



Taking India's E-mobility to the Next Orbit

...and how startups can
contribute to this transition



THE PITCHBOOK

Powered by Let'sVenture

EAI
Energy Alternatives India

Let'sVenture





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FOREWORD

Dear Reader,

A few years ago Nandan Nilekani while speaking at a conference made a bold presentation; he declared that the 'WhatsApp moment' for fintech startups had arrived due to a few factors coming together: ubiquity of the smartphone, cheap mobile data on the back of Jio coverage, India Stack and the launch of an interoperable platform like UPI by NPCI. And indeed, we have since seen the fintech startup ecosystem flourish and serve a very genuine pain point for businesses (large and small, especially SMEs) as well as end consumers like you and me. It still amazes and delights me every time a cab driver or support staff requests me to use one of the payment apps to complete a transaction – at that moment I don't see these payments companies as multi-billion dollar 'unicorn startups' but as part of a new wonder fuel that is lubricating our economic supply chain.

Today, I believe we are inching towards the 'WhatsApp moment' for electric vehicles. Here are some of the mobilisers that are coming together:

- A strong push by the government with aggressive targets supported by proactive policy making in this space especially with the release of the second phase of the Faster Adoption and Manufacturing of Electric Vehicles Scheme (FAME II)
- A dire environmental need – the consequences of irreversible climate change are very real not just globally but also in India – and an increasingly conscious business and direct consumer. It can't be business as usual.
- And while big auto will do what it has to do, the green shoots of an India Stack like innovation ecosystem of 'public goods' for the EV industry are visible too with the creation of LetsVenture's EV Innovation Lab, Micelio's maker studio for mobility startups, think tanks like Council on Energy, Environment and Water (CEEW) and Energy Alternatives Institute (EAI).

Here I would like to talk about the role the Software Technology Parks of India (STPI) is playing by opening 28 centres of excellence (CoE) in emerging technologies. Each CoE is a domain-specific specialized incubation facility for start-ups in areas like IoT, Block Chain, FinTech, Artificial Intelligence (AI), Augmented & Virtual Reality (AR/VR), Medical Electronics & Healthcare, Gaming & Animation, etc. Each of the CoEs provides the highest-standards and best-practices to founders in terms of infrastructure, technology, leadership, mentoring, training, research & development, funding and networking for the given focus area.

I am happy to report that the CoE in Autonomous Connected Electric Shared (ACES) Vehicles at Pune is going to be launched in the first quarter of next year in collaboration with Government of Maharashtra, M/s. Tata Motors, M/s. Kinetic, M/s. Visteon, M/s. MathWorks India, M/s. Intel, College of Engineering Pune (CoEP) and associations like ARAI, SAE-India, TiE-Pune, etc.

Lastly, I would like to compliment the efforts of EAI and LetsVenture in putting together this very readable 'PitchBook' with actionable insights on the startup and investing landscape in India as far as EVs are concerned. I believe this is a good starting point to understand what the various customer segments needs are and the kind of innovation we might expect to see at least in the immediate term (2020-2025).

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Introduction



Electric vehicles are all the rage, but you will be lucky to see any on the roads!

Except for rickshaws where electric vehicles have a clear penetration especially in select geographies such as Delhi and the National Capital Region, for most other segments, electric vehicles form an insignificant portion of vehicle sales and an even smaller portion of total vehicles on road.

While the challenges for poor adoption are fairly well-known - high cost of vehicles, low range on single battery charge, lack of charging infrastructure - there are no easy solutions. As a result, different stakeholders are exploring different avenues to accelerate EV adoption, with mixed results.

Among stakeholders, startups play an important role. Unhindered by baggage that established companies have, they bring fresh perspectives. With fire in their bellies, they dare to do risky things, fast. This combination of "new and daring" has already shaken up some established industries in India and taken them to the next orbit quickly. Can startups accomplish the same for India's e-mobility industry too?

Our review and analyses of Indian e-mobility startups in this context have thrown up a mixed picture: On the positive side, Indian e-mobility startups comprise exceptionally talented youngsters and experts with a passion to achieve excellence and make a difference. On the flip side, these startups could do much better in delivering differentiated value to many end-user segments and enhance their e-mobility adoption.

The startups clearly have the requisite intellectual horsepower and skills – prominent startups such as Ather Energy (founded by IIT Madras alumni), Sun Mobility (founded by Chetan Maini, a veteran in India's e-mobility sector) and Revolt Motors (founded by Rahul Sharma of Mixromax) are testimony to this. They also have significant and growing support from government, industry and investors. What is needed

for them to take off and achieve a high cruise-speed is an effective framework they can use to make crucial decisions on target markets and products. Deciding products and markets based on just intuition or past experience alone may not be good enough.

This white paper, prepared by LetsVenture in collaboration with EAI, provides a framework that has the potential to drive EV adoption in the short & medium term (2020-2025) even under fairly conservative assumptions for technology enhancement, cost reduction and EV charging/swapping infrastructure development.

We provide examples that show how successful international efforts and case studies, many of these from startups, have a strong alignment with this framework. We also provide a summary of how Indian startups are approaching e-mobility opportunities, and highlight some startups with unique value propositions in this section. Finally, we provide recommendations for startups on strategizing for a winning e-mobility transition, right away.

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SECTION 1: Framework for Accelerating E-mobility



We can't direct the wind, but we can adjust the sails

The Indian e-mobility market promises to be one of the largest in the world, in future. The challenge is to make the future happen fairly quickly.

The keenness to invest in Indian e-mobility is palpable among many stakeholder segments. Some of them have already invested in it, and many others in the process of doing it. The country already counts over 150 e-mobility startups, and this number is increasing rapidly.

While businesses, startups and investors appreciate that they are investing for the long term, most of them would like to see good growth and momentum in the short and medium term as well. And this is where things are looking not so positive.

