



Sustainable Transitions

Assessing the impact of electric mobility enterprises in India



Image: Vaishali Bhatia (MetroRide)



Executive Summary

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Over 550 start-ups in India are currently working across various aspects of the electric vehicle (EV) value chain, ranging from vehicle manufacturing and battery recycling to electric mobility services and EV financing. As leaders of this novel transition to e-mobility, enterprises must ensure that their products and services contribute to the sustainable development of the transport sector.

This sustainable transition requires a holistic outlook that acknowledges all socio-economic and environmental impacts of the value chain.

While the environmental benefits of EVs have been widely discussed, there has been inadequate attention paid to the potential social benefits of the e-mobility transition. This report presents a first-of-its-kind impact assessment framework tailored specifically for e-mobility enterprises, and enables the measurement and tracking of social, economic and environmental impacts of companies and the e-mobility sector. The framework, which is

based on the widely recognized Sustainable Development Goals (SDGs), aims to raise awareness on maximizing impacts beyond zero tailpipe emissions while also facilitating the creation of a uniform standard for socio-economic and environmental impacts within the sector. This assessment framework also provides e-mobility enterprises an opportunity to track and manage their impacts from an early stage of development, allowing a deeper integration of sustainable practices into their businesses.

Our impact assessment framework is a valuable tool for tracking, measuring and maximizing impact of early and later-stage start-ups. It is also a vital instrument for ESG and impact investing firms –helping them prioritize social and environmental impact besides financial viability and growth metrics. For the widespread adoption and mainstreaming of this framework, we encourage industry-level consultations and deployment of the framework in partnership with impact investors focusing on e-mobility enterprises.



Contents

1. Growth of Electric Mobility in India	3
2. The Rise of E-mobility Enterprises	5
3. Enabling a Sustainable E-mobility Transition	10
4. Impact Assessment Framework for E-mobility Enterprises	12
4.1. Framework for impact assessment	14
Who: Beneficiaries of e-mobility enterprises	15
What: The Sustainable Development Goals (SDGs) agenda	16
How: Impacts of e-mobility enterprises	17
How much: Indicators for measuring impact	20
4.2. Direct impacts of e-mobility enterprises	20
4.3. Indirect impacts of e-mobility enterprises	28
4.4. Deploying the Impact Assessment Framework	30
5. Integrating social impact with E-mobility business models	31
5.1. Case Study 1: Sheru	32
5.2. Case Study 2: Ziptrax	35
Endnotes	37
Annexure-1: SDG targets impacted by E-mobility enterprises	39

1 | Growth of Electric Mobility in India



Number of private motor vehicles in India is likely to triple by 2050



India has witnessed rapid motorization in the last two decades. Between 2001 and 2018, domestic sales of motor vehicles grew at a compounded annual growth rate (CAGR) of 9.6%.¹ This has led to fast-growing transport emissions, making transportation the third largest contributor to Greenhouse Gas (GHG) emissions in India. Road transport accounts for nearly 87% of total transport emissions² and is a significant contributor to localized air pollution.

Additionally, the transport sector is also among the largest consumers of crude oil in India. With India importing more than 85% of its oil demand,³ decarbonizing the transport sector can reduce its negative environmental externalities while improving the country's energy security.

Despite growing sales of private vehicles, motor vehicle ownership in India remains relatively low, at about 225 vehicles per 1,000 persons, including motorized two-wheelers (as of 2019).⁴

With the projected growth in India's GDP and per capita income, the number of private motor vehicles is expected to increase threefold by the year 2050.⁵ The number of cars per 1,000 persons is likely to grow even more rapidly, from 20 in 2014 to 175 in 2040.⁶

This offers India an opportunity to transition to a cleaner, more sustainable transport sector. The transition to electric vehicles (EVs), which are powered by electricity rather than fossil fuels and emit zero tailpipe emissions, is an important pathway for sustainable transport systems. Coupled with the Government of India's (GoI) push for increasing the share of renewable energy in the country's electricity generation,⁷ a transition to electric mobility will further catalyze decarbonization of the transport sector. Currently, the share of renewable sources in India's energy mix stands at 38.5%⁸ – which is poised to increase in tandem with rising EV charging demand that is estimated to breach 37 TWh by 2030.⁹

Spurred by conducive policies and increasing consumer awareness, the domestic electric mobility (e-mobility) industry has been growing rapidly in the last few years. Between 2017 and 2021, the number of EV registrations in India grew at a CAGR of 46.37%, while overall motor vehicle registrations grew at 8.38%. In absolute numbers, EV registrations in 2021 were up by 2.23 lakh vis-à-vis 2017.¹⁰ It is evident that despite the COVID-19 pandemic and the associated slowdown of the automobile industry, the e-mobility sector has shown significant growth. With the EV market expected to grow at a CAGR of 44% and EV battery storage at 32% between 2020 and 2027,¹¹ the e-mobility sector is poised to become an integral part of the Indian automotive industry.

Despite the pandemic-induced economic slowdown, the e-mobility sector has shown significant growth



FIGURE 1: Annual electric and motor vehicle registrations in India

Source: Vahan Database, Ministry of Road Transport and Highways

2 | The Rise of E-mobility Enterprises



Hero Electric, Okinawa, Ather Energy and Ampere collectively account for nearly 80% of all e-2W sales in India



Electric mobility represents a disruption in the traditional automotive sector. Innovation and activity in the e-mobility sector have been led by e-mobility start-ups unencumbered by internal combustion engine (ICE) vehicle businesses, while the established automotive original equipment manufacturers (OEMs) have been sluggish in transitioning to EVs.

In the electric two-wheeler (e-2W) segment, which accounts for nearly 97% of all EV sales in India,¹² start-ups like Hero Electric, Okinawa, Ather Energy and Ampere have a market share of more than 80%.¹³

Globally, Tesla, an e-mobility start-up launched in 2010, dominates the electric four-wheeler (e-4W) market with a share of 21% in the first three quarters of 2021, ahead of auto giants like SAIC, the Volkswagen Group and Hyundai.¹⁴

As EV adoption gathers pace in India, a growing number of start-ups are actively supporting the e-mobility transition. As of mid-2021, there were more than 550 start-ups working on various aspects of the EV value chain.¹⁵ Key areas of start-up activity in the e-mobility ecosystem include auto manufacturing, EV charging, passenger transport services, battery solutions, EV financing, vehicle conversion kits and urban logistics. Figure 2 highlights the main sub-sectors along with the share of start-ups in each sub-sector.

Within these broad areas, start-ups have been providing either one specialized solution (for instance, battery swapping) or a set of different solutions like charging infrastructure and charging network services simultaneously. Some start-ups also operate in more than one sub-sector. For instance, a battery recycling firm can also provide battery swapping services using recycled batteries.



