities as an integral part of the system and have been incorporated in the design of streets where BRTS is/ has been implemented with toolkits developed with assistance of Asian Development Bank (ADB). The cross sections also include provision of pedestrian pathways and cycle tracks for safe movement of pedestrians and NMT. Cities such as Ahmedabad has implemented high density zones and mixed land use development across the BRT corridor to help ‘avoid’ travel and ‘shift’ to BRT.

The objective of GoI has been to increase the supply of public transport through funding urban buses and ‘improving’ the quality of bus service that has also contributed in reducing overall urban transport emission. In its efforts to push the reforms agenda and delivery of urban infrastructure, MoHUA revisited the Urban Bus Specifications to help cities procure and run modern city buses to improve the problems associated with congestion, poor safety measures and pollution in the existing public transport services in urban agglomerates and to provide a safer and comfortable transit for the road users. The buses sanctioned for BRTS projects and in the two phases of Bus Funding Scheme were all procured based on improved vehicle specification that ‘improved’ the vehicle emissions and may have contributed in reducing overall urban transport emission.

GoI financial assistance on building transport infrastructure to facilitate private car movement is much higher than for Bus Funding Schemes. These may have reduced the travel time in the short-term but would contribute in increasing urban transport emissions in a longer-term and automobile dependence. Further, the funded road projects don’t include any ‘shared street’ projects which have shown to reduce the private vehicle use and increase active mode share and safety. Under JnNURM funds released for urban renewal projects is significantly lower as compared to roads/ flyover or even parking. Urban renewal projects have shown that they can help in improving urban fabric and creating walking city fabric. This is misappropriation of fund allocations when compared with INDC

commitment and would help only in increasing automobile dependence in Indian cities and increasing transport emissions. However, the contribution of JnNURM scheme has been high in starting the discourse on urban transport importance in Indian cities and significance of bus based organized public transport, especially as bus funding programs were relaunched after two decades.

### ***Smart City Mission, 2015***

Smart City Mission (2015) with a coverage of 100 cities succeeded JnNURM with an objective to improve cities and to provide a decent quality of life to its citizens; provide a clean, safe and sustainable environment and application of ‘Smart’ Solutions. The focus is on sustainable and inclusive development and with compact areas, and to create a replicable model that would act as a pilot for other aspiring cities. One of the core urban infrastructure elements identified as part of the smart cities are efficient urban mobility and public transport, with focus on smart parking, intelligent traffic management and integrated multimodal transport. The scheme envisages comprehensive development in cities-creating walkable localities and promoting a variety of transport options including Transit Oriented Development (TOD), public transport and last mile para-transport connectivity. However, these objectives don’t reflect in the fund allocation of the scheme as shown in Table 2.

**Table 2. Transport related fund allocation share in Smart Cities Mission**

<b>Project Type</b>	<b>Percentage</b>
Total Central and State Government funding	\$ 14.9 billion
Total outlay for Mobility projects	\$1.78 billion (100%)
Road infrastructure (roads, junctions, flyovers, overbridges, etc)	31%
Parking	15%
Intelligent transport system (traffic management, smart card, etc)	14%
NMT and Pedestrian infrastructure (Foot over bridges, skywalks, etc)	8%
Transit & Transit infrastructure (BRT, bus, terminals, depot, etc)	26%
Others (any sub category can be included if major)	6%

Source: Ministry of Urban Development, GoI

The installation of ITS infrastructure would primarily facilitate the private vehicle use and may help in ‘improving’ the overall efficiency of urban transport and safety for active modes. It does not actively speak of Avoid strategies neither shifting strategies that could facilitate the Achievement of climate goals. Furthermore, the status of accomplishment of Smart Cities mission is rather ambiguous as the scheme indicates an inclination towards IT and ITes Services.

Table 2 indicates that the scheme has not contributed largely to reduce emissions as the road infrastructure has the largest share (31%) and active transport has the lowest (8%) share, even lower than parking (15%). There is significantly lower funding for NMT and Pedestrian infrastructure. The National Urban Transport Policy (NUTP) (2006) that emphasizes on ‘moving people not vehicles’ is not reflected through this fund allocation and the scheme indicated a poorer allocation of funds than the JnNURM scheme. This also shows the lack of continuation of schemes and vision of GoI that may impact climate change agenda adversely. There are no specific funds allocated to implement urban reforms to support low carbon urban transport. The combined funding of road transport, parking and ITS is 60% which is disproportionately higher than the private vehicle mode share of 21% in Indian cities. Such allocation is not inclined with India’s INDC’s and raises significant equity issues. It appears that smart cities are for ‘cars’ or possibly for the ‘automobile/ IT sector’ rather than for ‘people’ as signified from its funding allocation.

