Paper 1: Evolving dynamics of competition in the electric mobility sector

WRI INDIA
ROSS CENTER

TRACKING INDIA'S INDUSTRIAL EVOLUTION WITH ELECTRIC MOBILITY

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Photo by: Ather Energy

CONTENTS

Abbreviations

ICE – Internal Combustion Engine

EV – Electric Vehicle

FAME – Faster Adoption and Manufacturing of Hybrid and EVs

IIT – Indian Institute of Technology

NIT – National Institute of Technology

IIM – Indian Institute of Management

OEM – Original Equipment Manufacturer

B2C – Business-to-Consumer

B2B – Business-to-Business

BMS – Battery Management System

PSU – Public Sector Unit

EU – European Union

EESL – Energy Efficiency Services Limited

R&D – Research and Development

MoU – Memorandum of Understanding

NCR - National Capital Region

HPCL – Hindustan Petroleum Corporation Ltd.

NTPC – National Thermal Power Corporation Ltd.

IOCL – Indian Oil Corporation Ltd.

BHEL – Bharat Heavy Electricals Ltd.

KABIL – Khanij Bidesh India Ltd.

BPCL – Bharat Petroleum Corporation Ltd.

EXECUTIVE SUMMARY

Context

The rapid advancement of electric mobility is causing ripples of change in the industrial landscape of India – from automotive and power to renewables and the materials industries. Product development and manufacturing practices are evolving, new players are making a foray into vehicle assembly and allied products, and organizations are being re-structured.

WRI India has identified more than 100 strategic moves made in the Electric Vehicle (EV) industry between 2017 and 2020. Applying a multi-case research methodology, we further analyzed 31 of these strategic moves using the Four-Dimensional Framework of Competitive Advantage[1]. Our goal was to observe how firms are choosing to become more *competitive* as they race to enter the global EV value chain.

We posit that policymakers can play a key role in driving competition, and thereby reap the rewards of economic development – including technological leadership, active participation in the global value chain and developing human capital and resource efficiency.

Key observations

- The majority of firms – in automotive, auto-component manufacturing, lead acid battery manufacturing – are adapting to the electric powertrain technology.
- Non-automotive firms are venturing into new product lines - battery packs and their re-energizing systems (charging/swapping) – and are thereby expanding beyond their parent industries.
- The manufacturing and assembling of electric two-wheelers, and deployment of charging solutions, offer low barriers. As a result, these domains are now attracting interest from non-automotive domains as well.
- Majority of firms are collaborating with other players to outsource manufacturing of products. Developing in-house assembly lines for the final products are seeking lower interest while collaborations and partnerships seem more prevalent.
- Firms have a much greater interest in forward integration. These firms are kicking in a network effect which is essential, for instance, to sell vehicles, attract fleet owners to use charging and other infrastructure, and to access a consumer base that enables the sourcing of waste batteries.
- There is much lesser interest in backward integration such as innovating in-house to designing and manufacturing products and finding cost-effective yet localized substitutes for equipment.
- International partnerships seem more prevalent than domestic partnerships at the moment.
- Regional clusters, which have been limited to the auto-industry so far, are now seeing an increased presence of non-automotive players as well.

Recommended policy pathways

Heavily invest in India's knowledge economy

- Define a skilling strategy that incentivizes movement of talented workforce leading to work opportunities across the value chain of EVs. The Ministry of Skill Development and Entrepreneurship and Auto Component Makers Association (ACMA), along with councils of power, renewable industry etc., could take the lead.
- Ensure that both formal and informal 'Human Capital' contributing to the EV value chain have social security measures at par with those employed in more established industries. This is an area which requires the ministries of Labor, Education and Skill Development to collaborate.

[1] *Adapted from How Information Gives You Competitive Advantage (Porter & Miller, 1985) and Competitive Strategy: Techniques for Analyzing Industries and Competitors (Porter, 1980)*

Put greater emphasis on innovation in India's EV ecosystem

- Encourage state universities to create learning opportunities – via live project-based learning, industry tie-ups – to impart pertinent skills in the incoming talent pool. Such universities can also create re/upskilling centers for workforce interested in joining EV relevant industries.
- The state and/or central government can institute a fund for aggressively driving experimental projects related to EVs and allied products.
- Fund tie-ups between industry and academia, either through the state or central government – and establish milestones for deliverables. Besides IITs, institutes of national importance such as NITs, IIMs and state universities could be explored.

Tap into incoming businesses for opportunities

- Invite international corporates and institutions to set up Overseas Development Centers (ODC) – for both research and development units in states – alongside creating lucrative demand-side incentives to produce volumes of EVs.
- State governments without auto-clusters could focus on inviting firms from industries 'related' to electric mobility.

Incentivize firms creating lucrative and cyclical value chains

- The central government's FAME-2 scheme allows for subsidy based on content manufactured in India; a similar incentive scheme could be put together for innovative EV products developed by companies in India – patents filed from India could be used as an indicator. Both the central and state governments could devise such incentive systems.
- State governments could put in place an additional fiscal incentive (or some form of reward) for closed loop business models and firms whose primary work is to recycle and repurpose batteries.

1. INTRODUCTION

The automobile sector in India is witnessing a technological change with the advent of EVs. However, compared to developed countries, the diffusion of and innovation in electric powertrain technology is in a very nascent stage in India. By 2023, India's passenger EV sales are estimated to account for less than 2% of the total vehicles sold. By 2040, sales are projected to increase to 30%. In comparison, EVs are expected to account for 14% of the total passenger vehicle sales in China and 9% in Europe by 2023 (BNEF, 2020). Despite the high initial costs of EVs and lack of charging infrastructure in India, there exists an economic case for greater adoption of EVs. Lower operating costs, falling price of batteries and longer lifespan due to lesser moving parts make EVs financially viable in the long run. Plus, growth in the share of EV technology holds numerous benefits for conserving energy, improving environmental quality and creating opportunities for economic development in India. Many state and central government policy tools have been developed to realize these effects.

Some of the shifts that are already visible in the EV industry include a new manufacturer (startup) partnering with an established Original Equipment Manufacturer (OEM) to benefit from the latter's widespread distribution network. Yet another example is a new vehicle maker horizontally integrating with a charging equipment manufacturer to provide customers with a prioritized network of chargers across their city. An example is that of established players securing supplies of precious minerals to make battery cells by signing pacts with mining companies off-shore in anticipation of future demand. OEMs are stacking up their bargaining power when scarce raw materials lead to high demand in the future.

Furthermore, while earlier OEMs of Internal Combustion Engine (ICE) vehicles used a B2C model to sell vehicles, the low operating costs of EVs are making them viable for commercial fleet application (logistics, ride-share, corporate fleets) despite high capital costs. As a result, OEMs are now custom-making EVs for fleet companies, following a B2B model. Besides, mergers and acquisitions – such as Ola's recent acquisition of a Dutch electric scooter startup 'Etergo' – demonstrate how an entrant and a non-OEM are competing by expanding into a new and indigenously relevant segment. Ola is also integrating vertically by undertaking activities from manufacturing to delivering rides. Oil and power companies have created new verticals to invest in charging infrastructure and new battery materials.

In addition, the motor in an electric powertrain consists of rare earths, 80% of which are supplied by Chinese companies (Bloomberg, 2019). Rare-earths form the core of many clean energy technologies as well. Given that clean tech firms have a wide network to source rare earths and components made out of them, it is plausible that they can be a supplier to the EV makers (at some point in the value system).

Majority of these examples are from India, but those from offshore will likely trickle down to India over time. Regardless of their origin, the 'shifts' illustrated above will affect an industrial change at the following levels:

Invite new entrants, buyers and suppliers

New actors come with a distinct bargaining power – which is collectively changing the rules of the competition plying in the automotive industry[2] in India. The internal structure of an EV is wholly different from that of a conventional one in terms of raw materials, components, manufacturing processes, enablers (the internet, cloud systems, data) and services that cater to altered ways of driving, re-charging and maintaining the vehicle. Besides, it is altering prevailing processes and products offered by the power, renewables, battery (lead acid) and auto component industries.

[2] *The auto industry in India, like in many parts of the world, consists of vehicle assemblers and component suppliers. Auto assemblers include players such as Mahindra and Tata Motors, who are the Original Equipment Manufacturers (OEMs). Beyond OEMs, the auto industry in India is structured into three 'Tiers'. Tier-1 firms supply components like engines, transmissions, seats, etc. to OEMs and constitute medium- to large-scale companies. Tier-2 firms feed sub-components to Tier-1 companies; these are typically medium- to small-scale firms. Tier-3 companies constitute raw material suppliers and could range from very large (e.g., Tata Steel) to very small companies constituting job-shops offering specific services like welding/soldering/heating/grinding, etc. Typically, Tier 2 and 3 are located in the form of an umbrella of micro, medium and small enterprises around the vehicle manufacturers, who are their primary consumer. Tier 2 and Tier 3 supply auto-parts worth 60-70% of the total cost of an ICE car, for instance.*

Re-structure organizations

The need for alignment with technological change is prompting firms to re-position themselves on the value chain. Firms are shifting from predominantly upstream activities (manufacturing and assembling of vehicles) to downstream (service delivery, developing consumer networks), and vice versa. To perform these additional activities, firms are also expanding their core capabilities and knowledge base while adding assets and improving their infrastructure at the same time (Murphy, 2000).

Create opportunities for new businesses

With newer products and by targeting new consumer segments, these shifts are expected to help firms tap into newer businesses. Apart from automotive firms, the production of EVs will draw the interest of firms across several sectors, including power, information technology (digitized aggregation platforms, payment gateways), battery storage, electronics, energy and electrical equipment, mining industries, etc.

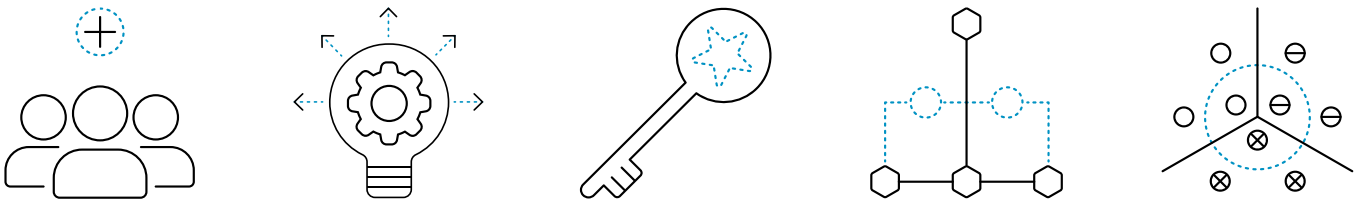
Restructure the industrial order

With new players coming into the industry with new capacities – through a network of suppliers and retailers as well as talent base – the erstwhile industrial order is expected to restructure to fit the new value chain.

Alter the spatial arrangement of industrial clusters

Currently, there are five auto-clusters in India that agglomerate producers and consumers of goods within a span of a few hundred kilometers. These clusters are Pune–Chakan–Talegaon cluster in Maharashtra, National Capital Region cluster, Chennai–Bengaluru–Hosur cluster, Sanand–Hansalpur–Vithalpur cluster in Ahmedabad and Pithampur cluster in Madhya Pradesh (InvestIndia, 2020). Some clusters are dedicated solely to auto-component manufacturing. These are located in Rae Bareilly in Uttar Pradesh, Silchar in Assam and Ahmednagar in Maharashtra (IBEF, 2019). Clustering of business activities assists firms in operationalizing their value chain and thereby delivering goods to the ultimate customer. How firms design their value chains in turn influences the strength of the cluster. The value chain of a conventional vehicle in India comprises of OEMs and the auto component suppliers in tiers 1, 2, and 3 of the auto industry, who work in tight symbiosis with the OEMs. Increased role of foreign players in supplying electric powertrain components (for example, lithium batteries and permanent magnet-based motors) and Internet-based communications will disperse the boundaries of these clusters. Previously hyper-regional production networks will now 'slice through' global networks (Edgington, 2009).

Figure 1 | Industrial shifts in the rise of electric mobility in India



The aforementioned shifts are known to produce long-range and macro impacts, such as on India's technological leadership in the arena of electric mobility, creating spillover effects on adjacent industries (e.g. lean techniques of manufacturing automobiles having a ripple effect on other industries) and shaping the spatial and economic features of industrial clusters in the country (OECD, 2008).

Government estimates indicate that the auto industry and its ancillaries contribute about 7% of India's Gross Domestic Product (GDP). It has also generated 37 million direct and indirect jobs (InvestIndia, 2020), which stand to be impacted with the switch to EVs.