We highlight the following to show why:

- Except in the case of e-rickshaws, penetration of electric vehicles is less than 1% of sales of any other vehicle segment
- Even annual two-wheeler (mainly e-scooter) sales amounted to about 1 lakh only in 2018 (0.5% of sales), and prior to that, it was only about 0.2%
- While there have been numerous tenders and MoUs for electric cars and buses from fleets, federal and state governments, the actual sales of these have been very low
- Recent news items suggest that FAME II, rather than revving up e-vehicle sales, is actually resulting in slower sales of electric scooters under the scheme. The main reason had to do with the fact that incentives under the scheme, in the form of subsidies, were available only for high-end vehicles, making buyers shift to lower-end scooters which cost less even without these subsidies.¹

Despite ambitious central and state government plans and industry aspirations, the above facts and data predict that it will be quite challenging for India to make quick gains in e-mobility.

For startups, making quick gains is important, far more than what it is for established businesses. Startups have a fairly short time window to prove that ideas will work in the market, and only a slightly longer timeframe to scale them to commercial success. What strategies can they follow that helps them start off the blocks quickly?

Our framework provides them a template to arrive at such a strategy.

We have built the framework for the 2020-2025 timeline. Why 2025? By this time, the three key disadvantages that EVs have compared to conventional vehicles – their high cost, their low range and long charging times – are likely to have been significantly mitigated or even overcome. A growth strategy past this date will hence need to be entirely different.

But the 2020-2025 period is crucial for India's e-mobility sector. Efforts during this timeframe will lay the e-mobility foundation for India; significant growth during this period – in spite of challenges – could hence transform the growth chart and the country's competitive positioning in the global EV ecosystem post 2025 too. A similar trajectory awaits Indian startups – those that are able to start with the right product-market fit could be in a position to achieve exceptional growth and market domination post 2025.

This white paper is for all the stakeholders, especially startups, who wish to get that good start now in India's e-mobility sector.

While acknowledging the tremendous efforts put in by planners and researchers from both government and industry towards analyzing the e-mobility sector, we feel that our approach to analyzing the Indian e-mobility sector and deriving a set of actionable insights for EV growth during 2020-2025 could provide useful decision-making tools to all stakeholders – industry, government, end users, startups and investors.

¹ Source: <https://economictimes.indiatimes.com/two-wheelers/with-fame-harder-to-come-by-electric-2-wheeler-sales-crash/articleshow/71697728.cms>)



Our approach identifies EV products and solutions that can succeed in the short and medium term with just moderate incentives and external support. Conceptually, the framework is centered around this principle: It is a lot easier to gain momentum when you get the wind in your sails compared to what it is when you sail against the wind.

The Framework



Our approach and the resulting analysis framework comprise the following dimensions:

01

End User Needs & Benefits

This represents need satisfaction & benefits to specific end user sectors from electric vehicles.

02

Different Types of Electric Vehicles

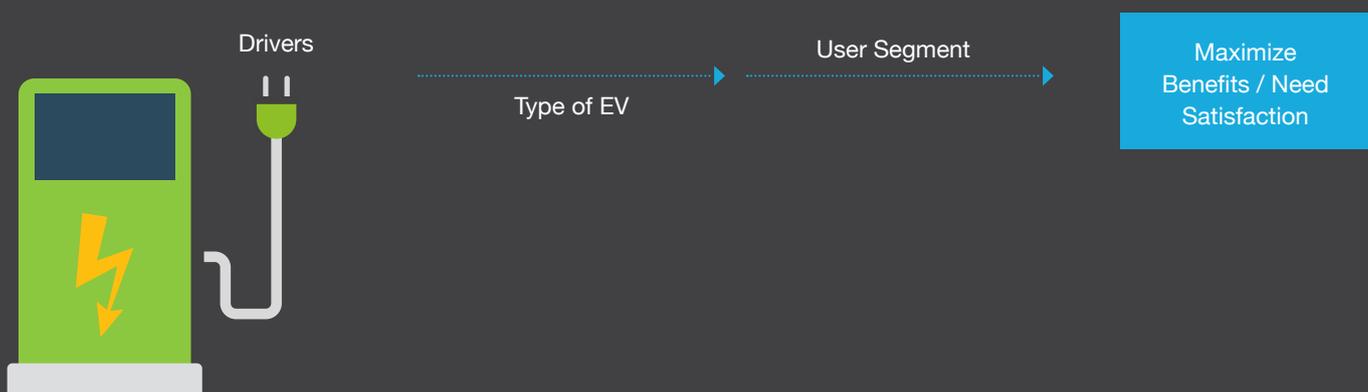
Electric vehicles comprise a wide range of transport – from a low-powered electric bicycle used for micro-mobility to a 40-ton truck that could travel inter-city. An appreciation of such a wide variety of vehicles used for a variety of purposes could lead to useful insights

03

Drivers

Finally, there's the tool-box. This comprises objects that can be used or acted upon by government (ex: policies and incentives), industry (ex: design, use of specific tech such as a hybrid or retrofit), support providers (ex: better testing and standards to enhance the perceived safety). It will be wise to select the tools such that they maximize benefits & minimize challenges for the end user through focus on an effective combination of user segment and product, and by leveraging the trends in transport and related ecosystems.

The key question that the framework answers is: What drivers should be used, and on what types of electric vehicles in order to deliver differentiated and valuable benefits to specific end user segments?



Answering this question will also require an understanding of the following:

- **EV Value Chain Components** – From mining of raw materials in the form of Lithium or cobalt all the way to EV maintenance and operations, the value chain components for EVs comprise a number of stages. A deeper understanding of these stages, their impact on the overall user value proposition, and the degree of control entrepreneurs or startups have over them will enable startups to focus on the right value chain components.
- **Trends in Transport, Energy & Technology** – E-mobility is part of a much larger transport ecosystem that today – in a shared and connected world – thrives in the dynamic intersection of fast-changing transport habits, design, renewable energy, and digital technology. Investments, policies and entrepreneur efforts that leverage these trends have a much higher chance of success.

- **EV Challenges** – The main challenges to the faster adoption are well-known – high vehicle cost, low range and long charging times for batteries. But there are a few other challenges, mitigating which, could lead to faster adoption. The drivers should be applied such that they are able to either mitigate or overcome these challenges.

The framework will be most valuable to startups who can use it to build more effective products and solutions, though investors (who can use it to evaluate businesses and startups) and policy makers (who can direct financial & non-financial incentives better) can also benefit from it.

Let's start with an understanding of needs & benefits.