Currently, there are over 550 start-ups operating in the EV value chain

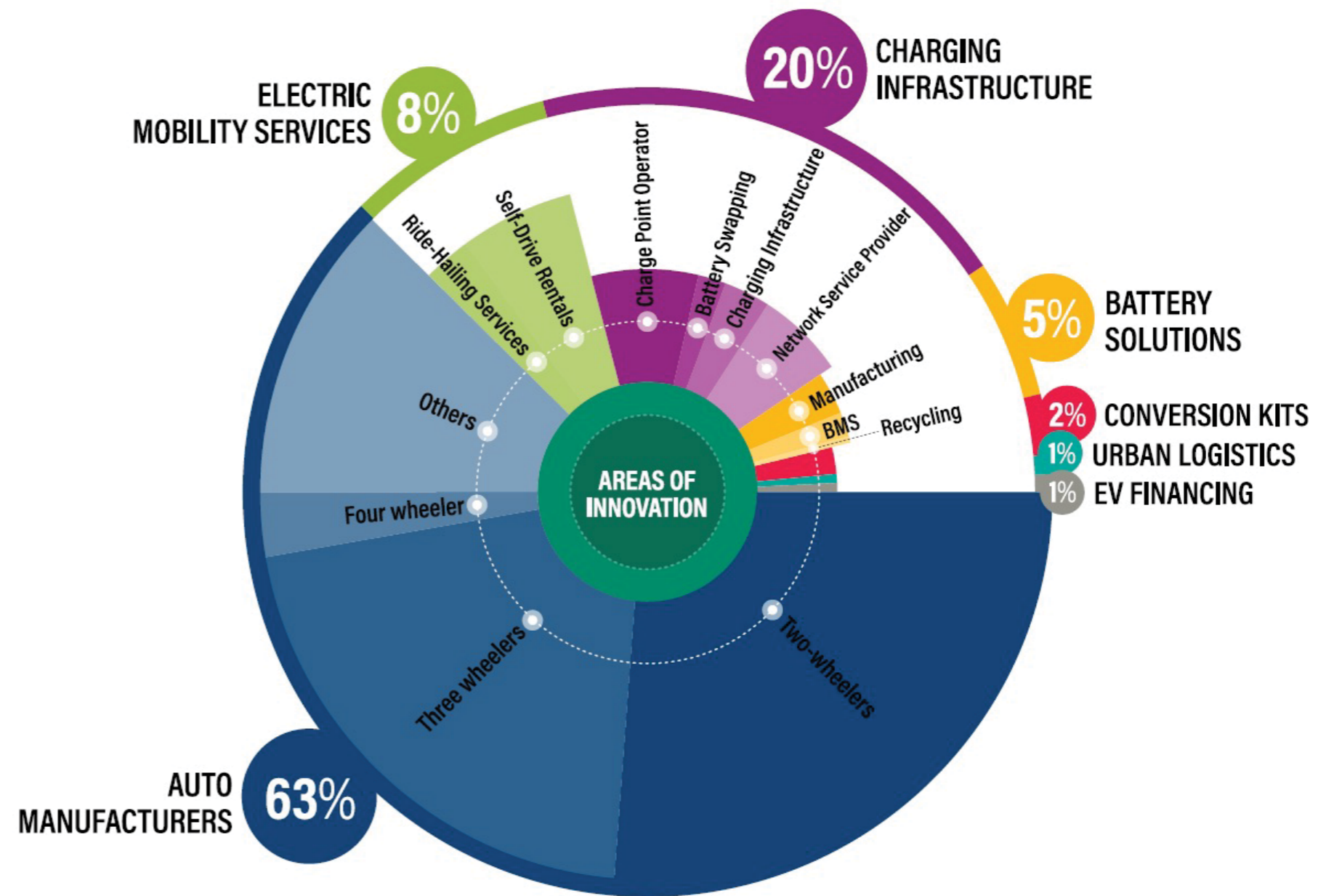


FIGURE 2: E-mobility start-up landscape in India





E-mobility start-ups raised more than \$850 million between 2012 and mid-2021



1. Auto Manufacturing



EV manufacturing start-ups comprise more than 60% of all e-mobility start-ups, with a majority involved in the manufacture of e-2Ws and e-3Ws owing to the market readiness of these vehicle segments. Start-ups in this sub-sector are setting up plants and manufacturing EVs for a range of applications, including personal mobility, passenger transport and urban freight. Major start-ups in this sector include Ola Electric, Ather Energy, Hero Electric, Euler Motors, Gayam Motor Works and E-Trio.

2. EV Charging Infrastructure



Start-ups in the EV charging infrastructure domain are the second-most numerous in the e-mobility sector after manufacturing start-ups. They include charger manufacturers, EV charging or battery swapping operators and network service providers. While charger manufacturers are responsible for the production of EV charging infrastructure, charging service operators (or battery swapping operators) provide their services for public and private applications. Network service

providers offer consumer services to access, reserve and pay for charging services from multiple operators. Major charge point operators include start-ups like Lithion Power, Fortum, Magenta Power, Statio, ChargeZone and PlugNGo, some of which also manufacture their own EV chargers. Electrifee is an example of a network service provider.

3. Electric Mobility Services




EV-as-a-service enterprises provide shared mobility services such as ride-hailing and self-drive rentals using a fleet of EVs. With lower operating and maintenance costs contributing to a competitive total cost of ownership (TCO), shared mobility services are increasingly shifting to EV fleets. SmartE, Yulu, Lithium Urban Technologies, and Blu Smart are some examples of EV-as-a-service start-ups.

4. Battery Solutions



Start-ups in the battery solutions space are involved in battery cell technologies, battery pack manufacturing and end-of-life battery recycling. Start-ups like Log9



Materials, Grinntech, SUN Mobility, Gegadyne Energy and Inverted have been competing to develop innovative cell and battery pack technologies to improve the range and service-life of EV batteries.¹⁶ Battery recycling start-ups like Lohum and Ziptrax refurbish used and discarded batteries from EVs for second-life applications and mining rare earth metals used in cell manufacturing.

5. Urban Logistics

With the rapid growth of e-commerce and local delivery services, start-ups like EvenCargo and LoadExx are deploying EVs to provide last-mile logistics in urban areas. Low TCO and lesser maintenance time for EVs provide cost savings for both service providers and their customers, especially small enterprises.

6. EV Financing

Considering their higher up-front cost, EV financing services play a crucial role in promoting e-mobility, especially for access by small enterprises and economically vulnerable users for livelihood generation. While banks and traditional non-banking financial

companies (NBFCs) are still gauging the EV market before providing vehicle loans, fintech start-ups like Revfin, Autovert, and Welectric are providing financing solutions to customers who might otherwise not have easy access to credit, such as e-rickshaw and e-auto drivers.

7. EV retrofitment

Retrofit enterprises specialize in the conversion of existing ICE vehicles to EVs by replacing the internal combustion engine and associated components like the gearbox and drivetrain, with an electric motor, batteries and other relevant components. Start-ups like E-Trio and EV Retron Energies are examples of enterprises providing retrofitting services.