Competitiveness in industries also influences the strength of industrial agglomerations, with India's auto clusters being a case in point (Institute of Strategy and Competition, 2020).

Given that the diffusion of electric powertrain technology stands at a very nascent stage in India, it is hard to fathom the direction and magnitude of macro impacts just yet. However, firms have begun displaying new behaviors to increase their competitiveness. These aren't predictable yet. They are occurring in the form of sporadic activities.

In this paper, we track the new behavior of firms – in particular, how they choose to become more competitive to gain an advantage as electric powertrain technology commercializes in India. This exercise is intended to be a first step in understanding the larger industrial shift and economic implications of the transition from ICE-based to electric powertrain-based vehicles in India. Specifically, this paper is looking to drive conversations that inform policymakers on creating a conducive environment for innovation on electric mobility products for domestic and export purposes, thus encouraging active participation in the global value chain.

This paper is the first of a four-paper series. The second paper will focus on the electric mobility value system. Subsequent papers will cover the evolution of occupations and skilling needs with the ascent of electric mobility and how policymakers ought to approach this change.

The paper is organized as follows:

- **Chapter 1** provides an introduction.
- **Chapter 2** discusses the research objective.
- **Chapter 3** illustrates the framework for analyzing the new behavior of firms.
- **Chapter 4** covers the methodology.
- **Chapter 5** presents the key results that are based on 31 case write-ups which are appended in Annexure 1.
- **Chapter 6** concludes the paper.

2. OBJECTIVE OF THE PAPER

The objective of our paper is to study how new and existing players in the electric mobility value system are heeding to the need for competitiveness. As technological change takes place with the proliferation of the electric powertrain in the Indian market, this paper is an attempt to track early movements of the firms in electric mobility ecosystem using the framework of 'Competitive Strategy' and drive policy conversations.

Specifically, our goal is to understand – *"How are new and established firms expanding the scope of their competitiveness with respect to EVs and associated industries?"* The term 'firm' here refers to establishments including power, renewable, automotive, auto components (motor, transmission, peripherals), battery storage systems, telematics, power electronic industries. We cover firms of small, medium and large sizes.

In the process of answering the above questions, our paper intends to offer the following:

- A methodical deconstruction of a sample of firms in electric mobility domain to show how their strategies vary with firm size and nature of primary business.
- Our paper also lays out how firms are re-structuring themselves to attain competitiveness.
- A micro-level view of the type of industries and organizations participating in the electric mobility value system. In the case of small-scale players, we attempt to explain why the entry barriers have decreased (for example, startups). We also attempt to explain why some firms choose to cooperate instead of competing through innovation.
- Finally, identify policy pathways for driving competition in EV industry in India

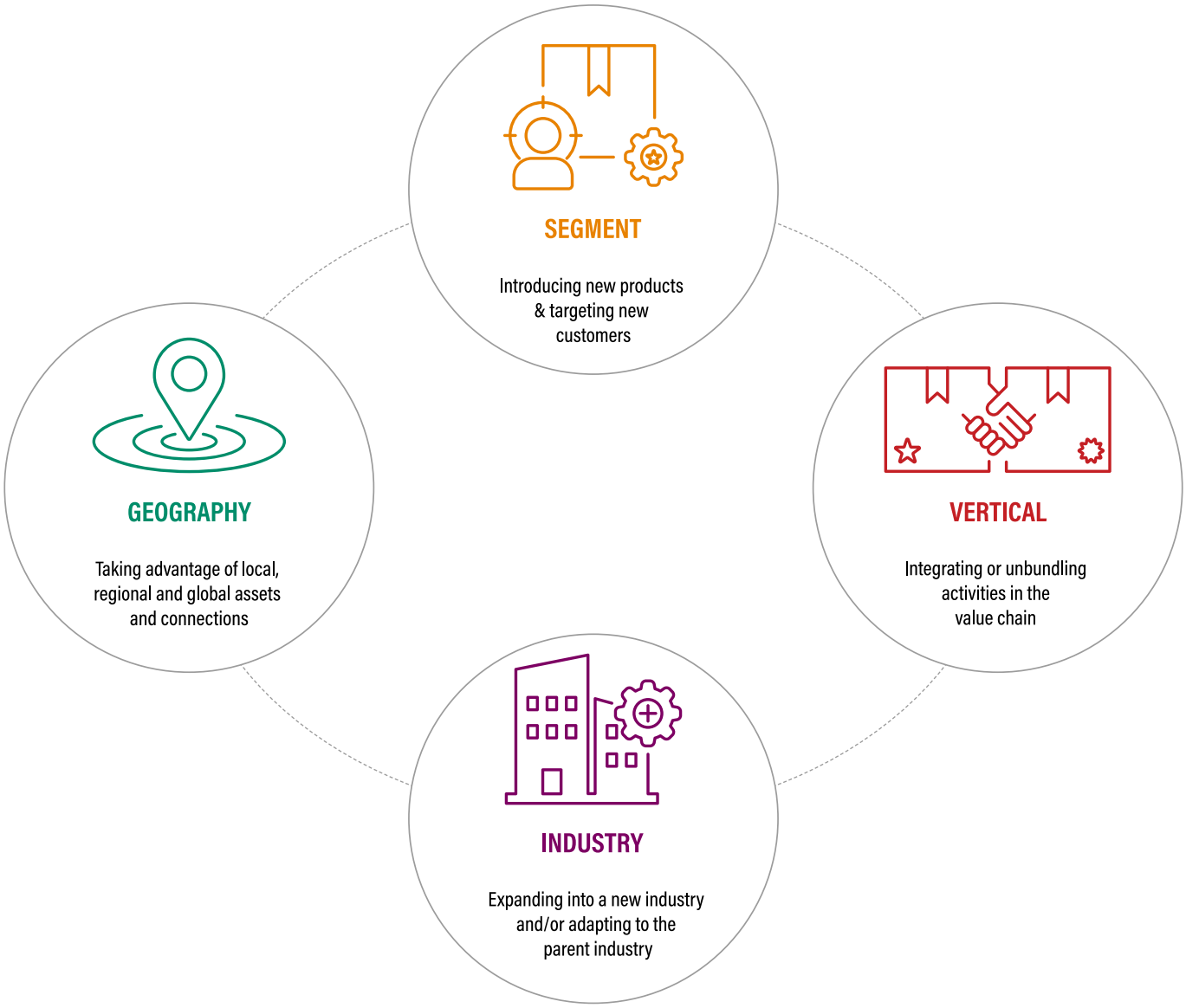
Competitiveness – as a theoretical and practical topic – is the core of our paper. There are many definitions of 'competitiveness' but typically, it is the ability of an establishment to acquire more wealth than its competitors in the market. Competitive markets have many positive economic impacts. Competitiveness can be studied at the scale of an organization, a sector (or industry), a region (cluster), or economy (country scale). We study competitiveness at the scale of an organization in this paper.

3. FRAMEWORK: FOUR DIMENSIONS OF COMPETITIVE SCOPE

New and established firms are employing a host of moves to make their foray into electric mobility. In the earlier sections, we have illustrated empirical examples of how firms operating in the value system of electric mobility are expanding the scope of their competitiveness. Their strategies consist of four dimensions (Porter & Millar, 1985) – ***segment*** (product, user), ***vertical*** (integration), ***geographic*** (regional, local and global) and ***industry*** (related industries). We use the 'Four Dimensions of Competitive Scope' (referred to as "4D Framework" from here on) – as the primary framework (see Figure 2). We use this framework to first dissect the competitive strategy of 31 firms – this is a micro-level exercise. We then collectively look at the findings – this is a macro-scale exercise – and derive integrated insights on the electric mobility domain for policymakers. For instance, with the lens of SEGMENT, we map which new product segments (for example, two-wheeler, public charging equipment, etc.) are drawing investment from firms. Similarly, by viewing the players from the lens of VERTICAL, we identify whether new and established firms are outsourcing design and manufacturing activities, or if they are investing in new capacities to manufacture EVs and allied products. Furthermore, we also map the original industries and geographies from which the firms evolved to enter the e-mobility sphere. We offer insights relevant to policymakers in Chapter 6 of the paper.

In the following pages, we explain each of the dimensions, along with activities that indicate use of a particular dimension. In subsequent chapters, we apply the 4D framework on actual cases to make practical observations. Table 1 lists indicative examples of how firms employ the four dimensions.

Figure 2 | '4D Framework' – Four dimensions of competitive scope used to study early movements of electric mobility firms in this paper



Segment

This dimension comes into play when a firm offers a new product or a significantly improved version of an existing one. This happens, for example, when a battery manufacturer offers battery management systems as an integrated offer to its consumer base; or when an electrical equipment maker ventures into EV manufacturing; or when a firm adapts its product line for a new user segment; or when an Indian engineering company offers powertrain monitoring system to an overseas customer base. Firms entering into partnerships to penetrate deeper into their existing customer base, thereby increasing demand for their product, are also counted to be employing the dimension of 'segment' in their competitive strategy.

Examples:

- Mahindra customizing EVs for shared fleet operators
- Power companies serving additional commercial clients like office buildings whose disciplined electricity use behavior makes bi-directional grid a viable proposition.

Vertical

This dimension is employed when firms integrate or unbundle their value activities. Integration goes beyond just insourcing activities. It extends from manufacturing components to vehicle assembly to the final delivery. We look at integration in comprehensive terms covering, partnerships like joint ventures, Memorandum of Understanding (MoUs), mergers and all agreements that firms undergo.

Some of these pacts assist firms in safeguarding upstream activities such as assured supply of raw materials and components (also known as backward integration) in times of crises. Others serve downstream activities and equipment that form the channel to sell and support the vehicle and its owner (forward integration). More so, the norms around integration of upstream and downstream activities for making conventional vehicles[3] in India are now fairly predictable. But in the case of EV makers, the choice of activities performed in-house versus outsourced will differ. While looking for indicators of 'vertical', we recognize that in most instances, forward and backward integration are quasi in nature. Full integration comes with risks, more so with a nascent technology.

Examples:
- Ola acquiring a Dutch two-wheelers maker to begin manufacturing electric two-wheelers in India

Geography

When a firm uses 'geography' to expand its competitiveness, it either moves some of its operations to a new location or chooses not to relocate and instead carves out joint ventures, acquires firms to access their innovation in EV technology and buy minority stake in firms situated in a geography of significance.

Each geography, whether a cluster, region (sub-national or local) or nation, encapsulates a set of advantages for businesses. Some regions allow firms to gain proximity to other players with whom they combine operations, get assured supply of sub-components, high-performing technologies and even obtain raw materials that is crucial to their end-product. For example, the automotive clusters in India offered such advantages, but this is set to change[4]. Yet other geographies place firms in proximity with relatively mature markets where they can sell more EVs and allied technologies. We count these as indicators of firms leveraging the geographical dimension of competitiveness.

Examples:
- International charging / swapping infrastructure manufacturers signing pacts with power and oil retail companies like HPCL, IOCL, NTPC (new players themselves)
- Buying stakes in offshore mines of lithium and cobalt (Khanij Bidesh, a joint PSU)

Industry

We can identify three clear indicators here: One, when a firm is growing its presence in its existing industry by means of a major product, a technological breakthrough or through a partnership with another leading player. Two, the fundamental offering of a firm is near-obsolete (owing to technological, policy and social change) and they adopt a new generation of technology to retain their footing in the industry. Automotive players making ICE vehicles are a case in point. Oil companies would also fall in this realm. The third realm consists of firms that are considered outsiders but expand into a new industry. The onset and adaptation to technological change gives a newfound relevance to the firm and its products.

Examples include electricity distribution companies and electrical equipment and data analytics for battery systems. Such firms are known to heavily employ their existing organizational capacity[5] to serve the new industry (Murphy, 2000). As firms expand into new industries, some degree of organizational re-structuring is inevitable.

Examples:
- Battery pack manufacturers serving vehicle makers, renewable generation companies, as well as individual customers for stationary storage devices

[3] Hero Motors, for instance, has several captive suppliers who exclusively make components for Hero's conventional two-wheelers. This is an example of quasi-vertical integration. In contrast, Honda Scooters (Hero's erstwhile partner) supports vigorous competition in its tiers 2 and 3 suppliers (Barnes, 2018).

[4] Up until now, automotive clusters have geographical agglomeration of activities, helping the firms co-locate in and around clusters to cooperate and compete. For example, In 2015, Mahindra imported less than 3% raw materials and components for making ICE vehicles (Barnes, 2018). A comparison of EV and ICE vehicles shows that a move away from localized sourcing is impending. Manufacturers of battery storage systems (and BMS) will supply around 43% while those supplying power electronics components will supply 11%, whereas traditional auto-component makers (Tier 2 and Tier 3 in India) will supply 44% of the vehicle content (60-70% originally). Bargaining power of tiers 2 and 3 suppliers will reduce (Saraf, 2017).