Needs & Benefits



Stop selling, start helping - a fairly insightful statement. If you provide a benefit that the customer really wants, sale is a certainty (without the need for large external incentives).

It hence is useful to first identify key market needs that e-mobility can satisfy.

Environmental Needs 	Non-environmental Needs 
<ul style="list-style-type: none"> • CO2 emissions reduction • Air pollution control • Making a green statement 	<ul style="list-style-type: none"> • Economic (cost) benefits • Ease of use • Health benefits • Energy security & lower oil import bill

Control of vehicular CO2 emissions and air pollution are the most recognized benefits from e-mobility. Economic benefits from lower running costs and showing one's commitment to green are the other benefits that are also fairly appreciated. Energy security is a benefit that government stakeholders relate to better than any end user segment.

There are two benefits listed above that are rarely discussed or leveraged: Ease of use and health benefits. But these two benefits, and the needs they satisfy, present attractive opportunities for startups as we will see from details in subsequent sections.

User Segments



A large proportion of India's population can use EVs in theory, but only a few sub-sets have the potential to become users in the 2020-2025 timeline, because these are the segments for whom clear need satisfaction exists even in the business as usual scenario. While a few other segments can be prospects during this period, penetrating those markets could require significantly more external drivers than these would.

The following are the segments that have strong potential for the 2020-2025 period.

Domestic Sector		Commercial & Industrial Sectors			
Middle class home-makers	Wealthy individuals with fitness needs	Private fleet for captive use	Private fleet for public transport	Light Commercial Vehicles	Government fleet for public transport

- **Middle class home-makers** – Mainly home-makers who undertake many local errands
- **Wealthy individuals with fitness focus** – individuals from the upper middle class and high-income categories keen on fitness activities
- **Private fleet for captive use** – Includes both corporates (Eg: captively used buses for ferrying employees) and commercial enterprises (Eg: food delivery companies using e-scooters)
- **Private fleet for public transport** – Refers to both privately owned 4-wheeler or 3-wheeler fleets (large cab or auto rickshaw companies) and vehicle aggregators (Ola/Uber)
- **LCVs** – Refers mainly to light vehicles used for intra-city goods transport (Eg: Tata Ace)
- **Government fleet for public transport** – Refers mainly to intra-city government buses

The User – Benefit Matrix



Understanding benefits that matter for specific user segments enables one to drive EV adoption in a focused manner. But which benefits are relevant for which user segments? The matrix explains.

In the matrix, the terms High, Moderate, refer to the extent of relevance of the corresponding benefit for the user segment.

Need/Benefit	Domestic		Business/commercial			
	Middle class home-makers	Wealthy Individuals with fitness focus	Private fleet for captive, commercial use	Private fleet for public transport	LCVs	Government fleets for public transport
CO2 emissions reduction	Low	Low	High	High	High	High
Air pollution control	Low	Low	Moderate	High	High	High
Green statement	Low	Moderate	High	High	Moderate	High
Economic benefit	Low	Low	Moderate	Moderate	High	Low
Ease of use	Moderate	Low	Low	Low	Low	Low
Safety	Moderate	Low	Low	Low	Low	Low
Health benefits	Low	Moderate	Low	Low	Low	Low



Notes for select items from the table:

*: Ease of use for this segment arises from the fact that slow electric vehicles (sub 25 Km/hour speed) need no motor license; in addition, their low speeds enhance the overall safety for seniors, and for women carrying children.

** : The health benefit could accrue from the use of pedelecs (pedal assisted electric bicycles) that could be used for exercise bicycling by many in the upper strata of the society.



From among the segments, private fleets, LCVs and government fleets present significant potential, as EVs can satisfy multiple needs for these segments. The potential of these segments is already well-known for most stakeholders. What is not clear is which drivers to use for these segments, and for what EV products, to offer maximum benefits to each.

The surprises from the above table come from the domestic user segments. There are two sub-segments that many OEMs do not focus on today – middle class home makers and fitness-focused individuals from higher income groups. For the former, ease of use and safety are unique benefits that no other motorized vehicles provide. For the latter, pedelecs offer a “cool” way for fitness activities, a unique benefit not available from any other vehicle.

At a broader level, the key takeaway from the above matrix is that startups will do well to map the needs of user segments, and even sub-segments. Because, if segments where EVs can satisfy clear needs are identified, adoption for these can happen at a fairly rapid pace during the 2020-2025 timeline even with the current constraints and challenges, and with only moderate external incentives!

Apart from need satisfaction, here's another important reason why the above segments have significant potential: for all of them, at least two of the three main challenges that electric vehicles have today (high cost, low range, long charging times) are minimal or non-existent with current technology and cost structures.² For both sub-segments under the domestic sector, none of the three challenges is significant³

For all the segments above, because EVs provide them clear benefits and EV adoption do not pose very difficult challenges, applying even moderate external drivers could significantly enhance EV market penetration. A startup targeting these segments could thus succeed even with a limited marketing budget and with only moderate help from government.