While these are the seven broad sub-sectors of start-ups in the e-mobility industry, each of the sub-sectors is further divided into more specific categories, as shown in Figure 2, based on the products or services offered by the start-ups.



It is estimated that \$180 billion of investments are required to meet India's 2030 EV targets



Enterprises in the industry have been able to successfully attract funding from various development and climate finance sources, along with venture capitalist firms and strategic investors. E-mobility start-ups raised more than \$850 million between 2012 and mid-2021.¹⁷ The biggest winners have been EV manufacturing and e-mobility service start-ups, while those in other sub-sectors such as charging infrastructure, battery solutions and urban logistics are poised to grow rapidly.

It is estimated that investments of over \$180 billion (₹12.5 lakh crores) will be required in the EV manufacturing and charging infrastructure sub-sectors to achieve India's 2030 EV targets.¹⁸ The battery manufacturing sub-sector would require further investments between \$6.1 to \$12.3 billion, depending on the extent of indigenization of battery manufacturing.

As start-ups capture a growing market share, they will account for a significant proportion of these investments.

Table 1: Major investments attracted by e-mobility start-ups in 2021

Start-up	Funding raised in 2021 (INR Cr)
Ola Electric	1,898
Blusmart	186
Simple Energy	156
Revolt Motors	150
Detel	150
Ultraviolette Automotive	130
Magenta EV Solutions	120
Euler Motors	94
Log 9 Materials	74.7
Lohum Cleantech	52

Source: The Economic Times

3 | Enabling a Sustainable E-mobility Transition



If EVs attain a 30% share in new vehicle registrations by 2030, their TCO is estimated to be 9-20% lower than their ICE counterparts



Electric mobility is well-understood as a pathway for environmental sustainability of the transport sector. While zero tailpipe emissions of EVs can significantly mitigate urban air pollution, they can also reduce transport sector GHG emissions by using electricity generated from renewable sources. However, the role of e-mobility industry in promoting more sustainable practices of manufacturing and ensuring circular economy of resources in the sector is not well understood. The social impact of e-mobility (on workers and low-income/marginalized groups) also remains largely unexplored.

Minimizing the lifecycle GHG emissions of EVs requires cleaner production processes and more efficient recycling of vehicles and their components. With EV manufacturing requiring new assembly lines, facilities and supply chains, the industry has an opportunity to significantly reduce its environmental impact. At the same time, e-mobility services can adopt cleaner practices such as ensuring a higher share of renewables

in the electricity supplied for EV charging and electrifying high-capacity shared mobility services.

In terms of socio-economic impact, the EV industry is expected to create millions of new jobs in India over the next decade.¹⁹ These green jobs can generate secure livelihoods for new entrants while ensuring an equitable transition to existing automotive industry workers through upskilling and assured employment. EVs can also positively impact access to mobility, which is an essential requirement that influences access to education, healthcare, livelihood opportunities and the overall quality of life for marginalized individuals, households and communities. For example, it has been estimated that if EVs have a 30% share in new vehicle sales by 2030, their TCO will be anywhere between 9-20% lower than those of ICE vehicles.²⁰ Coupled with the falling production cost of EVs, this would result in making mobility accessible to more people, especially economically vulnerable users.

Achieving a truly sustainable e-mobility transition requires a holistic outlook that takes all socio-economic and environmental impacts into consideration across the value chain for all beneficiaries including potential users, workers, and society at large. As innovators and leaders in the transition, e-mobility enterprises must ensure that they are building products and services that contribute to a more equitable, clean and inclusive mobility ecosystem.

With declining production cost and TCO, EVs can make mobility more accessible to economically vulnerable users



Zero tailpipe emissions



Reduction in GHG emissions



Livelihood generation



Improved access to health and education



Access to mobility for low-income groups



Creation of green jobs

FIGURE 3: Environmental and social impacts of electric vehicles



4 | Impact Assessment Framework for E-mobility Enterprises



Image: Ather Energy

Measuring the sustainability impacts of a product or service is not easy, given the myriad direct and indirect (sometimes intangible) impacts they have on beneficiaries. Start-ups struggle with integration of impact management into their activities amidst constraints of limited capital, resources and time. An established assessment framework can enable start-ups to track and manage their impacts from an early stage of development, allowing more sustainable practices to be integrated into businesses from the start.

An impact assessment framework may be used by responsible enterprises to maximize their social and environmental benefits. It can also be used by impact investors to guide their decision-making process on where to invest. Globally, there are various assessment frameworks that have been formulated to track and measure the impact of start-ups. In general, these are universal frameworks that can be adapted for start-ups from a given sector or those operating in a particular geography.

Of these, the Impact Reporting and Investment Standards (IRIS)+ set of metrics managed by the Global Impact Investing Network (GIIN) is a well-known resource for measuring impact consistently, either at a sectoral level or for specific Sustainable Development Goals (SDGs).

With rapid global growth in e-mobility and billions of dollars of expected investments over the next decade, there is a unique opportunity to maximize the positive impacts of this sector across the value chain. Identifying and tracking the sector's varying impacts on different stakeholders at an early stage of the e-mobility transition can facilitate an efficient deployment of resources and can support a more impactful and equitable transition from internal combustion engine vehicles to EVs. To this end, an impact assessment framework tailored for e-mobility enterprises can help create a uniform standard for socio-economic and environmental impacts of the sector, raising awareness on managing and maximizing impacts beyond zero tailpipe emissions.



IFC estimates impact investments of nearly \$2.3 trillion in 2020, representing 2% of global assets under management by investors



Impact investments in the e-mobility sector

The start-up ecosystem is driven by private equity funding from angel investors and venture capital firms, as well as debt capital from financing institutions and investors. These equity and debt funding flows are increasingly influenced by the social and environmental sustainability of investments, besides the traditional parameters of fiscal growth prospects.

The growth of ESG investing (also known as socially responsible investing or impact investing) points to the increased prioritization of environmental, social and governance (ESG) outcomes in investment decisions. It assumes that human well-being and environmental sustainability impact the long-term financial performance of start-ups and enterprises.

For e-mobility start-ups looking to access a wider array of funding instruments – besides more expensive venture capital funding – climate finance and impact investments are attractive alternatives. While climate finance focuses on GHG emissions reduction, impact investors also look

for social and economic impact on low-income and marginalized groups alongside environmental impacts.

With a sturdy growth trajectory projected over the coming decades, India's e-mobility sector will create a range of socio-economic impacts on its stakeholders. A system that helps track the specific positive impacts enabled by e-mobility startups would, in turn, attract more impact investors in the space.