[5] Organizational capacity is known to be decisive for the competitiveness of a firm. It includes the ability of a firm to employ its resources to meet the "current needs of the market and anticipate upcoming needs as well". Firms with organizational capacity will have change capability, organizational culture, concrete machinery and materials, and inter-organizational connections.

Table 1 | Indicative examples of the four dimensions of competitive scope

Indicative examples of how firms use the four dimensions of competitive scope	
SEGMENT • Mahindra customizing EVs for shared fleets • Power companies serving additional commercial clients whose disciplined electricity use behavior makes bi-directional grid a viable proposition	**VERTICAL** • Mining companies in Latin America entering downstream and Australia spawning downstream industries • Ola acquiring a Dutch Scooter maker to begin manufacturing electric two wheelers in India • OEMs building multi-modal digital platforms as a point of entry in the service (Mahindra's Glydd)
GEOGRAPHY • International charging / swapping infrastructure manufacturers signing pacts with power and oil retail companies like HPCL, IOCL, NTPC (new entrants themselves) • Buying stakes in offshore mines of lithium and cobalt (Khanij Bidesh, a joint PSU)	**INDUSTRY** • Battery pack manufacturers serving vehicle makers, renewable generation companies, as well as individual customers for stationery storage devices

4. METHODOLOGY

We have employed a multi-case research method in this paper. We first scanned the news and data published by media outlets and automotive data portals to glean strategic moves made by firms between 2017 and 2020. These firms are on diverse scales and originate from diverse parent industries. We collected a total of 110 strategic moves. We distilled the list down to 31 moves; there was no random selection, rather we consciously picked cases from disparate industries engaged in electric mobility. This was essential to obtain a comprehensive view as the electric mobility value system is systemically different from that of a conventional vehicle. We restricted ourselves to studying 31 moves to remain within the scope of this paper.

4.1 Preparing cases with 4D framework

Once a list of cases was drawn, we used the 4D Framework to dissect each case. We ranked each of the four dimensions based on the intensity (rank 1 to 4) of their contribution in the firm's move. We also took note of overlaps between dimensions – in the event where support of one dimension is integral to optimizing another. For example, reaching a new consumer base needs a country-wide retail network.

We used publicly available data – ranging from mainstream media outlets to presentations made by firms during webinars to Marklines which is an automotive data portal. We did not conduct individualized interviews for any of the 31 cases. All the case write-ups are appended in Annexure 1.

Each case write-up begins with a background of the firm and their strategic move. It is then followed by evaluating the intensity of the four dimensions. We also determined how the location of the firm shifts (or does not) in its value chain and whether the move allowed the firm to expand into an altogether new value chain. We also identified if there are pre-existing public policy tools that overlap with the firms undertaking the strategic move.

4.2 Collective analysis of the cases

First, we categorize the 31 cases based on their Turnover (TO), Total Income (TI) and Revenue (Rev). Table 2 shows the resulting six categories.

Next, for each company, we assess which dimension out of the four is most noticeable or 'most prominent'. This depends on the strategic move that the company is making, as highlighted in the case studies in Annexure 1. Let us, for example, say that the dimension of INDUSTRY is most noticeable in the strategic move of Company A, followed by the dimensions of VERTICAL, GEOGRAPHY and SEGMENT.

Industry is Rank 1 = 4 points
Vertical is Rank 2 = 3 points
Geography is Rank 3 = 2 points
Segment is Rank 4 = 1 point

We do this exercise for all 31 cases, and calculate the total points accumulated for each of the four dimensions. For example, if industry is rank one for 3 companies, rank 2 for 1 company and rank 4 for one company, the total points for it would be: 4+4+4+3+1 = 16. The advantage of the point system is that it looks at the overall performance of a dimension, and not just in majority instances. If, for example, total points collected in INDUSTRY are greater than say VERTICAL, it implies that collectively the 31 firms use INDUSTRY as a more prominent dimension to be competitive, more so than VERTICAL. Such key findings are given in Chapter 5. Note that we also categorize the 31 firms as per their turnover – in Table 2 – to understand the drivers of competition in firms of relatively similar scales.

4.3 Limitations

Given a statistically small sample of 31 cases, the collective findings cannot predict the competitive strategies that firms will adopt in the future (near or far). This means a larger sample of cases would be needed to produce generalizable results. Secondly, it is likely that some of the firms may re-think their strategic moves to tackle the adverse economic effects of the COVID-19 pandemic. These updates may not immediately reflect in this paper, but as and when they are made public, the authors will try to revise the paper.

Table 2 | Categories of firms generated from the 31 cases

CATEGORY	BASIS
1	**BIGGEST** - TO >100000cr Rev >92000cr
2	**BIG** - TO >27000cr Rev >30000cr
3	**MEDIUM** - TO >8800cr TO <12000cr Rev >1000cr
4	**SMALL** - TO >3000cr TO <5000cr TI >5000cr TI <7000cr
5	**SMALLER** - TO >1000cr TO <2500cr Rev >500cr TI >1000cr TI <2000cr
6	**StartupS** - TO <1000cr Rev <500cr

***Assumptions**

- Manikaran - Revenue >500cr
- Ola Electric – Just looked at the revenue of this firm, not the parent company
- KABIL – fairly new

5. NOTABLE RESULTS AND OBSERVATIONS

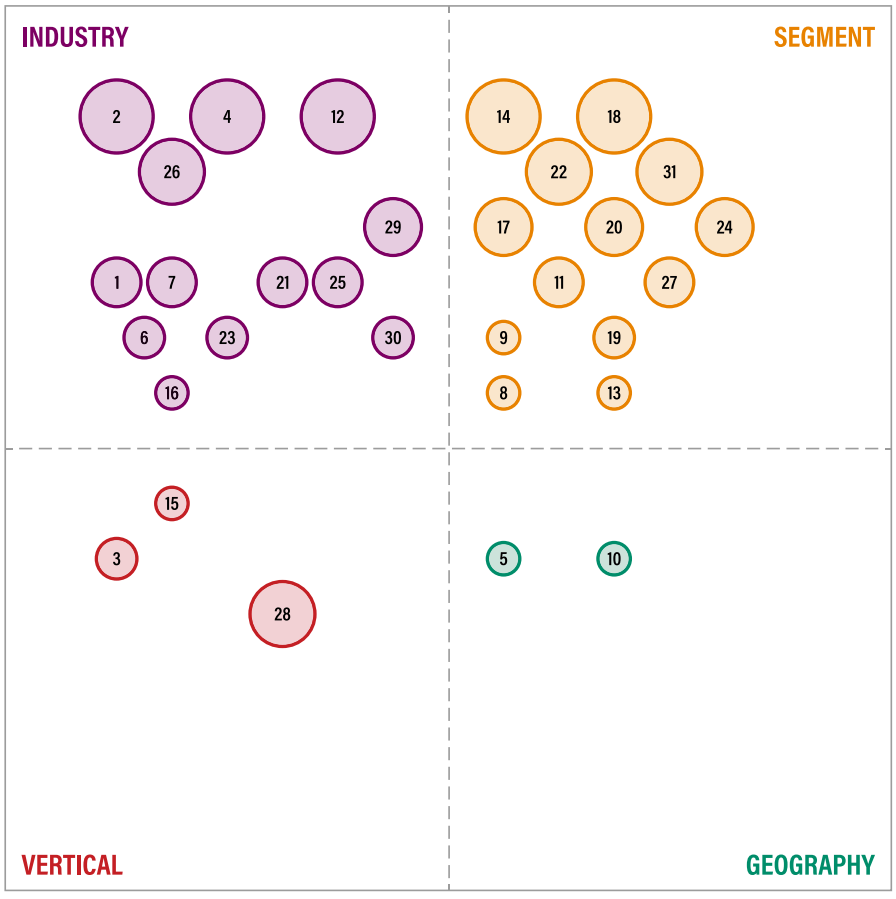
Overall, INDUSTRY and SEGMENT seem to be the most prominent dimensions for attaining competitiveness in the domain of electric mobility in India.

The quadrants of INDUSTRY and SEGMENT, as seen in Figure 3, are more densely populated than those of VERTICAL and GEOGRAPHY. However, competitiveness once achieved doesn't become a permanent asset of a firm – irrespective of the industry or technology (Fine, 1998). Neither is the strategy to attain it. The strategy to attain competitiveness must evolve with technology, social and political context and in response to unexpected crises like the COVID-19 pandemic.

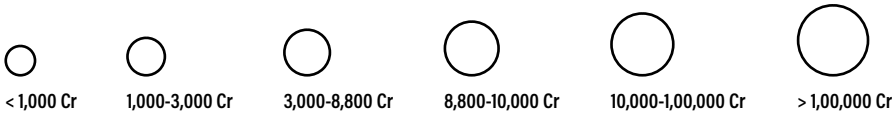
Keeping that context in mind, existing players and those entering the electric mobility domain may find employing tactics based on GEOGRAPHY and VERTICAL to be more effective to attain competitiveness.

Next, we look at each of the four dimensions of the competitive scope one by one, in the following sections. We make observations, with an intent to explain the majority and anomalous behavior of firms. Before we head to the observations, Figure 4 encapsulates the types of activities firms are undertaking under each dimension.

Figure 3 | In the 31 cases, which dimension is most prominently used to make a 'strategic move'?

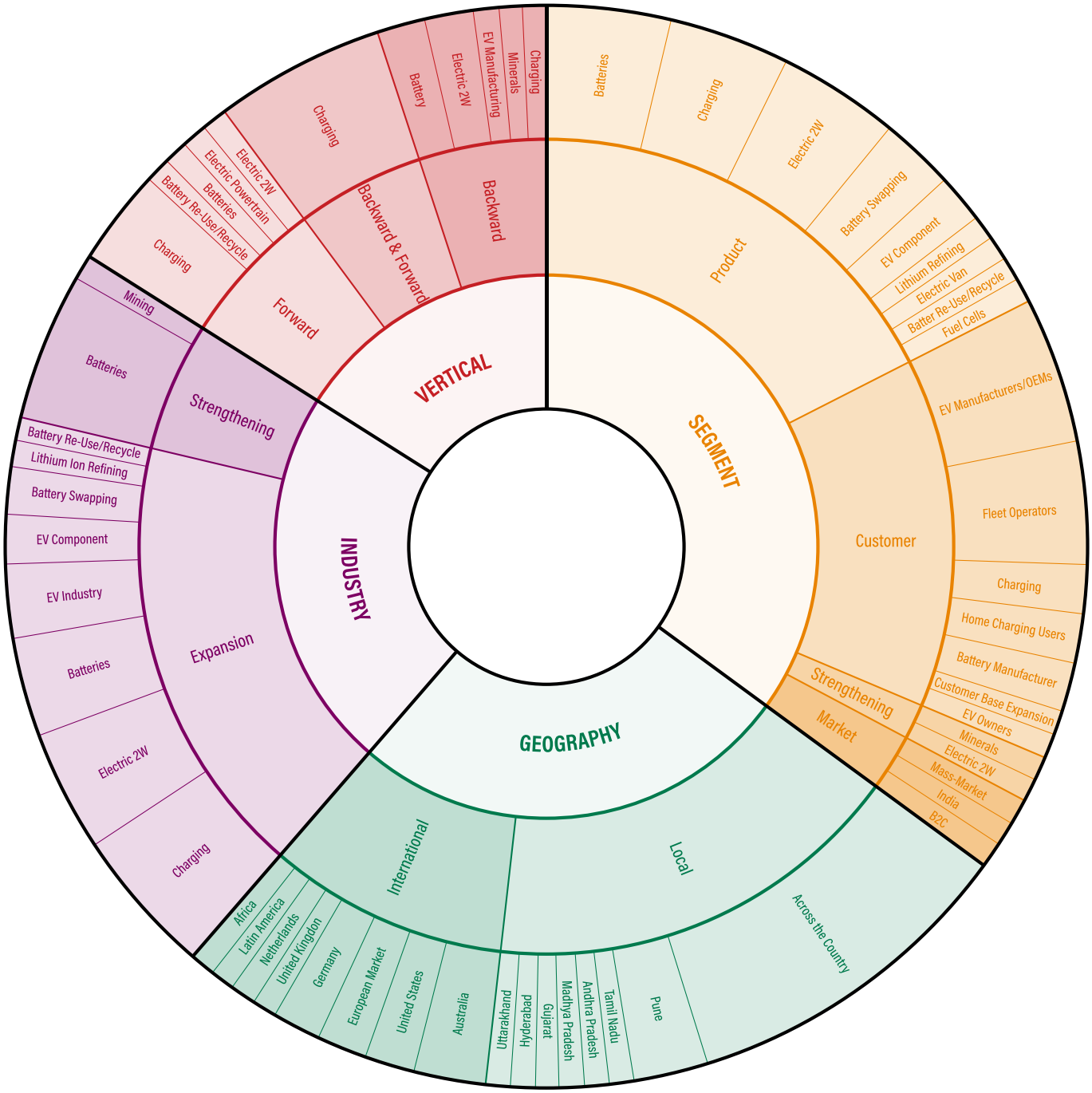


Bubble size indicates scale of a firm



1. RR Global
2. Hindustan Petroleum Corporation Limited (HPCL)
3. Ather Energy
4. National Thermal Power Corporation Limited (NTPC)
5. Khanij Bidesh
6. Greaves Cotton
7. Larsen & Toubro
8. eCharegBays
9. Ion Energy
10. Ion Energy
11. Acme Cleantech
12. Indian Oil Corporation
13. Log9 Materials
14. Bharat Petroleum
15. Ola Electric Mobility
16. Innolia Energy
17. Exide
18. Hitachi ABB Power Grids
19. Exicom Power Solutions
20. Bharat Forge
21. Force Motors
22. Bajaj Auto
23. Manikaran Power
24. Varroc Engineering
25. Amara Raja Batteries
26. Bharat Heavy Electricals Limited (BHEL)
27. Amara Raja Batteries
28. Hyundai Motors India
29. Tata Power
30. Tata AutoComp Systems
31. Bosch

Figure 4 | What types of activities are firms undertaking to attain competitiveness?