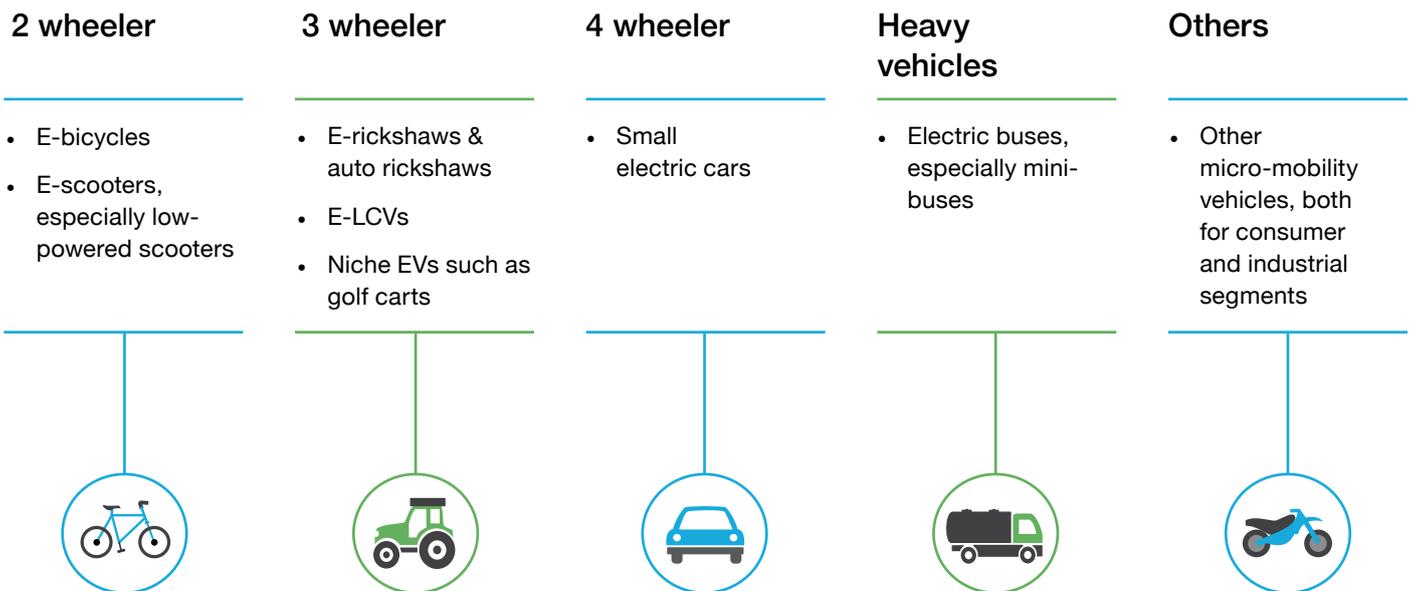
EV Products



If there are end user segments that can derive significant benefits from EVs even with their current constraints, what products could be ideal for each segment?

On paper, there is a wide range of electric vehicle possibilities. Many of these could succeed in the market if there are significant external incentives, or if there are some unanticipated technology breakthroughs, or if we simply wait long enough.

But, if we are keen to identify the products that have the potential for good market penetration under the business as usual scenario for the 2020-2025 period, they would be the following:



2 Because all of them are for local, short distance travel, battery range and battery charging times are likely to be less critical challenges

3 In addition to the range and charging times not being serious challenges, high price of EVs is unlikely to be challenge for either of these sub-segments – for the middle class home-maker the low-tech scooter's cost is fairly affordable, and the high-income user is fairly price insensitive

Here's a common thread that runs through most of the products in the list above: Many of these are "low-tech" and "low-feature" versions in their corresponding segments – low-powered scooters, e-rickshaws, small cars and mini-buses (the exception is e-bicycles which are targeted at the premium user).

These low-tech versions however provide clear benefits to user segments which are sizable; besides, their low-tech nature make them far more affordable than high-end EVs. Surely this a powerful combination to facilitate quick market penetration?

“ This dominance of “low-tech” and “low-feature” in our framework is contrary to what many startups and even many government stakeholders are aiming for – higher-end versions with higher power, high-end designs and premium markets. ”

Drivers



As the final dimension in our framework analysis, we explore external drivers that can accelerate EV adoption.

A range of drivers exist (and many of them are also being employed) to accelerate EV adoption. The prominent ones are listed under broad categories.

Tech/Engineering/Design drivers	Operational drivers	Policy drivers
<ul style="list-style-type: none"> • Vehicle design • Fast charging • Hybrids • Vehicle intelligence & analytics • Intelligence & analytics for charging/swapping stations • Retrofitting conventional vehicles • Customized battery packs/BMS design 	<ul style="list-style-type: none"> • Use of renewable energy sources • Battery recycling • Battery swapping • Testing & standardization • Innovative payment schemes • Opex business model* 	<ul style="list-style-type: none"> • Dynamic electricity prices** • Government subsidies & tax incentives • Bank financing rate • Non-financial incentives (reserved parking lots etc.)

* The Opex (operational expense) business model converts the upfront cost of purchasing an EV (a capital expense) into a recurring, operational cost (an operating expense). This is typically done by charging the user for using the vehicle, rather than for an outright purchase.

** Dynamic electricity prices, typically based on time of charge, could provide benefits both to EV owners (through lower rates) and power utilities (through a lower peak demand) by letting EV users charge their vehicles during off-peak times of electricity demand.

Except for a few drivers (government subsidies, testing etc.) that are not in the hands of private firms, the rest can be employed by any stakeholder, either directly or through partnerships.

The drivers listed above are well-known. What is challenging is to determine which of these drivers are to be used for which user segments and what EV products.



Startups that combine their products with the drivers most appropriate for specific end user segments can achieve significant momentum in market penetration even in the short run.

The User-Product-Driver Matrix



We now know user segments that derive focused need satisfaction from EVs; we also know the various EV products with potential to do well in the short and medium term. Putting these together with the drivers, we arrive at the following matrix that shows the combinations that can have maximum impact on EV penetration.

Key benefits targeted					
Domestic		Business/commercial			
Middle class home-makers	Wealthy Individuals	Private fleet for captive use	Private fleet for public transport	Private goods carriers	Government fleets for public transport
<ul style="list-style-type: none"> • Safety • Ease of use 	<ul style="list-style-type: none"> • Green statement • Health benefits 	<ul style="list-style-type: none"> • Economic benefits • Green statement • CO2 emissions reduction • Air pollution control 	<ul style="list-style-type: none"> • Economic benefits • Green statement • Air pollution control • CO2 emissions reduction 	<ul style="list-style-type: none"> • Economic benefits • Green statement • CO2 emissions reduction • Air pollution control 	<ul style="list-style-type: none"> • Green statement • CO2 emissions reduction • Air pollution control
Product & details					
Domestic		Business/commercial			
Middle class home-makers	Wealthy Individuals	Private fleet for captive use	Private fleet for public transport	Private goods carriers	Government fleets for public transport
E-scooters	E-bicycles	3-wheelers, e-scooters	E-rickshaws, small electric cars	3-wheelers	Mini buses
<ul style="list-style-type: none"> • Low powered e-scooters 	<ul style="list-style-type: none"> • Pedelecs that can be used for micro-mobility and as exercise aid 	<ul style="list-style-type: none"> • 3-wheelers for closed spaces - malls, airports, colleges • E-scooters for food ecomm companies • 3-wheelers for ecomm companies for local transport of goods 	<ul style="list-style-type: none"> • Low-feature versions of rickshaws and cars 	<ul style="list-style-type: none"> • Custom designed for space and ruggedness 	<ul style="list-style-type: none"> • Smaller buses that travel short distances on each trip
Drivers from the current key benefits targets					
Domestic		Business/commercial			
Middle class home-makers	Wealthy Individuals	Private fleet for captive use	Private fleet for public transport	Private goods carriers	Government fleets for public transport
<ul style="list-style-type: none"> • Design for utility • Low interest loans 	<ul style="list-style-type: none"> • Design for aesthetics • Vehicle intelligence & analytics 	<ul style="list-style-type: none"> • Battery swapping • Low interest loans • Dynamic electricity prices for charging • Opex model 	<ul style="list-style-type: none"> • Fast charging for small cars • Battery swapping for rickshaws • Low interest loans • Dynamic electricity prices for charging • Powered by renewable energy 	<ul style="list-style-type: none"> • Design for utility • Battery swapping • Retrofitting • Low interest loans • Opex model 	<ul style="list-style-type: none"> • Fast charging • Battery swapping