### ***Atal Mission for Rejuvenation and Urban Transformation (AMRUT), 2015***

AMRUT scheme launched in 2015 had the objective to provide basic services (e.g. water supply, sewerage) to households and build amenities in cities to improve the quality of life for all, especially the poor and the disadvantaged. It covered about 500 towns and cities across the country. The scheme

identifies development of pedestrian, non- motorized and public transport facilities with 1436 Cr (0.03%) allotted for the same but not as a main objective. The AMRUT schemes may help in ‘avoiding’ trips in the future as it is an urban rejuvenation scheme which can build mixed land use neighborhoods and walking urban form and could also help in ‘shifting’ of private vehicle use and increase walking and cycling as it has funding for active modes and placemaking in cities.

### ***National Transit Oriented Development (ToD) Policy, 2017***

The Ministry of Housing and Urban Affairs notified the National Transit Oriented Development (ToD) Policy in 2017 with the objective to integrate land use and transport planning to develop compact growth centers within the walking distance of transit stations. The policy is primarily a guidance document on ToD and is not mandatory for cities and states to implement it. The ToD policy has three-fold vision to ‘enable transformation’ in cities away from automobile dependence; provide active transport access to Public Transport; and build Compact Walkable Communities. All three visions are significantly inclined with existing requirements of Indian cities to enable low carbon transport and help achieve climate change agenda. The policy defines 12 Guiding Principles and 9 Supportive tools which include Multimodal Integration, Complete Street, First and Last Mile Connectivity, NMT Network, Traffic calming and Informal Sector Integration, Universal Accessibility, Safety and Security. The policy proposes mandatory minimum 30% affordable housing, installation of renewable energy and adoption sustainable habitat practice in the ToD influence zone. These measures can all contribute in achieving Sustainable Development Goal 11 of the Paris Agreement.

The policy is largely silent on infrastructure for electric mobility and intermediate public transport as first/last mile connectivity options that is now transforming electric in Indian cities, low carbon and increasing becoming a key mode to access transit such as Delhi Metro. This electric infrastructure would need to be integrated within urban planning and transport components of ToD; this integration can lead to ‘improved’/ ‘decarbonization’ of vehicles. Overall the ToD policy is a brief document that discusses key aspects required to ‘avoid’ travel and ‘shift’ to low carbon intensive modes. However, the policy may face critical issues in implementation as no detailed plan is provided for its implementation. If ToD policy is implemented it may help development station precinct that promote low carbon transport and may have possibility to be carbon positive.

### ***Metro Rail Policy, 2017***

MoHUA, GoI under Metro Rail policy from 2017 and has prepared ‘Appraisal Guidelines for Metro Rail Project Proposals, 2017’ to assess metro projects. The policy advocates the need for a Systems Approach in design of the project and stresses on provision of universally accessible infrastructure for integration of various modes of transport, last mile connectivity through pedestrian footpaths and NMT infrastructure. The Appraisal Guidelines for Metro Rail Project Proposals is comprehensive document and addresses all strategies of ASI and climate changes. It mandates State/Cities Governments to prepare Comprehensive Mobility Plan (CMP), alternatives analysis report and detailed project report. These reports will include analysis of technology transitions under a low carbon scenario, CO<sub>2</sub> emissions and air quality that are important indicators to measure in relevance to this article. The guidelines provide a framework for economic cost benefit analysis, which involves estimation of reduction in number of accidents due to lower number congestion levels and shift to the proposed system.