5.1 Industry

Nearly 42% of the cases use INDUSTRY as the most prominent dimension, while 26% use INDUSTRY as the second-most prominent dimension. The following paragraphs illustrate our main observations across the 31 cases (see Figure 6).

First, those who use INDUSTRY as the most and second-most prominent dimension are established players (see the first two rows in Figure 6). Majority are relatively large- to mid-scale firms (category 1 to 4 in terms of scale, see Table 2). The need for increased competitiveness is giving rise to:

Firms that are diversifying into new industries

Some firms are diversifying into new opportunities that are opening up with electric mobility (from production to service delivery); these opportunities are located beyond their parent industry. See first row in Figure 6. They originate from oil refining and retail, power distribution, lead acid battery manufacturing, auto component manufacturing, electric equipment manufacturing and engine manufacturing industries, such as Force Motors, Amara Raja Batteries, Greaves Cotton, Larsen & Toubro, Tata Power, BHEL, HPCL, NTPC. Majority are expanding into public charging and swapping station deployment (the evidence we have collected doesn't suggest manufacturing of equipment), electric two-wheeler manufacturing and assembly and battery storage systems. Table 3 shows expansion of firms into new industries.

An important question is to explore the enabling factors that allow these firms to expand into altogether new industries. One factor is the organizational capacity that these firms are able to mobilize can help explain this. Organizational capacity depends on internal resources such as skills of existing workers and external connections with peer companies and the supply chain, domestic and overseas.

In the case of RR Global, for instance, the company is moving into the electric vehicle industry by creating a new brand 'BGauss' for an indigenously significant vehicle segment (two-wheeler). RR Global's core business in electrical equipment manufacturing shares a technical related-ness with EV technologies. It will also be taking advantage of its proximity to an existing auto cluster to assemble vehicles. Some components, though, will be outsourced. Figure 5 shows how the four dimensions interact to assist RR Global in expanding to a new but somewhat related industry. HPCL is expanding as a charging network operator by integrating with an equipment maker, an electricity distributer and an energy service company. See how the dimension of INDUSTRY is fed by vertical and segment in the top-right quarter in Figure 5. In essence, the interplay between the four dimensions helps build organizational capacity for new players to make their mark in the industry of EV and their ancillary components.

Firms that are adapting within their parent industry

Some firms are adapting to the electric powertrain technology. They seem to be investing in the next generation of products; otherwise they stand to be substituted with EVs and their ancillaries in due course of time. Note that INDUSTRY is the second-most prominent dimension for these firms.

Majority of these firms originate from automotive, auto-component manufacturing, and battery manufacturing

As seen in second row from the top in Figure 6, majority of these firms originate from automotive, auto-component manufacturing, and battery manufacturing.

Consider the examples of Bajaj Auto, Bharat Forge, Varroc Engineering, Bosch, Exide Industries, BPCL, Acme Cleantech, and Khanij Bidesh. Their existing production, distribution and buyer network is under a reset. To elaborate, Bajaj, a two-wheeler manufacturer, has partnered with an Austrian manufacturer to co-develop an electric two-wheeler platform to evolve its product architecture. Bharat Forge, a Tier 1 auto component manufacturer, is employing a series of tools. These include buying stakes in foreign and domestic EV startups, power electronics firm, and research and development (R&D). Exide, a lead acid battery manufacturer, plans to jointly manufacture lithium ion batteries with Leclanche, an EU-based lithium ion battery maker, in India. In another instance, a recently formed joint public sector unit (PSU) Khanij Bidesh plans to explore strategic minerals in overseas mines by taking advantage of India's diplomatic relations with several countries.

Several foreign partnerships are noticeable in this set of firms. Overseas partnerships assist firms in rapidly and cost efficiently on-boarding altered processes, from manufacturing to service delivery. This is typical of an industry undergoing a major technological shift. Other firms have signed supply agreements with overseas players which cater to markets where EVs are being much more widely adopted. Measures of cutting costs while adopting new processes and expanding market share are typical first-line priorities when an industry begins a technological shift (Holweg, 2009).

Table 3 | Firms that are expanding into new industries

FIRM	ORIGINAL INDUSTRY	EXPANDING INTO
RR Global	Electrical wires and appliances	Electric two-wheelermanufacturing
Hindustan Petroleum Corporation Ltd.	Oil refining and retail	Battery charging solutions
National Thermal Power Corporation Ltd.	Thermal power generation	Battery charging solutions
Greaves Cotton	Automotive and industrial engine manufacturer	Electric two-wheelermanufacturing
Larsen & Toubro	Engineering services	Electric powertrain testing
Indian Oil Corporation	Oil refining and retail	Aluminium air battery research and development
Manikaran Power	Power trading	Lithium ion refining
Amara Raja Batteries	Lead acid batteries	Lithium ion batteries and fleet charging solutions
Bharat Heavy Electricals Ltd.	Electrical equipments	Battery charging solutions
Tata Power	Power	Battery charging solutions
Tata AutoComp	Auto component manufacturing	Battery charging solutions

Figure 5 | How do the four dimensions interact and add up to create organizational capacity for a firm

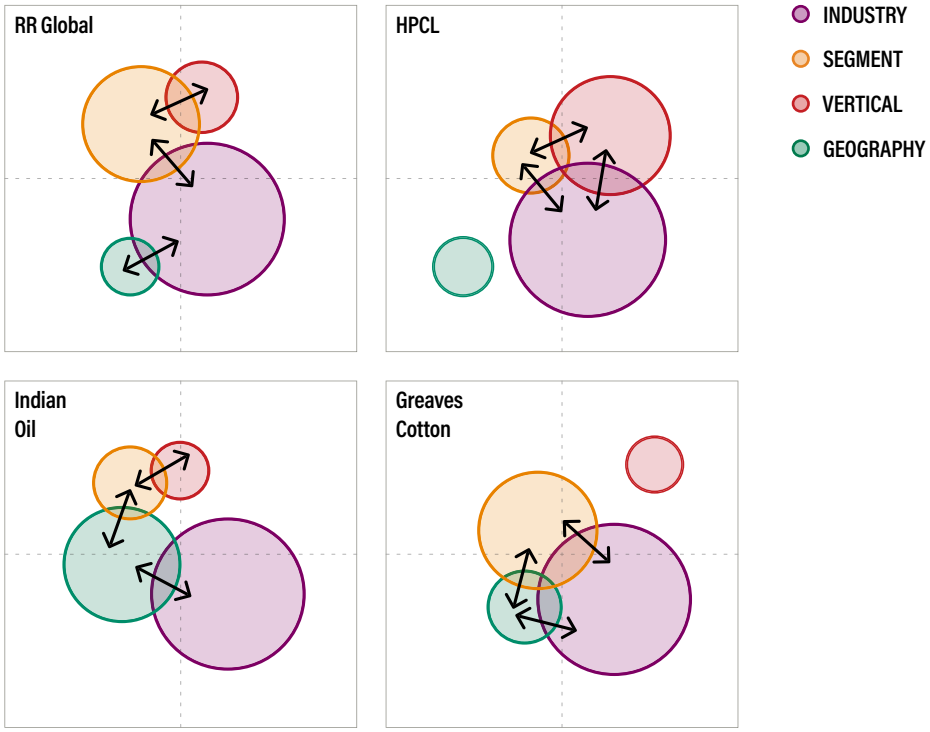
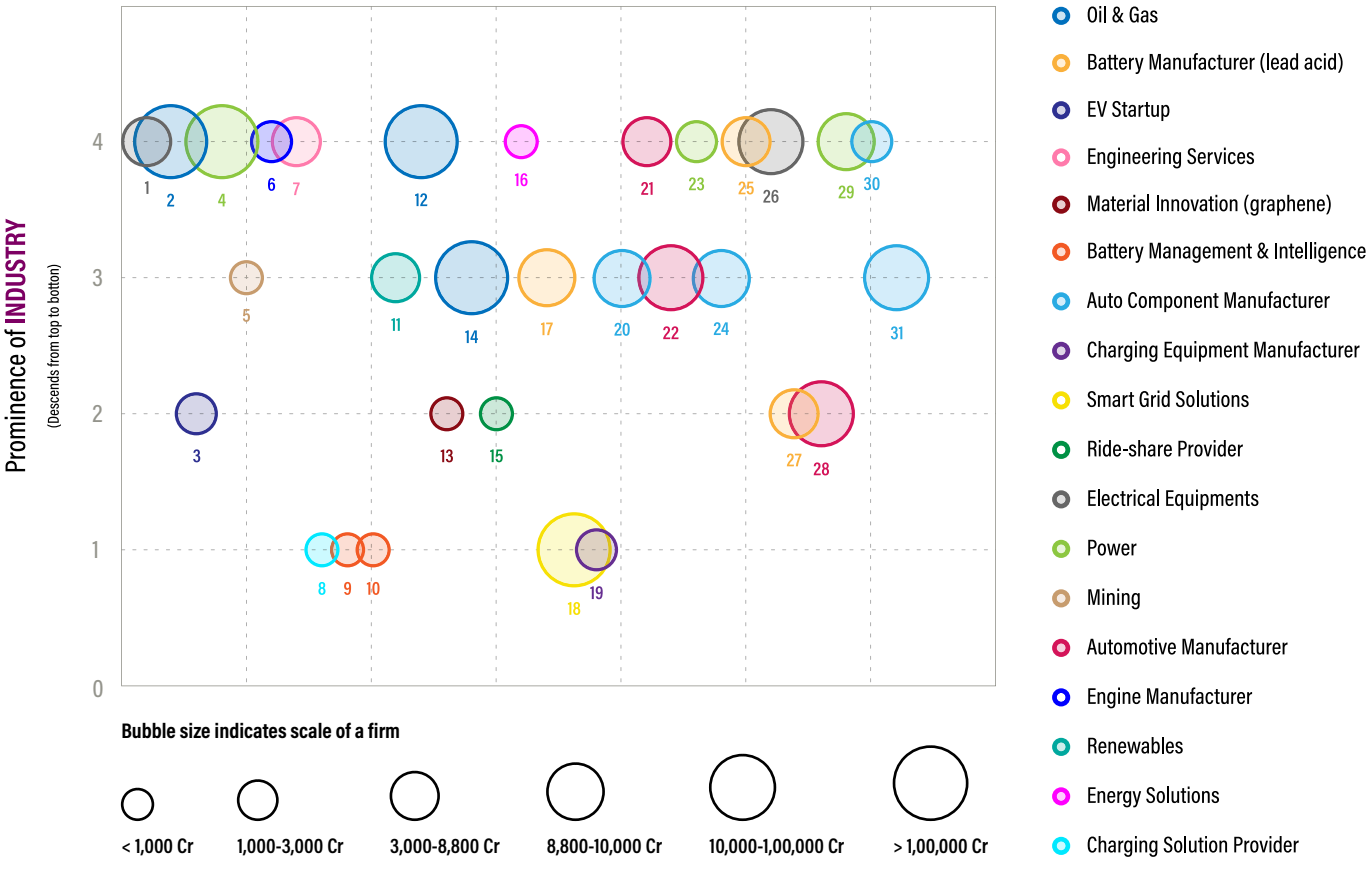


Figure 6 | Prominence of 'Industry' as a dimension across the 31 cases



5.2 Segment

Of the 31 cases we studied, 42% employ SEGMENT as the most prominent dimension, while 29% employ it as the second-most prominent dimension to attain competitiveness.