One driver we have not included explicitly in the above matrix is financial incentives in the form of subsidies or tax breaks. This is because financial incentive as a driver is relevant for all the above combinations, though its effectiveness will differ for each. Between the two main categories – domestic & business – financial incentives as drivers will be far more effective for the business/commercial sector than for the domestic sector.

Insights from the Framework



The above matrix is a key resource for startups and investors, as it lays out the pathways through which e-mobility adoption can be enhanced significantly in the short and medium term.

An analysis of the matrix raises some interesting questions:



Is low-tech the low hanging fruit?

Sometimes, market disruptions can happen by using “low-tech” or “low-feature” products to cater to underserved segments (think low-cost airlines). In this context, our analysis brings up the opportunity in low-powered electric scooters that could provide unique benefits to home makers, especially women home makers from the middle class. Another example is low-speed e-rickshaws which, when combined with a battery swap model that takes away the battery cost, could convert the traditional manual rickshaw pullers into the e-rickshaw market (this is already happening in Delhi-National Capital Region).

Electric vehicles for health?

The forgotten niche of electric bicycles could have a far higher potential than acknowledged if only it is thought of differently. Electric bicycles, in the form of pedal-assisted versions that can be both pedaled and motor driven (pedelecs), can be specifically designed and targeted at high-income individuals, more as a product for their health & fitness than for mobility.

Why not retrofitting?

Our analyses also bring out the potential for retrofitting as a transition technology to quickly convert a sizable portion of commercial fleets into electric. Interestingly, quite a few e-mobility startups in India have recently started focusing on retrofits

Mini-buses instead of buses?

While bus electrification could make a big difference to reduction of both air pollution and CO₂, could mini-buses be the ideal starting point for this sector rather than large electric buses that are very expensive and will take a long time to charge? With services such as office commute service provider Shuttl becoming more popular, electric mini-buses could have attractive growth markets.

Sub-optimal incentives?

If low-tech and low-feature products are the ones that can drive the market over the next five years, the current incentive structures from central and many other state government policies targeting premium versions appear misplaced. Incentives targeted at low-powered 2-wheelers and 3-wheelers, targeted at middle class home-makers and low-end passenger and goods carriers, might have been a more effective strategy to accelerate sales. FAME II actually did the inverse for the electric two-wheeler market, by making incentives applicable only to expensive vehicles that are more powerful with larger Lithium-ion batteries.

Takeaways from the matrix for the government & startups



For start-ups: Identifying needs for specific e-mobility user segments and building your product and business using the appropriate drivers dramatically enhances your chances of success.

For government stakeholders: If financial incentives are aligned optimally to product-user combinations that inherently have the potential to buy electric vehicles, they are likely to have a far higher positive impact on sales than they would otherwise.



SECTION 2: International E-mobility Startup Trends



There's nothing more deceptive than an obvious fact – Sherlock Holmes

Popular media headlines make us think that electric mobility in developed economies is all about gleaming Teslas and expensive electric buses. But look under the hood and you see that there are a number of startups that have put serious thought into specific end-user segments, identified differentiated benefits relevant for each, and have designed products and solutions accordingly.

As part of our research for this LV PitchBook, we analyzed hundreds of international e-mobility efforts, many of which are startups that have commercial products in the market. Our research covered efforts in over twenty countries spread across North America, Europe, Asia & Oceania.

International E-mobility Startup Efforts - Highlights



An analysis of the international startup efforts shows a fairly strong alignment to the framework we discussed in Section 1. There are many startups, across countries, that have “sharpened the axe” to provide focused and differentiated benefits for different user segments.

We provide highlights of international startup efforts, categorized by the type of benefit.

Benefit: Making a Green Statement

Given the sizable markets in developed countries that appreciate green, it is not surprising to find a number of EV startup offerings strongly aligned to aspirations of these user segments. This is especially true for specific geographies such as California that have a high proportion of proactive, upper income population with strong eco-credentials (in fact, half of all EVs sold in the US are in California).

While e-scooter rental startups such as Bird and Lime are prominent all the way from California to Spain, there are other EV offerings targeting the commercial segments. Rivian, a prominent electric truck startup, is focusing on e-commerce and logistics companies such as Amazon and FedEx.

One common characteristic present among the target user segments is that they belong to the relatively premium category within their sectors.

Target segments: Upper-class domestic users | School, college and corporate campuses | Diverse commercial sectors

Products: Two, three-wheeler electric vehicles | Electric light goods carriers | Electric trucks

Benefit: CO2 Emissions Control

Not surprisingly, many startups targeting this need are focused on the commercial sectors, specifically three user sectors that are large scale emitters of CO2: Truckers, e-commerce firms and logistics firms.

A prominent example in this category is Rivian that is working on electric trucks. The company has as one of its investors Amazon, which recently announced an order for an astonishing 100,000 electric trucks from Rivian through 2030! But Rivian is only one of many startups targeting this benefit. Commercial trucks (both small and large) is in fact one of the most prominent categories being targeted by startups internationally. Some of these startups are exciting, or should we say daring – for instance, the startup Nikola which has already launched an electric truck based on fuel cells.