The policy has made private participation mandatory for availing funds and proposals for feeder systems, non-motorized transport infrastructure and para transport facilities that would enable to enlarge the catchment area of metro stations to around 5 km. The policy includes alternatives analyses for public transport options; spatial pattern, high population, with adequate density to justify investments in a metro; demand projections over the project life cycle and cost effective- 30 years horizon. Currently 425 km of metro rail systems are operational in 10 metro cities with approximately 700 km of metro under construction. This is a good proposal for “Avoid” by reducing travel, ‘shift’ of people from private vehicles and “Improve” with solar energy use on in the metro project which helps

reduction of emission at the system level. For example, the Delhi Metro started in 2002 and thus had negligible solar panels then but now meets 80% of its daytime energy from solar (Energy World, 2017; Sood & Bhaskar, 2017). Metro rail is a long term capital-intensive project which require integration of mode and land use to realize its benefits and needs careful planning and implementation of the project ridership as projected for most metros indicate a negative trend with some metros like Jaipur Lucknow, Chennai and Kochi having a ridership deficit of more than 1,000%. This ridership pattern may not help in reducing emissions. The Metro Rail Policy, 2017 is one of few policies of GoI where it has statutory powers to govern the infrastructure in cities. The GoI seems to have recognized their limited role and has significantly increased its share of funds for metro projects and reduced their funding for other modes as evident in table 3.

**Table 3. Investment of GoI in metro projects (2009-2017)**

Budget component (INR, Cr)	2009	2010	2011	2012	2013	2014	2015	2016	2017
MoUDBudget*	6077	6547	6858	6563	7297	11013	18419	32550	34212
GoI Investment in Metro Projects	4212	5025	4212	4955	5458	6016	11937	19172	18366
Total investment of in Metro Project as compared to Department of Urban Development, GoI budget (%)	12%	46%	23%	15%	16%	55%	65%	59%	54%

Note: \* This includes all the expenses and budgetary allocations of Ministry of Housing and Urban Development, GoI including administrative.

Source: <https://openbudgetsindia.org/dataset>

This is a policy shift from JnNURM funding scheme of the previous government at Center that involved more holistic approach of funding of urban transport project. The significant fund allocation to metro project may create stranded assets in cities if the existing ridership pattern exists for a coming decade. The GoI may need to implement schemes to incentivize and enable large ToD project in existing metro to help increase their ridership and formulate other strategies on urgent basis if it wants to halt the huge loss to exchequer. In lieu of above, there is a need to review GoI funding allocation for transit systems to achieve overall climate change goals.

### ***National Urban Transport Policy (NUTP), 2006 & 2014***

The NUTP, 2016 was a first step from the GoI to target and improve urban transport. The policy was framed with a focus on ‘moving people rather than vehicles’ to address urban transport issues of equity, safety and sustainability. It provided a base for MoHUA to provide funding for urban mobility plan’s, capacity building, promoting active transport and urban transport projects specifically public transport. The main objective of the policy may not have been the reduction in emissions and was possibility of how to meet the significant debt of urban transport infrastructure in Indian cities.

This policy was revised was issued in 2014. The revised policy includes detailed sections on ‘Use of Clean Fuel and Clean Vehicle Technology’ which is critical to achieve India’s INDC’s. Further the policy includes comprehensive list of ASI methods that may help in reducing emissions.

The NUTP policy is a strong top down approach with no legal obligation to cities and states to follow the policy recommendations. The main objective of ‘moving people and vehicle’ has failed as the growth of the vehicles in India has been highest in the last decade. The policy discourses on integrated transport and land use as a critical strategy to reduce emissions but the GoI has failed to influence such schemes in Indian cities. The policy lists number of public transport technologies with its characteristics without any qualitative and quantitative relevance to diverse Indian cities and their transport geography and ethnography. The policy mentions of the Service Level Benchmarking (SLB) toolkit of the GoI to assess the existing urban transport scenario and identify gaps and problems in

service levels. The SLB toolkit has comprehensive list of urban transport indicators that includes number of 'avoid' and 'shift' strategies that can help cities to reduce emission. Like other policies, these documents are only recommendatory in nature and the responsibility of adopting of the same for implementation lies with the state or the ULBs.

The revision of CMP, 2008 in 2014 was a significant step in relevance to low carbon mobility and other urban transport aspects. The revision was based on a critical review of CMP, 2008 which revealed significant gaps within the guidelines and CMP's relevance to cities. The revised guidelines were based on the National Mission on Sustainable Habitat that was part of National Action Plan on Climate Change of GoI. This base provided inclusion of GHG emissions in CMP as a key critical component and urban planning techniques, increased modal shift in public transport and non-motorized transport were to achieve reduction in CO<sub>2</sub> emissions. These all are important aspects of climate change agenda and "ASI" strategies.