Majority of firms that employ SEGMENT as the most prominent dimension of competitiveness belong to non-automotive industries (see the first row in Figure 7). Largely, their products fall in two brackets: battery packs and their re-energising systems (charging/swapping).

These firms are diversifying into new sectors without creating transitional products that may complicate their existing product lines that are netting revenue and adequately serving consumers.

These firms enter into new product lines which do not traditionally belong to their parent industries with the exemption of three startups – eChargeBays, Ion Energy and Log9 Materials. Majority of these firms have relatively higher scale – Category 1 to 4. This means they already have an established footing in their original industries. These firms are diversifying into new sectors without creating transitional products that may complicate their existing product lines that are netting revenue and adequately serving consumers. This is a well-known strategy that established firms use to stay competitive amidst a technological shift (Erhun, Goncalves, & Hopman, 2007). For example, a lead acid battery maker investing in silicone joule lead acid battery whose performance is comparable with advanced generation of batteries such as lithium ion.

Another example is Exicom, a charging equipment supplier, entering the battery repurposing business by partnering with an automobile maker (MG Motors) whose ready-made pipeline with individual customers will assist Exicom procure spent batteries. This is a new business model. In a similar vein, Bharat Petroleum, is partnering with Kinetic Green (a three-wheeler maker) to set up battery swapping stations; this is yet another example amidst a long-range energy transition from oil to electricity (Andersen & Gulbrandsen, 2020).

Firms employing SEGMENT as the most prominent dimension are to some extent shaping and being shaped by new behaviors of individual and commercial consumers.

Furthermore, firms employing SEGMENT as the most prominent dimension are to some extent shaping and being shaped by new behaviors of individual and commercial consumers. These firms can be termed early movers in a changing social landscape. Notice that some of these firms are partnering with local manufacturers and solution providers – e.g. Hitachi ABB with Ashok Leyland, Bharat Petroleum with Kinetic, Bosch with SunMobility, inter alia. One plausible benefit is the first-hand know-how of the consumer pulse (price-points, trust factor, informal network) that the local players bring.

In contrast, firms employing SEGMENT as the second-most prominent dimension of competitiveness are much lower in scale – from Category 4 to 6. This subset of firms display a special propensity towards electric two-wheeler manufacturing. For instance, RR Global, an electrical wire and appliance manufacturing firm is foraying into electric two-wheeler assembly, while Greaves Cotton, an engine manufacturer, has acquired Ampere, a local electric two-wheeler maker, for manufacture and sale of electric two-wheelers. In another instance, Ola Mobility, a ride-share company, has acquired a Dutch electric two-wheeler company (Etergo), and will be manufacturing vehicles locally.

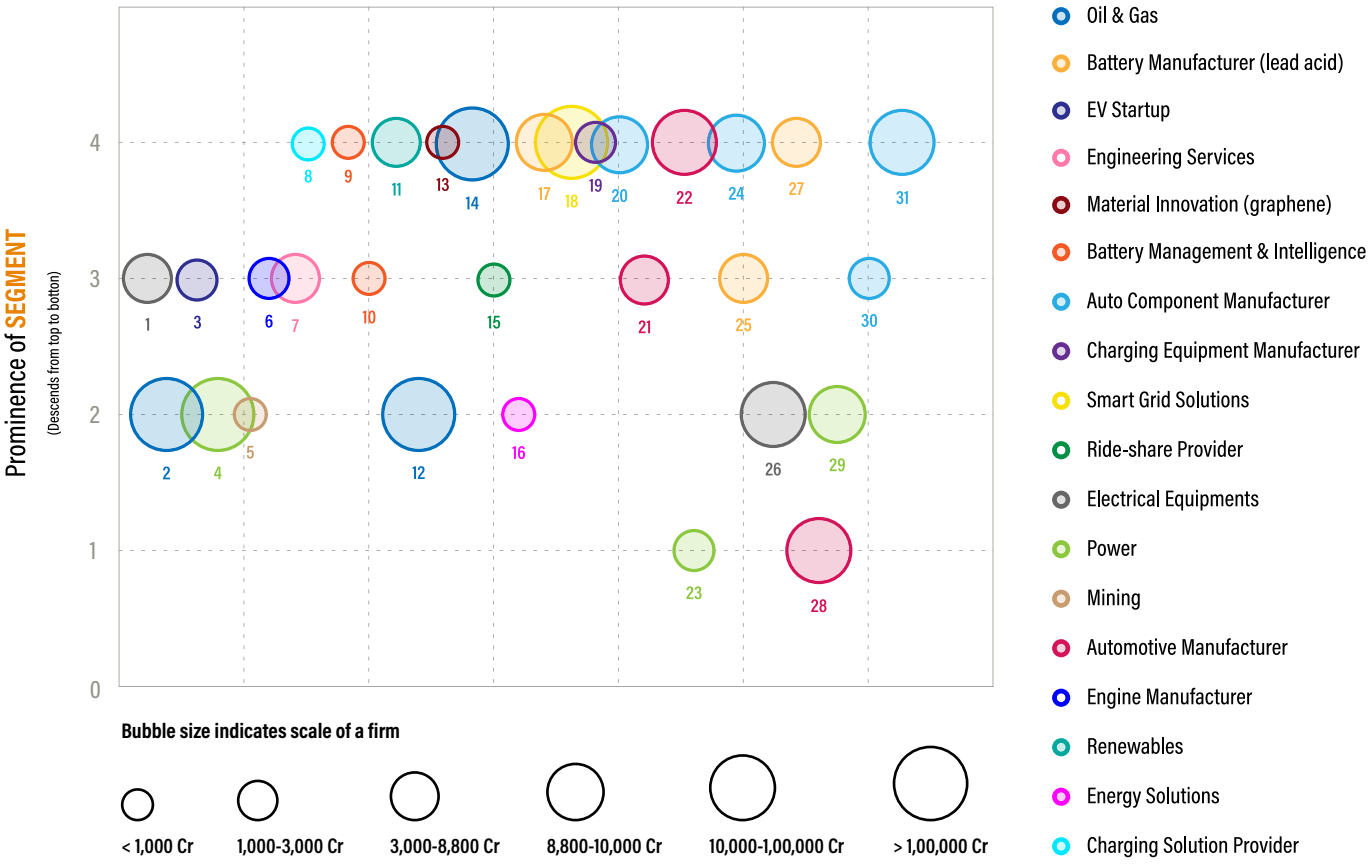
At the moment – of early stage diffusion of EV technology – it seems that the entry barriers for the firms foraying into electric two-wheeler manufacturing have lowered.

At the moment – of early stage diffusion of EV technology – it seems that the entry barriers for the firms foraying into electric two-wheeler manufacturing have lowered, especially when seen in comparison to the tightly gated structure of the ICE two-wheeler industry in India thus far. There seem to be multiple factors behind this. To begin with, short trip lengths (about 71% measuring less than 5 kms) and low driving speeds in Indian cities uniquely complement the use of two-wheeler, which account for 78% in India's fleet (Census, 2011) (SIAM, 2018). See Table 4. Electric two-wheelers have a further advantage as their assembly and manufacture is mechanically less complex than their ICE counterparts. Finally, venture capitalists as well as established firms are seen to be investing in electric two-wheeler startups. For instance, Hero Motors has invested in Ather Energy, and Bharat Forge has invested in Tork Motorcycles.

Table 4 | Plausible reasons for rise of interest in electric two-wheeler business

ENABLING FACTORS	FIRM & STRATEGIC MOVE
• Small trip lengths/low speed • Easy to manufacture/assemble • Venture capitalist funding	• Ola, a ride share company, acquires a Dutch electric two-wheelermaker (Etergo) • RR Global, an electrical equipment maker, forays into electric two-wheelermaking/assembly in its Pune plant • Greaves Cotton, an engine manufacturer, acquires Ampere, an electric two-wheelerstartup in India • Ather Energy an electric two-wheeler startup based in Bengaluru, India

Figure 7 | Prominence of 'Segment' as a dimension across the 31 cases



5.3 Vertical

Of the 31 cases, only 10% employ VERTICAL as the most prominent dimension, while it is the second-most for 22% of the cases we analyzed. In contrast, a greater share of firms are employing VERTICAL as a supporting dimension rather than as a primary dimension. Compare the number of firms in the last two rows with the scarcely populated ones on top in Figure 8. Majority of the firms have not yet ascribed to VERTICAL as a dimension in their competitive strategy. We discuss how they use it as a supporting dimension.

Notice the top-most row in Figure 8, which includes two startups (Ather Energy and Ola Eletric Mobility; both emphasizing on electric two-wheeler manufacturing) and an ICE car manufacturer, Hyundai India. Out of the 31 cases, these three firms appear to be engaging VERTICAL as the most prominent dimension. For example, Ather Energy has partnered with CredR, an online two-wheeler marketplace to enable consumers to exchange their conventional two-wheelers in return for Ather scooters. This is a form of forward integration – which is widening Ather's sales channel. Ola, on the other hand, has an established network of riders but doesn't have vehicle development and manufacturing capacity. Its acquisition of Etergo is a backward integration of sorts to create the pipeline for manufacturing electric two-wheelers.

Now, notice the second row from top in Figure 8. These players engage VERTICAL as the second-most prominent dimension of competitiveness. They originate from power, battery, charging, oil and electrical sectors. They seem to have greater interest in integrating forward to reach more users, more so than backward integration (see Table 5). These firms are kicking in a 'network effect' (Katz & Shapiro, 1994). One driver appears to be the product segment. Majority of firms are offering charging equipment and services while a few are offering battery management and recycling/repurposing services. Several subsidies have been earmarked for those deploying charging infrastructure under the FAME 2 scheme and state government policies. But these products and services are of little value in isolation. For instance, charging equipments need fleets of compatible EVs (and vice versa) that use the hardware; this forms a complete vehicle system. For example, NTPC is partnering with ride-share companies, presumably the early adopters of EVs; Tata Power is tying up with oil retailers to take advantage of the pan-India outlets to reach customers. Exicom, as discussed earlier, is forming a system of battery re-purposing/recycling, by tying up with an automobile maker to collect retired batteries from customers.

In their quest to sustain competition, majority of the firms mentioned above show a tendency to cooperate with other players than innovating new products in-house.

In their quest to sustain competition, majority of the firms mentioned in the previous section show a tendency to cooperate with other players than to innovate new products in-house. Table 6 illustrates whether firms choose to innovate, make, collaborate or buy products from external sources.

Let us break down the 31 cases based on the product segment they are offering. For instance, firms offering charging infrastructure are 'buying' the equipment instead of making it in-house – almost entirely; majority of these firms belong to oil and power sector. See the column of 'Buying' in Table 6. This is common in early-stage markets (like India), which are not technologically savvy yet in the arena of electric mobility. New players, therefore, find these markets easier to move in (Andersen & Gulbrandsen, 2020). As EV technology penetrates deeper into the Indian market, more and more firms might be inclined towards investing in R&D on charging equipment. In contrast, startups are predominantly innovating, rather than collaborating with other players. Much of their focus is working on innovative materials (such as light-weight and indigenously available battery materials) and cloud-based battery monitoring systems. In contrast, established players like IOCL and Amara Raja Batteries are undertaking battery innovation through partnerships with startups located overseas. Automotive and component manufacturers seem to be focusing on collaborating and thereby graduating into the making of electric counterparts of their focal products. They do not appear be innovating as yet.

Startups are predominantly innovating, rather than collaborating, with other players.