IFC estimates impact investments of nearly \$2.3 trillion in 2020, representing 2% of global assets under management (AUM) by investors.²¹ As a niche but rapidly growing sector globally and locally, impact investments are a promising avenue for sustainable enterprises. As e-mobility start-ups seek capital for rapid projected growth in the ecosystem, undertaking robust impact assessment and management of the environmental, social and governance outcomes of their businesses can enhance their access to such investments.

4.1 | Framework for Impact Assessment

The impacts of e-mobility enterprises can be assessed across a framework comprising four elements: Who, What, How and How much.²² In the first element, the relevant beneficiaries (**Who**) of enterprises are identified. The second element involves identification of all potential outcomes (**What**) to which an e-mobility enterprise may contribute and the beneficiaries they impact. In the third element, impacts (**How**) of e-mobility enterprises which contribute to the identified outcomes are highlighted. Lastly, to determine the extent of the impact (**How much**), measurable indicators are identified which can be quantified and compared across different enterprises. Figure 4 shows the impact assessment framework matrix for e-mobility enterprises.

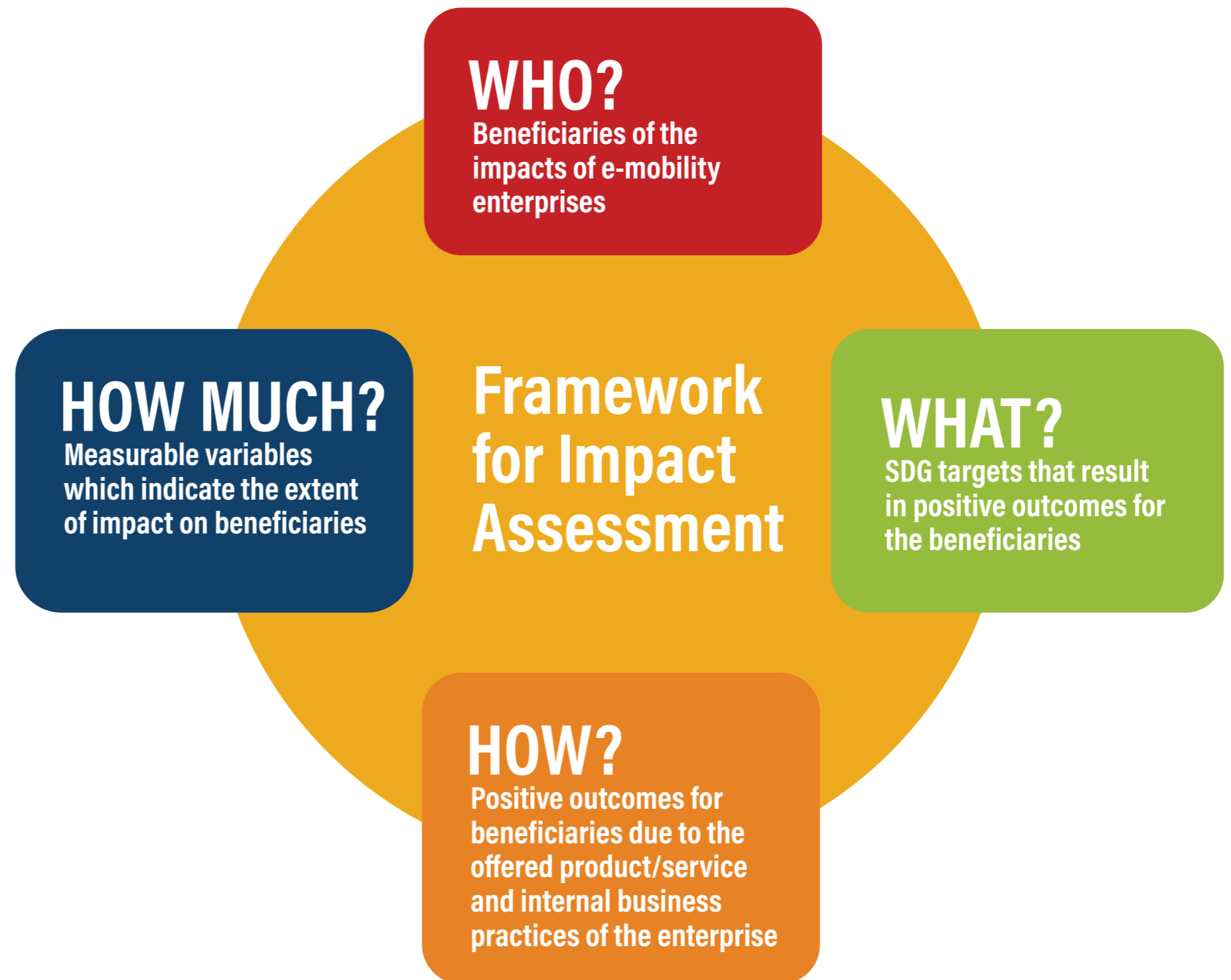


FIGURE 4: Impact assessment framework matrix for e-mobility enterprises



Image: Ashish Rawat (WRI India)

WHO?

Beneficiaries of E-mobility Enterprises

There are three identified beneficiary groups of e-mobility enterprises: customers, employees/workforce and the environment.



Customers



Employees



Environment

Depending upon the enterprise, its business model and offerings, beneficiaries can be further classified into specific types. For example, customers of an enterprise could be individual commuters or entrepreneurs providing transport services, or small businesses providing transport services in case of B2B enterprises. Similarly, employees or workforce could either be individuals employed by the enterprise, upstream small businesses that are contracted by them or, in the case of a franchise model, small businesses which are their franchisees.

E-mobility enterprises may also choose to expand their impact mapping to stakeholders along an extended value chain. This may include customers of customers, as in the case of charging operators or battery swap providers that serve transport service providers, who in turn serve end commuters. It may also include contractors of contractors to assess governance and manufacturing processes upstream of the enterprise's activities.

While a broad template of beneficiaries can be applied to each sub-sector within the e-mobility ecosystem, the exact stakeholder groups comprising the beneficiaries will likely vary from one enterprise to another. Therefore, as a first step of the impact assessment and management process, enterprises are encouraged to map their beneficiaries in as much detail as possible.



WHAT?

The Sustainable Development Goals Agenda

The SDGs are a set of interlinked goals that were adopted by the United Nations in 2015 as a universal call to action for protecting our planet.²³ The 17 goals with 169 targets act as a guiding light to work towards sustainable development and respond to major global sustainability challenges – poverty, inequality and environmental degradation.

While the SDGs are meant to be achieved at national and global levels, they have been adopted not only by governments but also by a variety of private sector and civil society organizations to guide their activities and growth trajectories. Private companies and businesses, especially, are expected to be key partners in achieving the SDGs. Business associations at the global and national levels, like the World Business Council for Sustainable Development (WBCSD) and the United States Council for International Business

(USCIB), help member companies navigate and track their impacts on various SDGs.