### ***FAME (Faster Adoption and Manufacturing of (Hybrid) & Electric Vehicles)-I, 2011***

With the objective to achieve national fuel security and promote Electric Vehicles (EVs) in India, Government of India approved the national mission on electric Mobility in 2011 and subsequently NEMMP 2020 in 2013 with a sales target of 6-7 million hybrid and electric vehicles year-on-year from 2020 onwards with a the vision to become a 100% electric vehicle nation by 2030 with a scheme FAME –INDIA till 2020, wherein it was intended to support the hybrid /electric vehicle market development and its manufacturing eco system to achieve self-sustenance. Phase 1 (2015-17, Rs 795 Cr) was planned as Pilot project launched from 1<sup>st</sup> April 2015 with a focus on four areas i.e. Technology Development, Demand Creation, Pilot projects and Charging Infrastructure.

Under the scheme the GoI has been offering incentives on electric and hybrid vehicles of upto Rs 29,000 for bikes and Rs 1.38 lakhs for cars. About 2,17,000 hybrid/electric vehicles (xEVs) have been given direct support by way of demand incentives till July, 2018 from the launch of the scheme. The scheme claimed to save approximately 3.0 million litres of fuel (48,000 litres per day) and 75 million-kg of CO<sub>2</sub> reduction so far. The overall goal will be a very ambitious task if the current trend of growth of electric vehicles is considered as the annual allocated budget also remained underutilized throughout the scheme duration.

The demand incentive was available to all types of hybrid and electric two, three and four wheelers. However, most of the scheme fund went into incentivizing the two wheelers and passenger cars. During the first year of the scheme, of the funds disbursed 60% of the incentives and 63% (33,394 out of 52931 units) by number of units were availed by "mild hybrid electric vehicles" with only two passenger car models eligible under the demand incentive. The subsidy tended to favour two diesels based mild hybrid passenger cars manufactured by a single manufacturer. In addition, mild hybrids are not as effective in reduction of fuel consumption over their base diesel/ petrol models as strong hybrids. By providing subsidy to mild electric vehicles under the scheme, the intention of the government to speed up adoption of electric vehicles has not been fulfilled. However, later on incentive for mild hybrid vehicles was withdrawn.

The National Electric Mobility Mission plan also envisaged charging but the government allotted a meagre sums of Rs 10 crore (2015-16) and Rs 20 crore (2016-17) towards installing dedicated charging infrastructure for public buses. Interestingly, electric buses were not part of the demand incentives of FAME-I and remain excluded during most of the scheme duration. With a view of focusing on Public Transport, in September 2017, fully electric buses were also included as eligible categories under the demand incentive of FAME-I. The incentive was also aimed at promoting localization in the manufacturing of electric buses in India. As a result 11 cities got funding for 40 buses each under the pilot project making this inclusion very late and of a small scale.

FAME-I as a whole maintains focus on providing the demand incentive (subsidy) to the private two wheelers and cars. Providing subsidy for electric private vehicles will definitely help in reducing the local pollution but at the same time it will encourage private vehicle ownership which is against the

vision of other policy i.e. “National Urban Transport Policy” (NUTP) i.e. “*Moving People not Vehicles*”. Moreover, the support subsidy under FAME encourages vehicle ownership.

### **FAME II, 2015**

In continuation with FAME-I, The GoI announced the second phase till 2022 with an outlay of Rupees 10,000 crore to boost the number of EVs in India. An amount of Rs. 1,000 crore has been earmarked for setting up charging stations for electric vehicles in India. Additionally, Rupees 8,596 crore have been sanctioned for incentives for electric buses, three-wheelers and four-wheelers to be used for commercial purposes. Plug-in hybrid vehicles and those with a sizeable lithium-ion battery and electric motor will also be included in the scheme and fiscal support offered depending on the size of the battery. FAME II, though it focuses on public transport element as well, largely continues to promote private ridership.

### **A case of investing in e-buses**

As per the estimates, close to 30,000 buses operate in various cities in country as against the estimated requirement of 1.73 lakhs. This requirement will manifold due to the population increase by 2030. Majority of current bus fleet in urban areas is the result of 2009 and 2013 bus funding program under JnNURM. Before the scheme, funding for the buses by the Government of India was done more than two decades ago. Post JnNURM, no such funding mechanism exists with GoI to bridge the huge existing gap of public transport supply in urban India. All Central policies and schemes during the last three decades remains ignorant about the provision of public transport in urban areas barring some efforts during 2009 & 2013 which was meager considering the huge supply gap.