Table 5 | Firms that place VERTICAL as the second most prominent dimension

FIRM & SEGMENT	NETWORK	INTEGRATION TYPE
HPCL (charging solutions)	Partnering with **Magenta Powers** (charging hardware supplier), **EESL** (government owned energy service entity), and **Tata Power** (utility)	Partially backward, and forward
NTPC (charging solutions)	MoUs with seven ride-share companies to set-up charging stations for them	Forward
eChargeBays (charging solutions)	Tie-up with **MG Motors** for installing at-home charging equipment for vehicle owners	Forward
Ion Energy (battery management solutions)	Acquisition of a French battery management company	Partially backward, and forward
Exicom (battery recycling/ repurposing solutions)	Tie-up with **MG Motors** to collect spent batteries from vehicle owners	Cyclical and forward
BHEL (charging solutions)	Partnering with **Exicom** to set up charging stations	Backward
Tata Power (charging solutions)	Expanding its network of charging stations; partnering with oil companies **HPCL**, **IOCL**	Forward

Figure 8 | Prominence of 'Vertical' as a dimension across the 31 cases

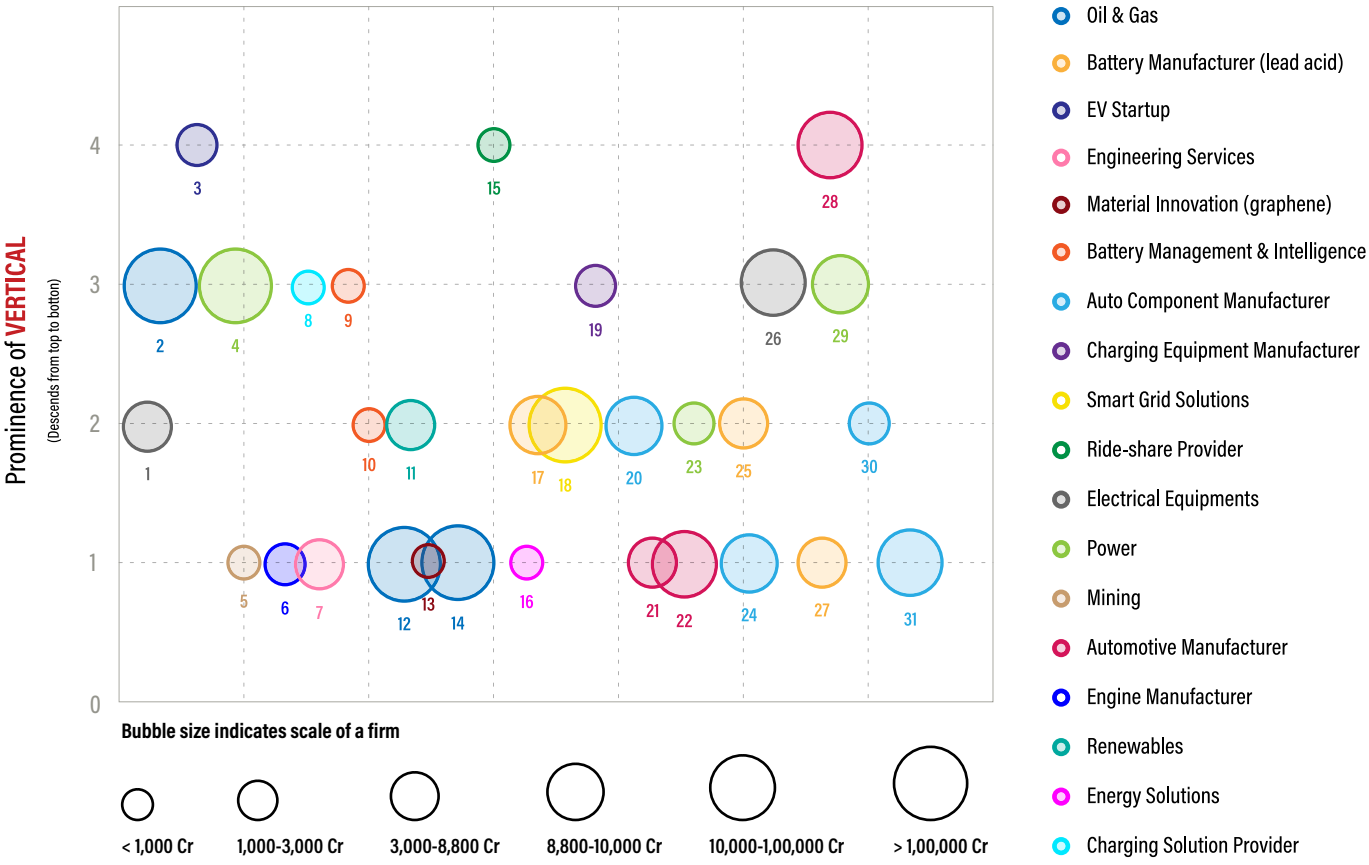


Table 6 | What do the firms choose to do – collaborate or innovate?

CASE # & FIRM	INNOVATING	MAKING	COLLABORATING	BUYING
1. RR Global		✓		✓
2. Hindustan Petroleum Corporation Ltd.			✓	✓
3. Ather Energy	✓	✓		
4. National Thermal Power Corporation Ltd				✓
5. Khanij Bidesh			✓	
6. Greaves Cotton		✓	✓	
7. L&T Technology Services	✓	✓		
8. eChargeBays				✓
9. Ion Energy	✓	✓	✓	
10. Ion Energy	✓	✓	✓	
11. Acme Cleantech		✓		
12. Indian Oil Corporation	✓		✓	
13. Log9 Materials	✓	✓		
14. Bharat Petroleum				✓
15. Ola Electric Mobility		✓	✓	
16. Innolia Energy	✓	✓		
17. Exide Industries		✓	✓	
18. Hitachi ABB Power Grids	✓	✓		
19. Exicom Power Solutions		✓		
20. Bharat Forge	✓	✓	✓	
21. Force Motors		✓		
22. Bajaj Auto		✓	✓	
23. Manikaran Power Ltd			✓	
24. Varroc Engineering		✓		
25. Amara Raja Batteries		✓		
26. Bharat Heavy Electricals Ltd.			✓	✓
27. Amara Raja Batteries	✓		✓	
28. Hyundai Motors		✓	✓	
29. Tata Power				✓
30. Tata AutoComp Systems				✓
31. Bosch India			✓	

5.4 Geography

Of the 31 cases, only 6% use GEOGRAPHY as the most prominent dimension while 22% use it as the second-most prominent dimension to attain competitiveness. Majority of the firms use GEOGRAPHY as a supporting dimension. Notice the last two rows in Figure 9, which are more populated than the first two.

While none of the firms are physically relocating within India or overseas, they are using indirect linkages to leverage from domestic and international firms. This enables them to slice through the global value chain of EV and allied technologies. In particular:

- Some firms are signing MoUs, forming joint ventures and acquiring offshore companies to gain access to newer and advanced technology. Most automakers and auto-component makers and battery manufacturers fall in this class. Firms based out of Europe seem to be the partner of choice in the majority of the cases we studied.
- Some firms are signing supply agreements with offshore companies to sell their newly launched products allied to EVs.
- Some firms are using their existing pan-India presence (real estate, manufacturing facilities, etc.) to disseminate their products and services. Oil and power companies entering the charging business and newly minted electric two-wheeler manufacturers (for example, RR Global and Cotton Greaves) are some examples.
- Some offshore companies (with a presence in India) are tying up with domestic manufacturers. For instance, Hitachi-ABB power grids will be supplying wireless charging system to bus manufacturer Ashok Leyland that is working with public bus agencies across India. Bosch has acquired a stake in SunMobility, a battery swapping system maker in India.
- Some startups are banking on linkages between Indian and other foreign governments. These firms are mainly working on sourcing and refining of minerals for vehicle batteries. For example, KABIL is a newly formed government entity that will scout for strategic minerals, such as lithium and cobalt, in Australia, Africa and Latin America to feed the EV battery value chain in India. Yet another example is a small-scale power trading company, Manikaran Power Limited, that has forayed into the lithium ion refining industry with Neometals, an Australian mineral exploration company.

Majority of firms that place GEOGRAPHY as the most and second-most prominent dimension are centering their competitiveness on procuring or innovating on new battery materials, which are concentrated in only certain geographies outside of India (lithium and cobalt are ready examples). These firms appear to be collapsing the geographical scales in the EV value chain.

However, particularly, the majority of firms that place GEOGRAPHY as the most and second-most prominent dimension are centering their competitiveness on procuring or innovating on new battery materials, which are concentrated in only certain geographies outside of India (lithium and cobalt are ready examples). These firms appear to be collapsing the geographical scales in the EV value chain. See the first two rows in Figure 9. Some are also partnering with overseas startups to innovate on alternate materials such as aluminium-air fuel cells and silicone-based lead acid batteries, whereas others are local startups making graphene-based batteries. Two companies are foraying into exploration and refining of lithium ion in mines in Latin America, Africa and Australia (Manikaran and Khanij Bidesh). In terms of the timeline, these firms seem to be in the initial stages of their mid- to long-range innovation cycles. As shown in Figure 10, these firms are based in Delhi-NCR (3), Bengaluru (2) and Andhra Pradesh (1).

A remarkably greater share of firms appears to employ GEOGRAPHY as the third- and fourth-most prominent dimension in driving their competitiveness. See the last two rows in Figure 9. These include auto-component and automotive manufacturers, whose priority is adapting their current ICE-based products. They are managing transition without disturbing existing products and are simultaneously entering new lines of business, like charging solutions. There seems to be lesser emphasis on innovating. Many inter-country collaborations are visible. In particular, firms based out of existing auto-clusters are a part of a mature value chain. Instead of disturbing the existing supplier-OEM network just yet, they are tying up with offshore partners to transition to EV technologies.

Overall, about 39% and 29% of the firms are headquartered in Maharashtra and Delhi, respectively. Aside from the traditional clusters, a bunch of firms appear to be agglomerating in Bengaluru region – mainly startups, two of them focusing on electric two-wheeler manufacturing. Furthermore, a relatively greater share of firms

seems to be undertaking electric two-wheeler manufacturing in the Mumbai-Pune and Bengaluru regions (see Figure 10). While the Delhi-NCR hub has been a major automotive cluster, a heterogenous mix of firms – power, electrical equipments, oil, charging equipment, renewables – seems to be becoming active in the region now. In principle, effective value chains are a corollary of proximally located activities in clusters. There are many benefits derived from this. The automotive and auto-component clusters in India have contributed to the regional and national economies for several decades. With the onset of electric mobility, the clusters will inevitably witness some changes in the way they operate and empower certain players with bargaining power. The precise nature of the shifts is hard to fathom with the current level of diffusion of EV technologies. But certainly, policymakers have a significant role to play.