The GIIN's IRIS+ metrics too can be mapped to the SDG agenda, thereby allowing impact investors to make investments that support the achievement of specific SDGs. The SDG framework for impact assessment is also globally acknowledged and accepted, especially by impact investors.²⁴ The impact assessment framework for e-mobility enterprises is based on the SDG agenda. Table 1 provides a list of SDGs and related targets that e-mobility enterprises contribute to, either directly or indirectly. The SDG targets have been shortened for brevity; for the full text of targets that are directly impacted by electric mobility enterprises, please refer to Annexure 1.

HOW?

Impacts of E-mobility Enterprises

E-mobility enterprises contribute to 22 SDG targets across 12 different goals. The impact of an e-mobility enterprise is defined as the change in an SDG target that is facilitated by core enterprise activities, ranging from EV manufacturing and battery solutions to EV-based transport services and financing. Some impacts of e-mobility enterprises overlap with those from the manufacturing, transportation and energy sectors. These impacts influence a wide range of socio-economic and environmental outcomes including creation of decent jobs, improving access to opportunities, and reducing air pollution and GHG emissions from the transport sector.

Impacts of e-mobility enterprises can be classified as core/direct impacts, indirect impacts, or project-specific impacts, as adapted from the framework developed by Shell Foundation and Enea Consulting.²⁵ Core or direct impacts are the first level outcomes of an enterprise's core activity and its governance. For instance, a direct impact of EV-as-a-service start-ups is the access to

mobility provided to consumers through their core activity, while creation of jobs is a direct impact on workforce.

Indirect impacts capture the outcomes of direct impacts. Continuing the example of EV-as-a-service start-ups, the direct impact of access to mobility can indirectly impact consumer access to healthcare, education and livelihood opportunities, while the direct impact of job creation can indirectly impact the quality of life of the workforce. Project-specific impacts may be the result of ancillary interventions undertaken by e-mobility enterprises to affect more sustainable outcomes, such as a specific gender-inclusion workforce initiative that is independent of general hiring practices.

The impact assessment framework proposed in this report includes the direct and indirect impacts of e-mobility enterprises. It is important to note here that direct impacts also include cross-cutting variables (such



E-mobility enterprises contribute to 22 targets across 12 SDGs



as impacts on lower-income groups and women) to ensure that the impact on vulnerable demographic groups is captured. Project-specific enterprises are specific to non-core activities and are not included to ensure the universal applicability of the framework.

Impacts can be classified into two broad categories:

1. Socio-economic development:


By providing affordable mobility solutions and creating jobs, enterprises contribute to the socio-economic development of the society and improve accessibility of mobility services. The customers and employees are beneficiaries of the socio-economic development impacts created by e-mobility start-ups. These impacts directly and indirectly improve the social and economic conditions of their beneficiaries. By providing affordable mobility solutions and creating jobs, enterprises contribute to better socio-economic development outcomes for beneficiaries. By improving accessibility

of mobility services, e-mobility start-ups also support a host of indirect impacts by offering greater access to health, education and livelihood opportunities.

2. Environmental sustainability:

E-mobility start-ups positively impact the society by providing solutions and sustainable practices that help us in actively reducing environmental damage. E-mobility directly enables a reduction in vehicular emissions, including air pollution emissions and GHG emissions, and reduces the GHG emissions contribution of the transport sector.²⁶ E-mobility enterprises also have the potential to reduce GHG emissions in the manufacturing sector (of which the automotive industry is an important part). They can contribute by improving the efficiency of manufacturing processes, increasing the use of renewable sources of energy in the sector and creating a circular economy for batteries through reuse and recycling.

Table 2: Direct impacts of e-mobility enterprises

SDG	Direct Impacts	SDG	Direct Impacts
	Affordable last-mile or hyperlocal delivery of goods and services using EVs Access to affordable financing for EV purchase		Job creation Job formalization with stable income for workers and transportation service providers
	Improved road safety due to improved vehicle safety and trained drivers for EV services Reduction in the number of private vehicles on road, leading to reduction in road congestion and likelihood of accidents		Job creation in the manufacturing sector Affordable and accessible financing for electric vehicles
	Skill development of workers		Equal participation of underprivileged in the workforce Increased income for workers and mobility service providers
	Equal participation of women in workplace		Make electric vehicles more accessible and affordable Facilitate increased access to transportation Reduction in air pollution by increasing number of EVs
	Wastewater treatment and recycling		Recycling of used electric vehicle batteries for second-life use Improved waste management in manufacturing
	Increased share of renewable energy sources for manufacturing processes for manufacturing and EV charges Access to mobility powered by cleaner fuel		Reduction in vehicular emissions with increase in the number of EVs Reduction in GHG emissions with improved efficiency in manufacturing

A close-up photograph of a hand holding several coins, with a larger pile of coins on a surface below. The lighting is dramatic, highlighting the texture of the coins and the skin of the hand.

HOW MUCH?

Indicators for Measuring Impact

To gauge the extent and magnitude of the impacts of e-mobility enterprises on the beneficiaries, quantifiable and comparable indicators have been defined for each identified impact.

The indicators have been designed to capture a comprehensive picture of the scale and extent of the impacts created by enterprises. For instance, to understand the impacts of an EV manufacturer on its customers, indicators capture the number of sold EVs and the reduction in operational costs compared to ICE vehicles.

Enterprises can use the indicators to measure impact by using the impact data that they already collect. They can also deploy primary surveys to collect data from their beneficiaries, especially for indirect impacts. To ensure standardization and universal applicability, these indicators are inspired by the IRIS developed by GIIN.





4.2 Direct Impacts of E-mobility Enterprises





In this section, direct impacts of different sub-sectors of e-mobility enterprises on the three main beneficiaries of customers, workforce and society are highlighted. All direct impacts are mapped to their relevant SDG targets and have defined indicators for measurement.

Table 3 maps the direct impacts and indicators of each e-mobility sub-sector on the customers. Impacts vary across different sub-sectors based on the business model and identified beneficiaries.

While the impacts are applicable to all e-mobility sub-sectors, some indicators are relevant only to specific sub-sectors. The focus of the impact assessment of e-mobility enterprises on the workforce is on low-skilled and vocationally trained employees of e-mobility enterprises, and company policies that support creation of decent jobs for men and women in the organization.