Target segments: Commercial goods carriers

Products: Mainly electric trucks – small and large



Benefit: Economics

Compared to offerings for premium segments that target the need to “go green”, startup offerings for the middle-class sector target primarily the economics of EVs. An analysis of the offerings show how economic benefits are anchored around not just the upfront cost, but also around running costs and battery charging.

A significant proportion of startups targeting to mitigate the upfront cost of vehicle utilize the “opex model” in its many variants - subscription model, vehicle as a service, lease model, etc. A startup UZE Mobility from Aachen, Germany even offers completely free EV rentals, with revenues coming from advertising displayed on the vehicles.

Startups targeting charging economics currently do so through business models that comprise free EV charging, financial benefits for frequent usage, and incentives for charging using renewable energy sources such as solar power.

Target segments: Predominantly middle-class domestic users

Products: Mainly four-wheelers | EV charging stations

Benefit: Safety

Startups use diverse solutions to satisfy safety and security needs of specific user segments. Many of these safety-specific solutions could perhaps also be applied to conventional vehicles (there's nothing “electric” about these), but it has been the electric vehicle startups that have been at the forefront of deploying these solutions.

Vehicle security needs are being solved using technologies such as IoT and GPS. Many of these solutions are targeted towards electric two wheelers, especially electric scooters that are becoming increasingly prevalent in many cities worldwide. An example is the Los Angeles, USA based Clevr that uses IoT for real-time monitoring and management of dockless e-scooters.

For safety, there are startups that focus on use of IT and better EV designs to enhance safety for specific segments. One such example is the Dublin, Ireland based startup Luna that has developed a telematics device to be used in e-scooters to understand the geography accurately enough to ensure that the scooters are ridden correctly and safely, something that could be useful for seniors, for instance. Another interesting example on safety, this one for the commercial sector, is the offering from the Swedish truck startup Volta Trucks that has significantly changed the electric truck design to enhance driver safety.

Target segments: School and college students | Seniors | Women | Commercial goods carriers

Products: Two-wheelers | Electric trucks

Benefit: Ease of Use

As it was in the case of safety, many solutions offered by startups for ease of use can be incorporated in conventional vehicles as well. There are however two aspects about electric vehicles for which the “ease of use” benefit makes them uniquely electric.

One of them is the EV charging process, which is of course completely different from the way we fill fuel in conventional vehicles. The other aspect is the presence of electric two-wheelers in countries that have been so far predominantly car-based - e-scooters seem to be completely taking over micro-mobility in many cities worldwide!

We see that startups are incorporating ease of use into e-mobility with special focus on these two aspects.

Let's consider an example of how EV charging is made easier. One of the challenges with EV charging is the low number of EV charging stations available in most cities. One way by which startups are mitigating this challenge is by providing a roaming solution for EV users to use EV charging stations provided by different providers – an example of this is the EVGo-Electrify America roaming arrangement announced recently for the US.

A number of creative solutions are deployed to make electric scooters easy to use. Many of them are centered around the ease with which you can find and use shared e-scooters. But there are also other design-based EV solutions that make them easier to use. Netherlands-based Cargoroo has designed an innovative electric two-wheeler with custom-designed space and capacity to carry some cargo or even a couple of children – an ideal vehicle to take for shopping.

Target segments: Diverse sub-segments under domestic sector

Products: E-scooters | Electric cars | EV charging stations



Differentiating for E-mobility – Highlights of International Trends



While not exhaustive, a majority of the highlights provided above are from global startups.

An analysis of the international startup trends shows us what we suspected they would: In many ways, these international efforts have a pattern that is aligned to the framework that we had introduced in Section 1.

Our analyses also show that the key avenues through which these efforts are attempting to provide focused and differentiated benefits. Prominent among these avenues are:

- **Focus on niche vehicles/user segments** – Some of the interesting niches include micro-mobility, vulnerable segments, commercial goods transport, tourists
- **Partnerships – A range of partnerships is emerging, between diverse stakeholders** – OEMs and EV charging providers, utilities and EV charging providers, between multiple charging providers themselves, EV charging providers and digital solutions providers, OEMs and fleets
- **Unique & effective business models** – Borrowing models from the Internet world (freemium) and renewable energy domain (OPEX), OEMs and EV charging operators are fast evolving customized business models to provide benefits to specific target segments
- **Clever use of available technology, especially digital technologies** – From the use of Cloud, AI & IoT for analytics to the use of Blockchain technology for secure transactions, international e-mobility stakeholders are leveraging “commodity” technology to provide premium benefits.

When discussing international research for accelerating e-mobility, most Indian startups try to highlight high-end, complex research for dimensions such as better Li-ion chemistries, better charging (faster DC, wireless charging), or even emerging storage technologies such as fuel cells without highlighting low-touch efforts that have proven successful.

The above trends show however that international research and innovative efforts are also being undertaken in less complex aspects of the e-mobility value chain. A good part of these innovations in fact have much less to do with groundbreaking technologies and a lot more with something far simpler: having empathy for the needs of different user segments!

SECTION 3: Indian E-mobility Startup Trends



When in Rome, do as the Romans do

There are 150+ Indian e-mobility startups currently. There were fewer than 10 in 2015!

Until about 2017, e-mobility was an almost unheard-of term in India. Since then however, the Indian industry has started taking electric mobility seriously.

Simultaneously, a startup ecosystem started taking shape in this sector. From almost nothing just a few years back, there are well over a hundred e-mobility startups in India currently, most of them founded post 2017.

Yet, the Indian e-mobility ecosystem is nascent, and we are at least a few years behind the US, EU and China when it comes to EV adoption. But being a late mover has its advantages; we can learn from the efforts – and mistakes - of pioneers.

With the help of our consulting team, we analyzed over 100 Indian e-mobility startups to get a better understanding of their efforts. We provide brief profiles of some startups which provide differentiated benefits.

Note that some of the prominent startups such as Ather Energy, Tork Motors, Sun Mobility, Ultraviolette are not included in this list. The reason is that many startups and investors are quite aware of these, and we wish to provide a flavor of the relatively less-known startups who also have differentiated offerings.