Figure 9 | Prominence of 'Geography' as a dimension across the 31 cases

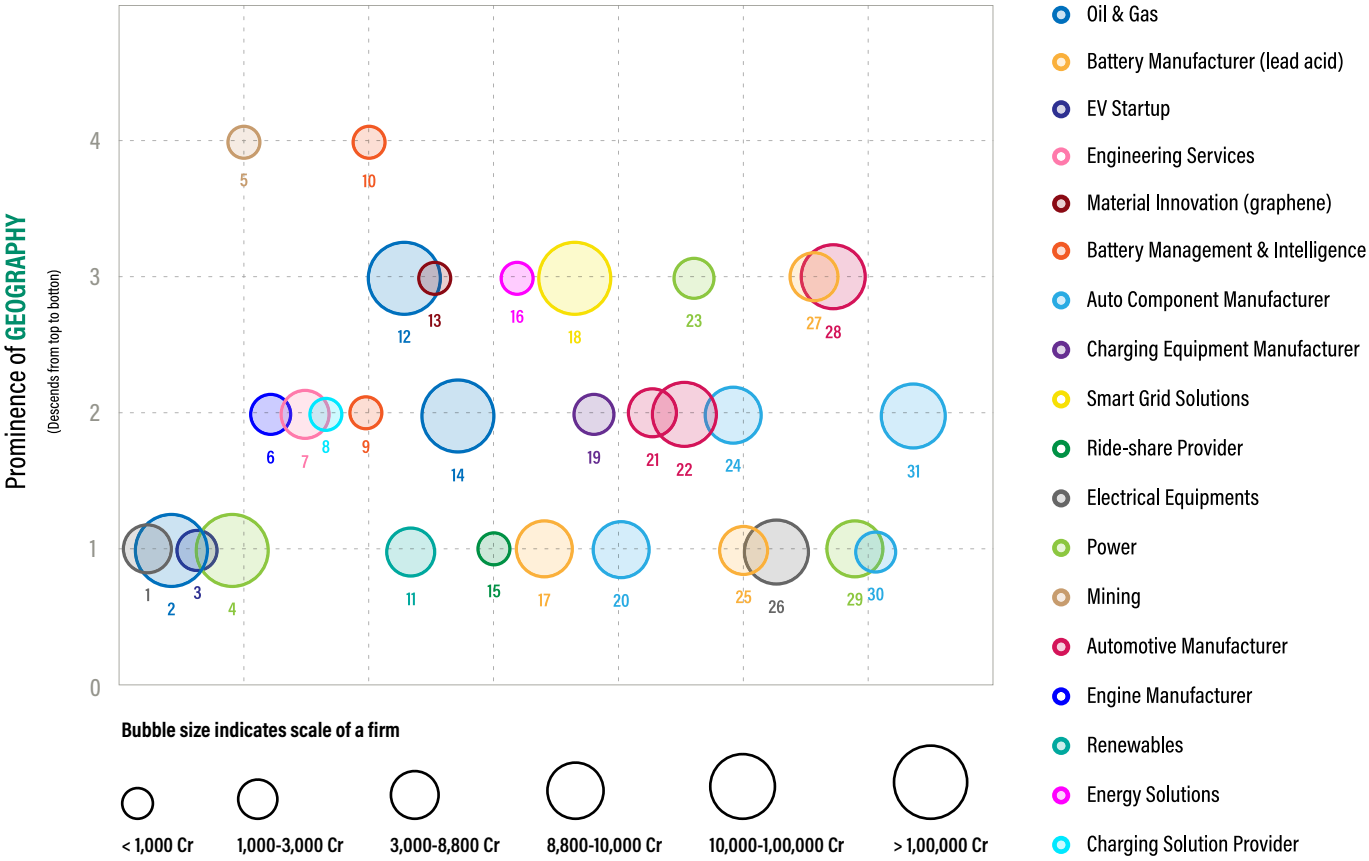
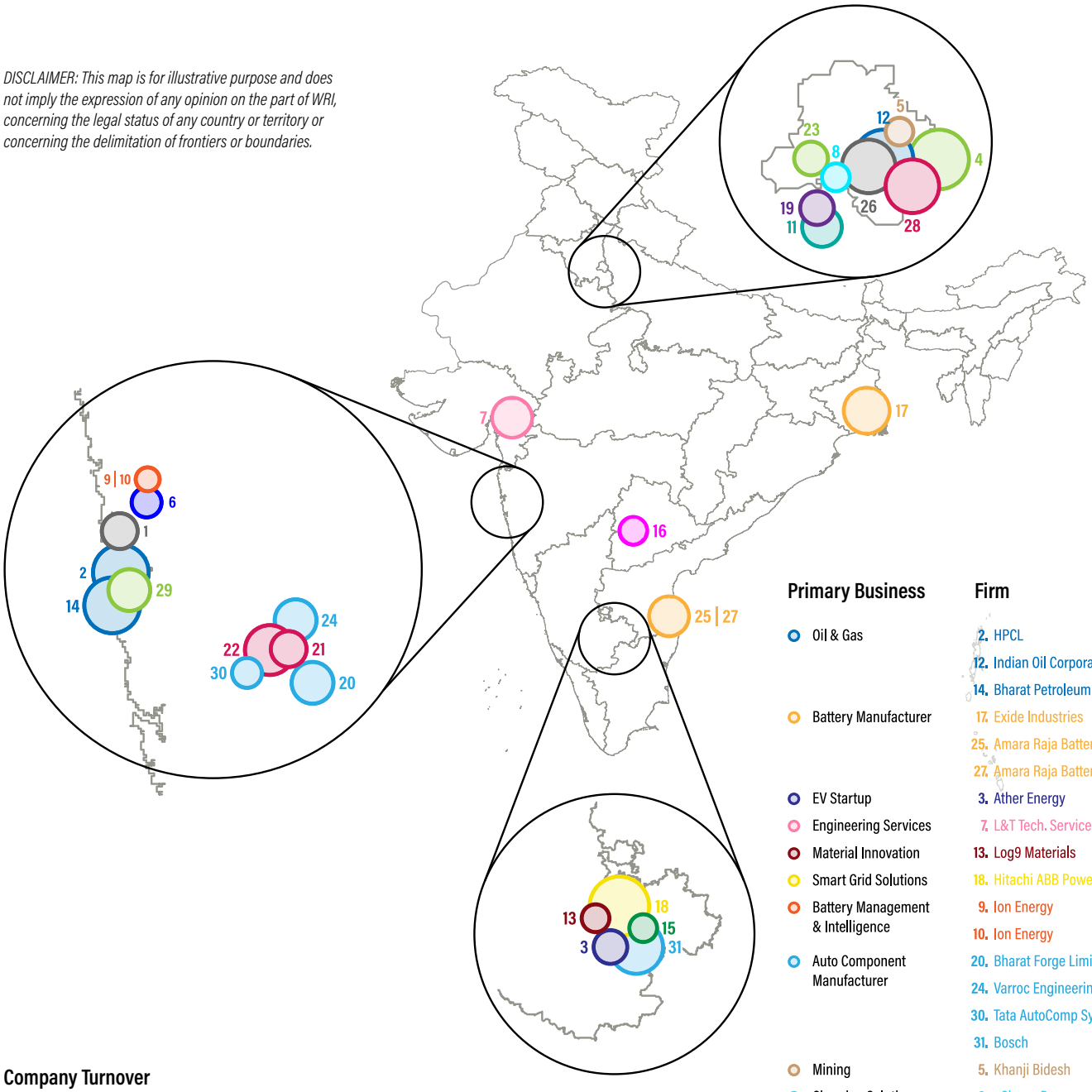


Figure 10 | Who is located where?

DISCLAIMER: This map is for illustrative purpose and does not imply the expression of any opinion on the part of WRI, concerning the legal status of any country or territory or concerning the delimitation of frontiers or boundaries.



Company Turnover

- > 1,00,000 Cr
- 10,000-1,00,000 Cr
- 8,800-10,000 Cr
- 3,000-8,800 Cr
- 1,000-3,000 Cr
- < 1,000 Cr

Primary Business	Firm
Oil & Gas	2. HPCL
	12. Indian Oil Corporation
	14. Bharat Petroleum
Battery Manufacturer	17. Exide Industries
	25. Amara Raja Batteries
	27. Amara Raja Batteries
EV Startup	3. Ather Energy
Engineering Services	7. L&T Tech. Services
Material Innovation	13. Log9 Materials
Smart Grid Solutions	18. Hitachi ABB Power Grids
Battery Management & Intelligence	9. Ion Energy
	10. Ion Energy
Auto Component Manufacturer	20. Bharat Forge Limited
	24. Varroc Engineering
	30. Tata AutoComp Systems
	31. Bosch
Mining	5. Khanji Bidesh
Charging Solution Provider	8. eChargeBays
Ride-share Provider	15. Ola Electric Mobility
Charging Equipment Manufacturer	19. Exicom Power Solutions
Electrical Equipments	1. RR Global
	26. BHEL
Power	4. NTPC
	23. Manikaran Power
	29. Tata Power
Engine Manufacturer	6. Greaves Cotton
Renewables	11. Acme Cleantech
Energy Solutions	16. Innolia Energy
Automotive Manufacturer	21. Force Motors
	22. Bajaj Auto
	28. Hyundai Motors India

6. WAY FORWARD

While analyzing the strategic moves of the 31 cases with the 4D framework, we observed certain noteworthy business activities that must be considered by policy-makers across all levels of government in India. They are as follows:

State governments without auto-clusters could focus on inviting firms from industries 'related' to electric mobility.

The majority of firms, from the 31 studied in this paper, are focusing on expanding into new industries pertinent to electric mobility (charging infrastructure, battery innovation, electric two-wheeler manufacturing, etc.). New players are mobilizing internal and external resources – an organizational capacity, of sorts - cultivated in their current businesses to offer viable products. Therefore, it stands to reason that firms in related industries could potentially expand to the domain of electric mobility. States (such as Kerala and Telangana) that are aspiring to set up clusters of EV manufacturing could begin by investing in these related industries – electrical, engineering, power, battery, IT and communication. It is most likely that firms manufacturing EVs (OEMs or startups) will target locations in and around the auto clusters, as shown in Figure 10.

Policy ideas that could be explored:

- Encourage state universities to create learning opportunities – live-project based learning, industry tie-ups – to impart pertinent skills in the incoming talent pool; such universities can also create re/upskilling centers for workforce interested in joining EV relevant industries.
- Invite international corporates and institutions to establish ODC – to set up both R&D units in states – with lucrative demand-side incentives to drive volumes.

Strive for an innovation-led EV industry, in addition to production-led

We notice that majority of firms are collaborating with other players to outsource manufacturing of products. Developing in-house assembly lines for the final products are of lesser interest. For instance, electric two-wheelers are especially easy to assemble, making them an efficient way to meet the demands of the market. Similarly, in charging infrastructure – activities in deployment of equipment and widening of consumer network are taking precedence over exploring opportunities to manufacture indigenously or pushing for innovation. Making a choice between in-house innovation and outsourced products to bypass setting up operations ab initio is a tricky one, especially in a nascent market. However, innovating in EVs and their supporting equipment must be a part of the long-term policy focus. When firms innovate in-house, they expand their capacities – technical know-how, skill growth, and overall self-sufficiency amidst a structural change with the onset of electric mobility. These are known to have long-term implications for economic development (Chang & Andreoni, 2020).

Policy ideas that could be explored:

- State and/or central government can institute a fund for aggressively driving experimental projects related to EVs and allied products.
- Fund tie-ups between industry and academia either through state or central government– and establish milestones for deliverables; institutes of national importance such as NITs, IIMs and state universities could be explored besides IITs.
- The central government's FAME-2 scheme allows for subsidy based on content manufactured in India; a similar incentive scheme could be put together for innovative EV products developed by companies in India – patents filed from India could be used as an indicator. Both central and state governments could devise such incentive systems.
- Define a skilling strategy that incentivizes movement of talented workforce into work opportunities across the value chain of EVs; Ministry of Skill Development and Auto-component Makers Association (ACMA), along with councils of power, renewable etc., could take the lead in doing this.

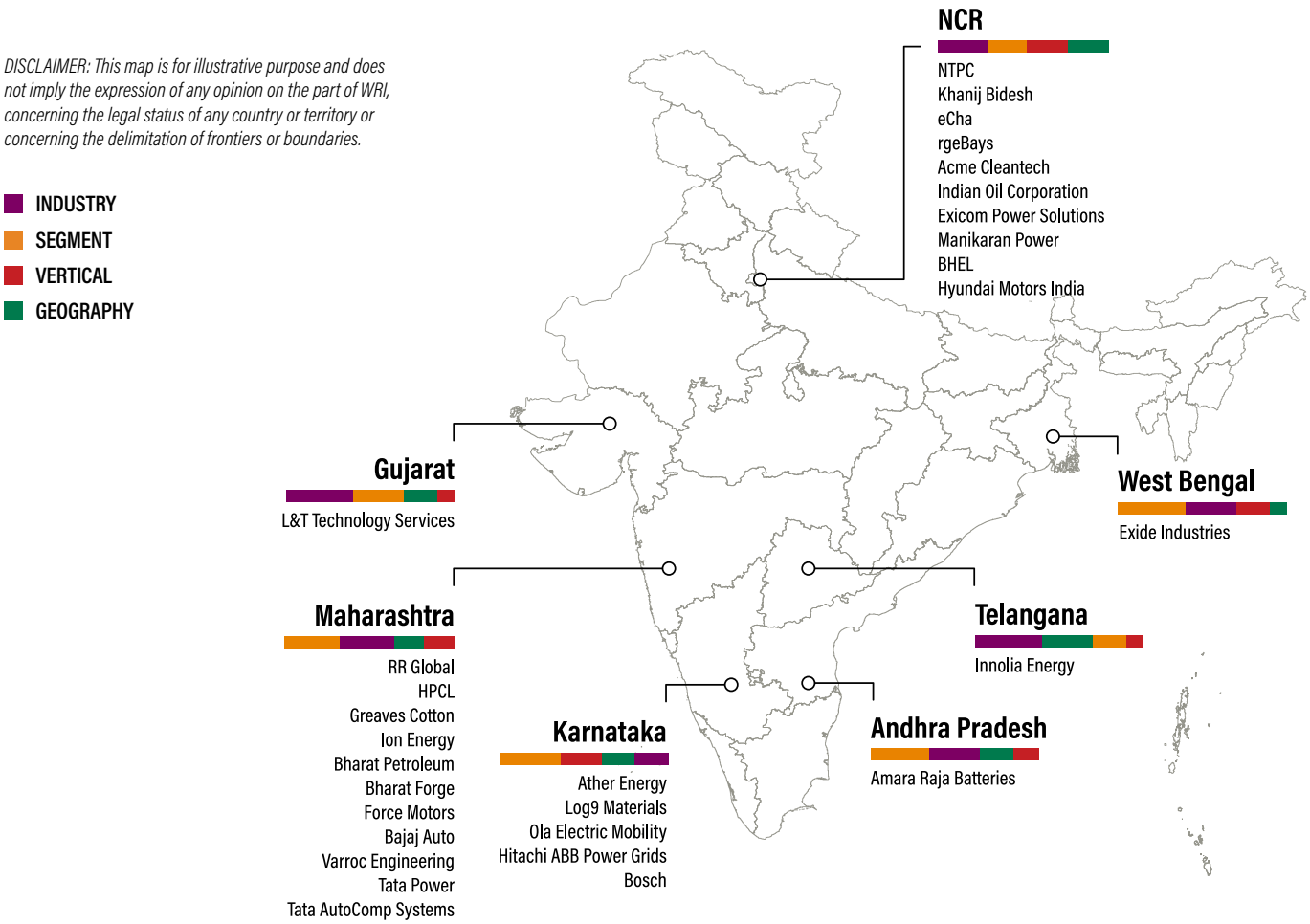
Incentivize cyclical integration of EV value chain

In the 31 cases studied in this paper, we notice only one case where a cyclical business model to recycle waste batteries is under way. It is well known that batteries retired from EVs are a source of strategic minerals that can be recovered and fed back to produce battery cells. Such closed loop systems also prevent waste batteries from entering the landfill. Creating a closed loop system requires a new, cyclical form of business model – where either the vehicle maker or a new entity takes the responsibility of purchasing expired batteries from vehicle owners.