Table 3: Direct impacts and indicators of e-mobility sub-sectors on customers

SDG	SUB-SECTOR	IMPACT	INDICATORS
 SDG11	Auto Manufacturing	Access to affordable transport due to low operational cost of EVs	Number of EVs sold per year
Share of EVs sold to women			
Share of EVs sold to low-income households			
Average monthly savings on operational cost against ICE vehicles			
 SDG3	Electric Mobility Services	Reduced incidence of road accidents with well-trained drivers and due diligence mechanisms	Number of road traffic accidents per 1,000 vehicle kilometres covered
Number of deaths due to road traffic accidents per 1,000 vehicle kilometres covered			
 SDG7		Access to mobility powered by cleaner fuel	Number of EVs sold per year
Share of EVs sold to women			
 SDG11		EV-based shared mobility increases access to affordable transportation	Share of population (in service area) within 250m of access to transport service
			Share of women users
			Share of users from low-income households
			Average time savings for commuters per trip
Average cost savings for commuters per trip			
Average share of income spent on transport per month			

SDG	SUB-SECTOR	IMPACT	INDICATORS
 SDG9	EV Charging/Battery Swapping	Charging infrastructure increases accessibility of EV-based transport	Number of chargers/battery swap stations per sq.km. for urban areas Number of 3x3km grids with chargers/battery swap stations available in urban areas Number of chargers per running km for highways Number of users of charging/battery swap services Units of electricity sold per day Service charge per unit of electricity sold Average charging cost per km, compared to an ICE vehicle
		EV charging firms support more accessible and affordable transport systems	
 SDG7	Battery Manufacturing	Increased affordability of EV batteries through better technology	Cost of battery per kWh
	Battery Recycling	Increased battery scrapping benefits and reduced cost of refurbished battery packs	Market price for used EV battery per kWh Cost of refurbished battery per kWh vs. cost of new battery
 SDG1	Urban Logistics	Affordable last-mile or hyperlocal delivery of goods and services using EVs	Number of deliveries made per day Number of urban freight kms covered per day Cost of service to customers per km against ICE vehicles
		Reduced incidence of road accidents with well-trained drivers and due diligence mechanisms	Number of road traffic accidents per 1,000 vehicle kms travelled Number of deaths due to road traffic accidents per 1,000 vehicle kms travelled
 SDG3			




SDG	SUB-SECTOR	IMPACT	INDICATORS
 <p>SDG1</p>	<p>Financing</p>	<p>Access to affordable B2C financing for EVs</p>	<p>Number of EVs financed</p> <p>Total amount of financing deployed to customers</p> <p>Share of financing deployed to customers without access to traditional credit</p> <p>Average cost of financing as proportion of loan amount</p>
 <p>SDG9</p>		<p>Access to affordable B2B financing for small EV firms</p>	<p>Number of EVs financed</p> <p>Total amount of financing deployed to early-stage EV start-ups</p> <p>Average cost of financing as proportion of loan amount</p>
 <p>SDG11</p>	<p>Retrofitment</p>	<p>Cheaper alternative to EVs with lower operating cost than ICE vehicles</p>	<p>Upfront cost of retrofit kit vs. new EV</p> <p>Average monthly savings on fuel expenditure vs. ICE vehicles</p>

Table 4: Direct impacts and indicators of e-mobility enterprises on the workforce





















SDG	IMPACT	INDICATORS
SDG4 	Skill development prepares workers for EV transition	Number of workers trained per INR 1cr turnover
SDG5 	Jobs for women in transport sector	Share of jobs held by women Share of women in managerial roles
SDG8  SDG9 	Creation of decent, formal jobs	Number of jobs created per INR 1cr turnover Share of jobs held by temporary/contract workers Number of manufacturing jobs created per INR 1cr turnover
SDG10 	Creation of well-paid jobs and reduced income inequality	Average monthly income for bottom quartile of workers Ratio of workers' income of bottom quartile to that of top quartile Average change in monthly income from previous job of workers in bottom quartile

Table 5: Direct impacts and indicators of e-mobility enterprises on the environment

	SUB-SECTOR	IMPACT	INDICATORS
    	Auto Manufacturing	Treatment of wastewater in auto manufacturing contributes to improved water quality	Proportion of wastewater treated from manufacturing
		Reduced water use due to improved manufacturing processes and wastewater recycling	Amount of freshwater used per EV produced
		Use of renewable energy for manufacturing increases share of renewable energy	Share of freshwater in water used per EV produced
		Reduction in vehicular emissions with higher market share of EVs	Renewable energy share in energy consumption for manufacturing
		Reduction in waste generation due to improved manufacturing processes and adoption of reuse and recycling	Reduction in urban air pollution per vehicle km
Reduction in transport GHG emissions with higher market share of EVs	Waste generated per EV produced, in tons		
			Reduction in GHG emissions per vehicle km

SDG	SUB-SECTOR			IMPACT	INDICATORS
 SDG11	Electric Mobility Service	Urban Logistics	Retrofitment	Reduction in vehicular emissions of EVs	Total number of passengers or vehicle kms travelled
 SDG13				Reduction in GHG emissions of EVs	Urban air pollution emissions per (passenger) km travelled vs. ICE vehicles
 SDG6	Charger Manufacturing	Battery Manufacturing	Wastewater treatment in auto manufacturing helps improve water quality	Proportion of wastewater treated from manufacturing	
 SDG7			Reduced water use due to improved manufacturing processes and wastewater recycling	Amount of freshwater used per manufactured product	
 SDG12			Use of renewable energy for manufacturing increases share of renewable energy	Share of freshwater in water used per manufactured product	
			Reduction in waste generation due to improved manufacturing	Renewable energy share in energy consumption for manufacturing processes Waste generated per product manufactured (in tons)	

SDG	SUB-SECTOR	IMPACT	INDICATORS
 SDG7	EV Charging/Battery Swapping	Renewable energy supply used for charging infrastructure	Share of renewables in energy supply for EV charging facilities
 SDG13		Reduced GHG emissions due to lower emissions intensity of electricity generation	Reduction in GHG emissions per km and total
 SDG6	Battery Recycling	Wastewater treatment in recycling plants helps improve water quality	Proportion of wastewater treated from recycling processes
 SDG7		Reduced water use with improved battery recycling processes and wastewater recycling	Freshwater used per kWh of recycled batteries
		Using renewable sources to power recycling plants increases their share in energy mix	Share of freshwater in water used per kWh of recycled batteries
 SDG12		Recycling of rare earth metals and/or production of refurbished battery packs	Share of renewable energy in powering recycling processes
		Improved management of hazardous chemicals in EV batteries through recycling	Amount of rare earth metals mined per kWh of recycled batteries
		Reduction in waste generation due to improved recycling processes	Capacity of refurbished battery packs produced per kWh of recycled batteries
			kWh of batteries recycled
			Waste generated per kWh of battery recycled (in tons)



4.3 Indirect Impacts of E-mobility Enterprises

The indirect impacts of e-mobility enterprises are the outcomes for beneficiaries resulting from their direct impacts. Hence, the identification and measurement of the indirect impacts provide a comprehensive picture of an enterprise’s impacts.





These indirect impacts are the result of either a change in income (in case of employees) or of increased access

to sustainable transportation (in case of customers) through the products and/or services offered by e-mobility enterprises. Examples of indirect impacts include enhanced livelihood opportunities, and increased access to healthcare facilities and educational institutions.