Profiles of Select Indian E-mobility Startups



01 Altigreen Propulsion Labs

- Founded: 2013
- Founders: Amitabh Saran, Ph.D. (Computer Science) with engineering and business experience; Shalendra Gupta, MBA with finance, business development and manufacturing experience
- Products: Powertrain retrofitting for fully electric and hybrid vehicles
- USP: Hybrid retrofitting for both petrol and diesel options; requires no external charging because of regenerative braking
- Target market: Fleet operators.
- Current Status: Well established, undertaking projects
- Future Plans: Recently received an order to retrofit two hundred 3-wheelers, and developing electric powertrain for tractors
- Funding: Funded by Jupiter Capital and an institutional investor
- Headquarters: Bengaluru
- Website: <http://altigreen.in/>



02 Quanteon Powertrain

- Founded: 2018
- Founders: Venkata Narasimham, earlier with Indian Navy; Neelam Sherawat
- Products: Axial flux direct drive motors for electric vehicles.
- USP: Motors to facilitate in-wheel architecture for EVs
- Target market: OEMs
- Current Status: Commercial
- Funding: Self-funded
- Headquarters: New Delhi
- Website: <http://www.quanteonworld.com/>

04 Pi Beam Labs

- Founded: 2013
- Founders: Visakh Sasikumar founded the company while studying at IIT-Madras
- Products: Electric 3-wheelers with pedal assistance, geared manual 3-wheelers (cargo vehicles)
- Target Market: Factories, industries
- USP: Solar powered electric 3-wheeler. e-vehicles for logistics within industry premises
- Current Status: Series A funded
- Future Plans: Developing electric 2 & 3-wheeler commercial vehicles
- Funding: Funded by Eagle 10 ventures, Blue Hill Capital and high net worth individuals.
- Headquarters: Chennai
- Website: <https://pibeamlabs.com/>

03 Cell Propulsion

- Founders: Nakul Kukar, Paras Kaushal
- Products: Electric retrofitting for buses
- USP: Diesel to electric retrofit for buses and cars
- Target market: Fleet operators
- Current Status: Pilot retrofit kit developed
- Future Plans: Working with BMTC
- Funding: Endiya Partners, angel investors
- Headquarters: Bangalore
- Website: <http://www.cellpropulsion.com/>

05 RevOS

- Founded: Not available
- Founders: Mohit Yadav (background in the automotive industry), Jyotirajan Harichandan
- Products: Tracking and control system integrated into the vehicle. Monitors motor controllers, BMS and fuel injection (hybrid, ICE vehicles). Hardware and software integration
- Target Markets: 2, 3-wheeler OEMs
- USP: Integrated technology company for EVs and also for ICE vehicles
- Current Status: Commercial. Clients include Sun Mobility, OK Play electric, YoBykes (Electrotherm) and Udaan EV; platform is patent pending but company is operational
- Funding: Seed funding round by ITI Growth Opportunities and Chetan Maini of Sun Mobility
- Headquarters: Bangalore
- Website: <https://www.revos.in/>

06 Log9 Materials

- Founded: 2014
- Founders: Akshay Singhal; Kartik Hajela (both have been featured in Forbes Under 30 Asia)
- Products: Graphene based metal-air batteries
- Target Markets: 4-wheeler OEMs
- USP: Metal-air batteries with graphene nanotechnology
- Current Status: Demonstrated their battery working by using it in a Mahindra E-verito
- Funding: Exfinity Venture Partners, Surge Ahead, Metaform Ventures and other individual investors
- Headquarters: Bangalore
- Website: <https://www.log9materials.com/>

07 Meladath Auto Components

- Founded: 2016
- Founders: Rakesh Meladath Karunakaran, Winnie Gangadhar
- Products: Hybrid retrofitting for 2-wheelers
- Target Markets: Retail users, fleet operators
- USP: Electric powertrain with regenerative braking ability
- Current Status: Well-established and recognized by various organizations
- Funding: Investments from Bosch
- Headquarters: Bangalore
- Website: <http://www.meladathauto.com/>

08 Liger Mobility

- Founded: April, 2018
- Founders: Ashutosh Upadhyay (IIT Kharagpur Alumni) and Vikas Poddar (IIT Chennai Alumni). Company incubated at IIT-Bombay
- Products: Self balancing electric scooter
- Target Markets: Retail users, especially women
- USP: Self balancing scooter with infused IOT
- Current Status: Pilot model developed and tested, being showcased
- Headquarters: Mumbai
- Website: <http://www.ligermobility.com/>

09 Revolt Motors

- Founders: Rahul Sharma (Founder of Micromax)
- Products: Electric bike
- Target Markets: Mass market
- USP: AI enabled motorcycle
- Current Status: Delivering their first set of vehicles to the customers
- Funding: Self-funded
- Headquarters: New Delhi
- Website: <https://www.revoltmotors.com/>

10 eMotion Motors

- Founded: 2014
- Founders: Pranav Singanapalli
- Products: Geared electric bike with solar cells for charging, electric scooters & bicycles
- Target Markets: Diversified
- USP: High performance electric bike with 200 km range and cloud integration
- Current Status: Pilot model has been developed and tested
- Headquarters: Coimbatore
- Website: <https://www.emotionmotors.in/>



A few other startups with interesting value propositions are listed below

NAME	PRODUCT	LOCATION	WEBSITE
MobyCy	E-Bicycle fleet	Gurgaon	https://www.mobyCy.com
Alta-Azu E Mobility	Ultrafast charging buses	Bengaluru	https://azuemobility.in
Bhorzvan Motors	Retrofit 2-wheelers, Custom-made motors	Pune	https://bhorzvan.com
Croyance	Retrofit LCV	Bengaluru	https://croyance.co.in
Pixy Electric Cars	Retrofit for jeeps, other limited purpose EVs	Pune	https://www.pixycars.co.in
Orxa Energies	E-bike	Bengaluru	https://orxaenergies.com
Yulu	E-bicycle fleet	Bengaluru	https://www.yulu.bike
Earth Energy EV	Long range cruise bike	Mumbai	www.earthenergy-ev.com
Menza Motors	High performance bike	Ahmedabad	https://www.menzamotors.com
Polarity Smart Bikes	E-bicycles	Pune	https://polarity.in
Srivarumotors	High performance bike	Coimbatore	https://srivarumotors.com
Smado Labs	Foldable bicycle	Kochi	https://tezlaa.com
Ziptrac Cleantech	Li-batteries repurposing, recycling	New Delhi	https://www.ziptrax.in
Ion Energy	Advanced BMS	Mumbai	https://www.ionenergy.co

Based on the analyses, where do we feel Indian startups can do a better job?