Moving forward, there are two choices for bridging the public transport supply gap in urban areas; 1) formulate the new policy/scheme for bridging the existing supply gap (mostly conventional fuel based) and later on replace them with EV, or 2) leapfrog the stage of conventional fuel by dovetailing the EV policy/scheme to achieve the dual objectives (and benefits too) of sustainable mobility combined with sustainable fuel.

Diesel buses, in terms of numbers may be in small percentage of the vehicles on city roads, but impact on environment is larger owing to low fuel efficiency and operated kms per day. Leapfrogging elimination of the diesel buses and opting electric offers a better alternative towards clean air. However, the shift is not easy as electric buses cost 2 to 4 times more upfront than conventional diesel buses with battery contributes more than half of the total cost. Further requirement of support charging infrastructure and replacement of battery during the life of the bus makes the overall cost of ownership further costlier. This combined with year on year decrease in battery prices, localization and other technology as well as procurement innovations will definitely narrow down the difference between the Total Cost of Ownership (TCO) of e-buses viz-a viz a conventional fuel bus (India’s Energy Storage Mission, NitiAyog and RMI, 2017).

### **Comparative Analysis of the Schemes on the ASI framework**

A comparative analysis of the various policies as discussed in the paper is made on the basis of the ASI framework as shown in table 4. The table analyses whether the aspects of the framework have been addressed in the particular scheme.

**Table 4. Comparison of Policies/Missions/Schemes of GoI on the ASI framework**

	<b>Name of Policy/ Mission/ Scheme Policies</b>	<b>Avoid</b>	<b>Shift</b>	<b>Improve</b>	<b>Remarks</b>
1	National Urban Transport Policy (NUTP), 2006 & 2014		✓		National level policies with success depending on schemes implemented
2	National Transit Oriented	✓	✓	✓	

	Development (ToD) Policy, 2017				
3	Metro Rail Policy, 2017	✓	✓	✓	
<b>Schemes</b>					
1	Jawaharlal Nehru National Urban Renewal Mission (2005-2014)	✓	✓	✓	Post-JnNURM, schemes only focus on improving transport and promoted private transport.
2	Smart City Mission (2015-2020)			✓	
3	Atal Mission for Rejuvenation & Urban Transformation(2015-2022)	✓	✓		
4	FAME-I (2015-2019)			✓	
5	FAME-II (2019-2022)			✓	

Source: Compiled by the authors

## Discussion and Conclusion

The analysis in this paper shows India has started relative decoupling of income and fossil fuel in the past decade that may change to an absolute decline in fossil fuels in coming years. Urban transport is likely to contribute to this decoupling. Indian cities urban fabric (inherently low in automobile dependence) may resist any high dependence on car use till a massive urban road scheme does not happen to destroy this urban fabric. In the last decade the GoI schemes and policies have been biased against active urban transport and have supported private vehicle use in cities. Though GoI has shown a progressive approach in a past decade through rapidly adopting and amending policies and schemes such as NUTP, CMP, TOD, and Metro Policy but since urban transport is the responsibility of State/ULBs and there is no statutory mandate to them to follow these policies, implementation remains poor so far.

Urban transport, being neglected for so long, JnNURM was the very first funding scheme for urban transport helped in implementation an organized public transport system in over 100 cities and provided funding for number of other modes including BRTS, NMT along with the funding for urban rail projects. So in a way, under JnNURM; array of transit options were available with cities to choose depending upon their size and topography. With the discontinuation of JnNURM, successive schemes are polarized towards only one mode (ie. Urban rail) which leaves a majority of the cities, especially small & medium size cities with no transit system. This necessitates an urgent need for a scheme covering all other transit options including NMT infrastructure.

On the other hand, it is evident from the discussion that the initial phase of FAME could not give desired result and it makes more sense to orient the next phase of the funding program for buses or shared transport systems. Moreover, by leapfrogging the diesel based transit system and bridging the public transport supply gap through electricity based, will help to early achieving the targets sets under INDC.

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