Table 6: Indirect impacts of e-mobility enterprises

SDG	Indirect Impacts	SDG	Indirect Impacts
 <p>SDG1</p>	Greater savings for mobility service providers and customers	 <p>SDG4</p>	Improved access to education with increased income
 <p>SDG3</p>	Improved access to healthcare with increased income	 <p>SDG8</p>	Better access to livelihood opportunities

Table 7: Indirect impacts and indicators of e-mobility enterprises

SDG	IMPACT	INDICATORS
 <p>SDG1</p>	<p>Greater savings for commuters or increased take-home income for drivers with reduction in transport expenditures</p>	<p>Number of customers that report increased income/savings due to reduced transport costs</p>
	<p>Increased access to basic household services and property with change in income for employees</p>	<p>Number of customers and employees that report improved household goods/access to basic services</p>
 <p>SDG3</p>	<p>Better access to health care due to accessible and affordable transportation for commuters/ due to increased income for drivers or employees</p>	<p>Number of customers (commuters/ drivers) and employees that report improved access to healthcare facilities</p>
 <p>SDG4</p>	<p>Better access to education due to accessible and affordable transportation for commuters/ due to increased income for drivers or employees</p>	<p>Number of customers (commuters/drivers) and employees that report improved access to educational institutions</p>
 <p>SDG8</p>	<p>Better access to livelihood opportunities with accessible and affordable transportation</p>	<p>Number of customers that report improved access to livelihood opportunities</p>
	<p>Lowered barriers to starting a job or becoming an entrepreneur due to reduced capital expenditure (retrofit solutions, recycled batteries, etc.)</p>	<p>Number of customers that report the ability to start a new job or take up a self-employment opportunity</p>



The impact assessment framework helps track, measure and maximize the impacts of electric mobility start-ups



4.4 Deploying the Impact Assessment Framework

The impact assessment framework defined for e-mobility enterprises is a valuable tool for tracking, measuring and maximizing impact of early and later-stage start-ups, as well as more established businesses. It is an equally important instrument for ESG and impact investing firms to base their investment decisions on a holistic, comparable, and standardized framework that prioritizes social and environmental impact besides financial viability and growth metrics.

Efforts have been made to standardize the indicators for consistency and applicability across different types of enterprises. At the same time, direct and indirect impacts have been highlighted with a view to focus on the socio-economic impacts on marginalized groups, while environmental sustainability impacts have been largely confined to direct impacts. This is meant to reduce data collection burden on companies, with an emphasis on transparent and quantifiable data that can be tracked by enterprises themselves, and a limited set of indicators

focusing on intangible impacts on customers and employees that are their direct beneficiaries. Impact metrics have thus been defined so as to minimize the cost of data collection for start-ups.

Ensuring the successful adoption and mainstreaming of the e-mobility impact assessment framework will require widespread buy-in from relevant stakeholders in the ecosystem, including e-mobility start-ups and companies, impact investors and other ESG investment firms. While stakeholder inputs and feedback were an important part of the formulation of this framework, the next steps should include wider industry-level consultations and deployment of the framework in partnership with impact investors focusing on e-mobility enterprises.

5 | Integrating Social Impact with E-mobility Business Models



Many e-mobility start-ups are integrating impactful initiatives in their evolving business models, be it in manufacturing, sales, or services.

Ola Electric's e-2W manufacturing facility aims to employ an all-women workforce; once fully operational, this is expected to create 10,000 jobs for women by providing training and up-skilling in core manufacturing skills.²⁷ SMV Green Solutions, a Varanasi-based e-mobility start-up, is supporting women in entering the transport workforce, by providing access to financing and driver training to purchase and operate e-rickshaws through its Vahini program. Fintech start-ups like Revfin and Three Wheels United use innovative, technology-based solutions and community engagement to extend access to financing for individuals that do not have access to traditional credit instruments to purchase EVs for livelihood generation. Fleet operators in passenger transport, urban freight and last-mile delivery, including BluSmart, BigBasket and Flipkart are

electrifying their vehicle fleets with operational savings that benefit consumers and drivers.

As more start-ups and growing enterprises in the e-mobility sector aim to strengthen their sustainability outcomes, the impact assessment framework developed in this report is expected to help them in identifying, tracking, and increasing their socio-economic and environmental impacts.

The impacts of two different EV charging enterprises have been analyzed in this chapter using the impact assessment framework. The case studies of the two enterprises demonstrate how the impact assessment framework can be used to establish a baseline. Over time, the framework can support the development of benchmarks for consumer, workforce, and societal impacts in the e-mobility sector for new and mature enterprises to strive towards.



5.1 Case Study 1: Sheru

Sheru is an e-mobility start-up that provides battery swapping services to e-rickshaw drivers using advanced batteries. The start-up uses a franchising model to scale its battery swapping services by offering batteries and swapping stations to franchisees.

It currently operates 20 battery swap stations in Delhi, of which 15 are run by their franchisees. A total of 750 e-rickshaw drivers avail the battery swapping services at these stations every day.

Beneficiaries of Sheru's impacts include e-rickshaw drivers, battery swapping franchisees and the enterprise's employees.

Impacts on e-rickshaw drivers

With battery swapping stations spread out in six different 3x3 km grids, Sheru provides accessible battery swapping infrastructure for the e-rickshaw drivers across a large area.

At a cost of ₹2.50 per km, Sheru has been providing affordable battery swapping for the e-rickshaw drivers.

Due to reduced downtime of the e-rickshaws, the drivers have been able to run their vehicles for a longer duration per day compared to older batteries which needed eight hours of charging. This has translated in an increase in income of about ₹300-400 per day for the drivers.

The increase in income has multiple benefits for e-rickshaw drivers, ranging from improved access to healthcare to greater security of property ownership.



750
E-rickshaw drivers



6
Number of 3x3 km
grids with battery
swapping stations



15
Franchisees



₹2.50
Average cost of
battery swapping
per km



52
Employees



₹300-400
Additional income
per day



Earlier, I could only drive my rickshaw for 3-4 hours and had to stop for charging it for three hours and then drive another three hours. Now, I can drive for more than 12 hours with short breaks for rest in between. I am now able to earn an extra ₹400-500 because of this. This has helped in paying the medical bills of my parents who are old and have age-related health problems.

- Ashok Rajput, e-rickshaw driver





Impacts on franchisees

Most of Sheru's battery swapping stations are owned and operated by their franchisees.

To set up a franchise, Sheru provides the battery swapping infrastructure, training to run the swapping station and the battery swapping management software.

The supplementary income from the battery swapping station franchise has helped franchisees tide over COVID-related business losses and has provided a stable income for them. Some of the franchisees are even looking to expand in the future by taking multiple franchises to set up battery swapping stations in different locations.



52
Total number
of jobs created



3%
Jobs held by
women



67
Workers trained

Impacts on employees

With about eight new jobs created per ₹1 crore turnover, and 30% of these jobs being held by low-skilled workers, Sheru is supporting job formalization and the creation of green jobs. Many of Sheru employees lost their previous jobs during the pandemic and were gainfully employed by it.