 <p>Actual market research</p>	 <p>Partnerships</p>	 <p>Business model</p>
<p>We have been interacting with dozens of EV startups in the past 2 years. While many of them are run by passionate founders, and some of them really good at what they do, we have seen only a few of them actually go into the market and understand customer needs fully. A good many of these companies are operating partly out of intuition and partly based on what they read in the media. We are confident that startups that achieve a superior understanding of user needs will go on to build products that have sustainable competitive advantages.</p>	<p>Indian electric vehicle companies need to really rev up on partnerships. While there have been a few high-profile financial investments in this sector, there have been very few partnerships⁴ based on strategy and business development. This is one aspect where international EV startups appear far ahead of their Indian counterparts.</p>	<p>We are yet to see Indian EV startups employ innovative business models uniquely positioned to overcome challenges and enhance benefits to focused user segments. International startups once again have done a much better job on this aspect.</p>

Finally, how well have the Indian startups used the framework that we had developed in Section 1? It is clear that some of the startup efforts show a strong alignment – be they startups that are working on the relatively “low-tech” retrofitting, those working to satisfy niche user needs such as vehicles for in-

factory logistics, or those targeting segments that value safety features such as self-balancing. But for a majority of startups, we feel that they could significantly increase their chances of success if they spend more time sharpening their value propositions targeted at specific end-user needs.

Indian E-mobility Startups – Highlights of Efforts



We researched over 150 Indian e-mobility startups. Many of them, at least right now, have very little to show for differentiated benefits to specific end user segments. Some of those that do relatively better on differentiated value proposition have been profiled in the earlier section.

Our analysis of this comprehensive list of startups provides useful and actionable insights for both e-mobility startups and for prospective investors.

One aspect that stands out from our analysis is the effort by many of these startups to adapt technologies, products or business models to provide customized specific benefits for the Indian end-user segments. Other aspects on which the startups are providing differentiated benefits are:



SECTION 4: Take-aways for Indian E-mobility Startups & Investors



Order & method, and the little grey cells – Hercule Poirot

Thousands of Indian entrepreneurs are eager to start something in this domain. Hundreds of investors are keen to support them in this journey.

Wouldn't it be highly productive if this exciting ecosystem is able to strategize effectively and lay a strong foundation for the 2020-2025 period that facilitates remarkable growth post that?

We offer some takeaways that could be helpful for the Indian e-mobility startup and investor ecosystem in evolving such a strategy:

OPPORTUNITY IS FOR REAL

E-mobility is a real opportunity in India, and the time to get in is now for both startups and investors.



IDENTIFY LESS RECOGNIZED AND LATENT NEEDS

Find a need that others aren't catering to and fill it – this is a textbook approach, but it almost always leads to success. We suggest that startups allot time to meet prospective users from relevant segments, have empathetic discussions with them, and integrate insights gained about needs and pain points to their business models, tech or designs. If there's only one takeaway we would like to leave startups with, this would be it.



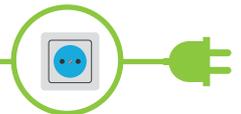
LOOK ALONG THE ENTIRE VALUE CHAIN

Significant startup opportunities may lie outside making electric vehicles, in other parts of the value chain – battery packs, power electronics, other powertrain components, EV charging station components, financing, or even in the downstream of EV value chain (sales & distribution)



INTEGRATE WITH EXTENDED TECH ECOSYSTEM

Rather than consider e-mobility as an electrified version of transport, Indian start-ups would do really well to integrate the rest of the mobility & technology trends – especially Shared & Connected Mobility, Micro-mobility, IoT, Big Data & Cloud – to arrive at solutions and business models that provide significant value to specific user segments. India's expertise in the IT sector would come in especially useful while integrating the above trends.



...BUT DON'T BE DAZZLED BY TECH ALONE

All said, technology is only an enabler to satisfy needs. If there are significant user needs that can be satisfied by low-tech e-mobility solutions - and our analyses shows there certainly are - go for them.



ESTABLISH PARTNERSHIPS

Startups need to look across the value chain for partners who bring complementary assets or skills, and with such partnerships, offer a more enriching solution to the end user



RESEARCH & LEARN FROM GLOBAL TRENDS

A thorough review and analysis of international trends and innovations, and effective learning from these, will be highly rewarding for startups.



About LetsVenture



Founded in 2013 by Shanti Mohan and Sanjay Jha, LetsVenture makes the process of fundraising (early and growth stage) easy, efficient and transparent for both startups and investors. In the last 6 years, LetsVenture has helped 220+ startups raise over INR 600 crore on the platform. Today our marketplace has 6500+ investors from 52 countries, 120+ microfunds, 200 institutional investors and 150+ family offices on the platform. LetsVenture works with startups and investors from discovery, personalised connects, syndication and paperwork closure, followed by quarterly portfolio reporting. We also have a SEBI registered Angle AIF with AUM of INR 120 crore. The 41 people LetsVenture team is based in Bangalore and Delhi. LetsVenture is backed by Accel, Chiratae Ventures, Nandan Nilekani, Sharad Sharma, Anupam Mittal, Ratan Tata, Rishad Premji and Mohandas Pai.

About EAI



Energy Alternatives India (EAI) is a boutique market and management consulting firm operating in the fields of clean energy, environment and sustainability. The company has been in operations since 2008 and has undertaken over 100 detailed consulting studies. Its market and feasibility reports have assisted over 2000 clients across the globe. While EAI has worked on diverse cleantech domains during its decade-long journey, the prominent focus areas have been in biomass energy, solar energy and electric mobility. Know more about EAI from www.eai.in