Impacts on environment

By replacing lead-acid batteries with lithium-ion in e-rickshaws, Sheru contributes to reduction in GHG emissions from battery production since lithium-ion batteries last significantly longer due to their higher cycle life (5-6 times higher than lead-acid). The calculations for the reduction in GHG emissions, however, is outside the scope of this report.



5.2 Case Study 2: Ziptrax

Ziptrax is an e-mobility technology start-up that works in the sub-sectors of battery recycling and battery swapping by providing life-cycle management of lithium-ion (Li-ion) batteries. Ziptrax refurbishes battery cells from used EV batteries into new battery packs for second-life applications. It also recovers critical battery metals like lithium, nickel, cobalt, etc, from dead battery cells of used batteries which can be used for various applications.

Impacts on customers

Ziptrax provides affordable refurbished batteries to the e-rickshaw drivers that are ₹5,000 per kWh cheaper than new Li-ion batteries.

At a cost of ₹1.00 - ₹1.50 per km, Ziptrax has been providing affordable battery swapping for e-rickshaw drivers. Due to reduced downtime of the e-rickshaw, the drivers have been able to run their vehicles for a longer duration compared to older batteries which needed nearly eight hours of charging. This has translated in an increase in income of about ₹450-500 per day.

The increase in income has multiple benefits for e-rickshaw drivers, ranging from improved access to healthcare to improved access to education for their children.



₹13,280
Cost of refurbished batteries



₹1.00-1.50
Cost of battery swap/km



₹450-500
Extra income/day



Impacts on employees

With about 24 new jobs created, and 50% of these jobs being held by low-skilled workers, Ziptrax supports job formalization and the creation of green jobs.



24
Total number
of jobs created



25%
Jobs held by women

Impacts on environment

Ziptrax has so far recycled 1,532 kWh of EV batteries - contributing significantly to a reduction in the generation of battery waste.



1,532 kWh
of EV batteries recycled



71%
Capacity recovery from
original batteries



Ever since I have shifted to using Ziptrax's battery service, I have been able to make ₹500 extra per day. After saving enough money, I took my elderly parents for medical check-ups and have been able to pay for their medicines as well.

- Rahul Chaudhary, e-rickshaw driver







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Annexure 1: SDG Targets Impacted by E-mobility Enterprises

SDG	TARGET
 <p>SDG1 No Poverty</p>	<p>1.4. By 2030, ensure that all men and women, in particular the poor and the vulnerable, have equal rights to economic resources, as well as access to basic services, ownership and control over land and other forms of property, inheritance, natural resources, appropriate new technology and financial services, including microfinance</p>
 <p>SDG3 Good Health and Well Being</p>	<p>3.6. By 2020, halve the number of global deaths and injuries from road traffic accidents</p> <p>3.8. Achieve universal health coverage, including financial risk protection, access to quality essential health-care services and access to safe, effective, quality and affordable essential medicines and vaccines for all</p>
 <p>SDG4 Quality Education</p>	<p>4.4. By 2030, substantially increase the number of youth and adults who have relevant skills, including technical and vocational skills, for employment, decent jobs and entrepreneurship</p> <p>4.5. By 2030, eliminate gender disparities in education and ensure equal access to all levels of education and vocational training for the vulnerable, including persons with disabilities, indigenous peoples and children in vulnerable situations</p>
 <p>SDG5 Gender Equality</p>	<p>5.1. End all forms of discrimination against all women and girls everywhere</p>
 <p>SDG6 Clean Water and Sanitation</p>	<p>6.3. By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally</p> <p>6.4. By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity</p>
 <p>SDG7 Affordable and Clean Energy</p>	<p>7.1. By 2030, ensure universal access to affordable, reliable and modern energy services</p> <p>7.2. By 2030, increase substantially the share of renewable energy in the global energy mix</p>

Annexure 1: SDG Targets Impacted by E-mobility Enterprises

SDG	TARGET
<p>SDG8 Decent work and economic growth</p> 	<p>8.3. Promote development-oriented policies that support productive activities, decent job creation, entrepreneurship, creativity and innovation, and encourage the formalization and growth of micro-, small- and medium-sized enterprises, including through access to financial services</p> <p>8.5. By 2030, achieve full and productive employment and decent work for all women and men, including for young people and persons with disabilities, and equal pay for work of equal value</p>
<p>SDG9 Industry, Innovation and Infrastructure</p> 	<p>9.1. Develop quality, reliable, sustainable and resilient infrastructure, including regional and transborder infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all</p> <p>9.2. Promote inclusive and sustainable industrialization and, by 2030, significantly raise industry's share of employment and gross domestic product, in line with national circumstances, and double its share in least developed countries</p> <p>9.3. Increase the access of small-scale industrial and other enterprises, in particular in developing countries, to financial services, including affordable credit, and their integration into value chains and markets</p>
<p>SDG10 Reduced Inequalities</p> 	<p>10.1. By 2030, progressively achieve and sustain income growth of the bottom 40 per cent of the population at a rate higher than the national average</p>
<p>SDG11 Sustainable Cities and Communities</p> 	<p>11.2. By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons</p> <p>11.6. By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management</p>
<p>SDG12 Responsible Consumption and Production</p> 	<p>12.2. By 2030, achieve the sustainable management and efficient use of natural resources</p> <p>12.4. By 2020, achieve the environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce their release to air, water and soil in order to minimize their adverse impacts on human health and the environment</p> <p>12.5. By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse</p>
<p>SDG13 Climate Action</p> 	<p>13.2. Integrate climate change measures into national policies, strategies and planning</p>



About MBRDI

Mercedes-Benz Research and Development India (MBRDI), headquartered in Bengaluru, India, was founded in 1996 as a captive unit to support Mercedes-Benz's research, IT and product development activities. The establishment of MBRDI is in line with the Mercedes-Benz group's ambition to attract the world's best engineering talent and form a global footprint for its R&D and IT competencies.

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About Villgro

Villgro is India's foremost and one of the world's largest social enterprise incubators. Established in 2001, Villgro creates impactful, innovative and successful enterprises in Health, Agribusiness, and Climate Action. Since 2001,

Villgro has supported 323 social enterprises that have raised over INR 4,388 million in investments, to create 4922 jobs and impact over 20 million lives. Villgro was awarded the Best Incubator Award by the Department of Promotion of Industry and Internal Trade (GoI) in 2020. Apart from India, Villgro also has a presence in the USA, Africa and the Philippines.

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About WRI India

WRI India is a research organization that turns big ideas into action at the nexus of environment, economic opportunity, and human well-being. We envision an equitable and prosperous planet driven by the wise management of natural resources. We aspire to create a world where the actions of government, business, and communities combine to eliminate poverty and sustain the natural environment for all people.

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