Policy ideas that could be explored:

- National Battery Storage Mission, along with central and state government agencies, could create a country-wide battery labeling program that would guide consumers on how to dispose retired batteries; similar battery labeling programs have been successfully pursued in countries like Japan.
- Another option is to create a battery recycling and urban mining firm, which could serve as an extension to KABIL.
- State governments could put in place an additional fiscal incentive (or some form of reward) for closed loop business models, and firms whose primary work is to recycle and repurpose batteries.
- Many informal players have been recycling lead acid batteries. The spread and strength of this informal network varies with states. State governments could assess the network of such informal players in their regions and devise means to use their operation in the recycling value chain of advanced batteries (like lithium ion).

Figure 11 | How does the role of four dimensions of competition vary across states?



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ANNEXURE: CASE WRITE-UPS

Disclaimer: The research and viewpoints of each case study conducted by WRI India is independent and not influenced by any of these companies.
The bubble sizes representing the rank of each dimension, based on the prominence, are consistent across the case studies.

Case Study 1: RR Global

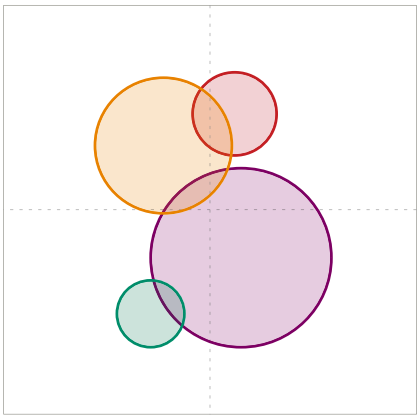
About

RR Global is a corporation in the electrical industry whose primary business is manufacturing of electrical wires, components and appliances. They reflects the turnover of the firms are headquartered in Mumbai, India and have an annual turnover of USD 850 million. They currently have manufacturing facilities in Silvassa (UT of D.N.H), Chakan (Maharashtra), Khopoli (Maharashtra), Waghodia (Gujarat), Bangladesh, and Dubai (UAE).

Strategic Move

In June 2020, RR Global announced its venture into the electric two-wheeler manufacturing segment.

Competitive Scope



Bubble size indicates the prominence of each dimension.

Segment

RR Global is venturing into manufacturing of electric 2 wheelers under the brand name – 'BGauss'. This is a new product segment for RR Global. The company seems to have capacity from prior work in manufacturing of automotive wiring, copper winding wires[5] which can be extended to EVs.

Industry

Electric component manufacturer with experience of manufacturing 70% of EV components foraying into electric two-wheeler manufacturing. Proposed investment of INR 125 CR in EV manufacturing over 3 years based on rise in sales volume.

Vertical

RR Global's 'BGauss' is integrating backwards for the pilot of its electric two-wheeler; design of pilot vehicles is to be outsourced from China, and manufacturing of motor and controller from Bosch.

Geography

Manufacturing and assembly in Chakan, Pune in the existing RR Global manufacturing plant. This location falls within an existing automotive cluster. Initial roll-out in Southern and Western states.

Conclusion

RR Global enters electric two-wheeler manufacturing backed by their experience in manufacturing electrical wires and components, which account for 70% of the content in EV components. They have taken a cautious approach by outsourcing key components of their pilot scooters and not investing in infrastructure till a rise in sales volume is seen. The scooters will initially roll-out in Chennai, Bengaluru, Pune, Hyderabad and Coimbatore which already has players like Ather Energy and Ampere Electric.

[5] *Used in EV motors*

Industry Transition

RR Global is diverging from its primary business focus of electrical equipment manufacturing to manufacturing of electric 2 wheelers.

Value Chain Position

Before the move:
Manufacturing of electrical wires, and appliances (downstream of the value chain of electricity sector)

After the move:
Assembly, manufacturing and sales of electric two-wheelers (upstream and downstream of the value chain of EVs)

Policy Intersections

Central Policies:

- Incentives under FAME
- Benefit extension under Section 35AD(1) to incentivize EV manufacturing
- GST reduction (Indirect benefit)
- Lower import duty on components of EVs

State Policies:

- Incentives under Maharashtra State EV Policy 2018

Sources

- RR Global enters Indian electric two-wheeler market with BGauss brand | *Overdrive*
- RR Global to launch made-in-India electric two-wheelers under BGauss brand name
  | *Express Drives (Financial Express)*

Case Study 2: Hindustan Petroleum Corporation Limited (HPCL)

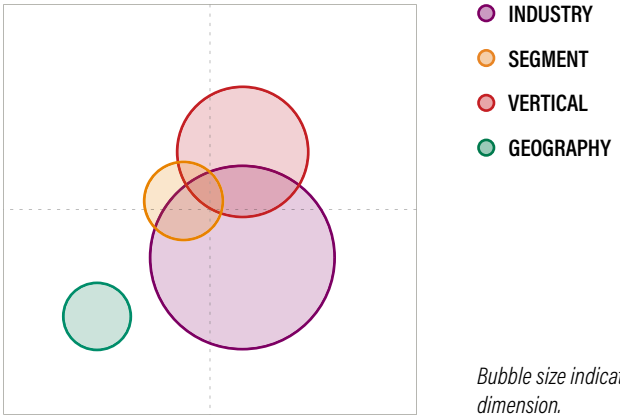
About

HPCL is an Indian oil and natural gas company headquartered in Mumbai, India established in 1974. They produce a variety of petroleum fuels and lubricant oils. The company has an annual turnover of INR 1,16,428 crore and a retail network of 15,440 retail outlets spread across the country.

Strategic Move

In 2019, HPCL announced its plans to setup charging stations across the country through partnerships with a charging solution provider (Magenta Powers), power distributor (Tata Power) and state-owned energy service company (Energy Efficiency Services Limited). The partnerships will integrate planning, deployment and operation of the proposed charging stations.

Competitive Scope



Bubble size indicates the prominence of each dimension.

Segment
HPCL entered a new product segment – public charging equipment. The consumer base will shift to EV owners and fleet operators.

Industry
Major shift from the Oil Industry to EV industry (more specifically, to EV charging industry).

Vertical
HPCL is collaborating with three players in electricity, charging infrastructure and energy service domain; this is a form of backward integration to set up and operate charging stations.

Geography
Retail network of fuel stations span across the country that gives HPCL access to a wider geography.

Conclusion

Following the global precedent of oil majors investing in alternative energy, HPCL forays in the EV segment by setting up charging infrastructure through partnership with the aforementioned stakeholders. Unlike its current vertically integrated operation in the oil industry, this move will involve partners contributing in different parts of the value chain.

Industry Transition

HPCL is diversifying into charging infrastructure industry, which also associates it with the EV industry.

Value Chain Position

Before the move:
Refining, processing and retail distribution of oil and gas products (downstream and upstream of the value chain of oil and gas sector; downstream of the value chain of ICE-based vehicles)

After the move:
Planning, deployment and operation of public charging stations (downstream of the value chain of charging equipment; downstream of the value chain of EVs)

Policy Intersections

Central Policies:

- Amendment of the Electricity Act 2003 by Ministry of Power (delicensing of setting up EV charging infrastructure)
- Incentives under FAME

State Policies:
HPCL operates in multiple cities across India; no single state policy intersection is observed.

Sources

- Magenta Power ropes in HPCL as strategic investor | *The Hindu Business Line*
- EESL inks pact with HPCL to set up EV battery charging infrastructure | *Business Standard News*
- Tata Power, HPCL partner to set up EV charging stations | *Business Standard News*

Case Study 3: Ather Energy

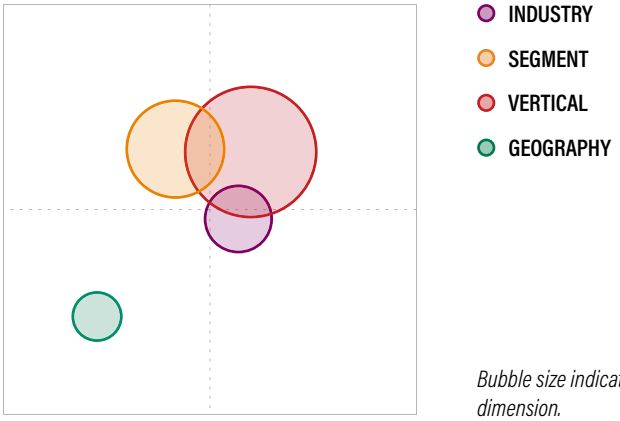
About

Ather Energy is an electric two-wheeler manufacturing company headquartered in Bengaluru, India. It currently manufactures 2 models of electric scooters (Ather 450 & Ather 450X) at a facility in Whitefield, Bengaluru, India. It has also established a charging network known as Ather Grid in Chennai and Bengaluru. It currently has a production capacity of 35,000-40,000 scooters per year. Following the release of the Delhi EV policy in Aug 2020, Ather has also announced its plans to enter New Delhi. In the first phase of expansion, Ather plans to have presence in 11 cities across India.

Strategic Move

In July 2020, Ather entered into a partnership with online two-wheeler marketplace, CredR, for a vehicle exchange program for its future customers.

Competitive Scope



Bubble size indicates the prominence of each dimension.

Segment

Partnering with CredR enables tapping deeper into the segment of electric two-wheeler aspirants who own IC engine vehicles.

Industry

Ather is furthering its foot-hold in the electric two-wheeler industry. Simultaneously, Ather is entering the two-wheeler resale industry through the partnership.

Vertical

Electric two-wheeler manufacturer integrating vehicle exchange[6] facilities at sale points. This increases the ease in purchase of a new Ather two-wheeler for conventional two-wheeler owners. Inspection and exchange points are set up at Ather's experience centers (Ather Spaces) to facilitate exchange. This is a partial forward-integration where Ather is building its sales channel.

Geography

This move does not leverage any geographical advantage to increase competitiveness.

Conclusion

Ather Energy partners with CredR to increase the ease with which conventional two-wheeler owners can transition to an electric scooter. This move will contribute in the increase in adoption of Ather electric scooters.

Industry Transition

Deeper penetration into current industry by using CredR platform to access ICE two-wheeler owners looking to switch to electric.

[6] *The vehicle exchange programme will need the ICE two-wheeler owners to bring their vehicles to the Ather Spaces where following a physical inspection of the vehicle health and document, a quote will be generated through the CredR app. Subsequently the exchange price will be adjusted with the cost of the new vehicle.*

Value Chain Position

Before the move:
Design, engineering, manufacturing and sale of electric two-wheelers (upstream and downstream of the value chain of an EV)

After the move:
Adds another gateway for sale of electric two-wheelers (upstream and downstream of the value chain of an EV)

Policy Intersections

Central Policies:

- Incentives under FAME
- Extension of benefits under Section 35AD(1) to incentivize EV manufacturing (Electric two-wheelerManufacturing)
- Reduction of GST
- Amendment of Electricity Act 2003 by Ministry of Power (Ather Grids; de-licensing of setting up EV charging infrastructure)

State Policies:

- Incentives under Karnataka Electric Vehicle and Energy Storage Policy 2017
- Incentives under Tamil Nadu Electric Vehicle Policy 2019

Sources

- Ather Energy partners CredR for vehicle exchange programme | *YourStory*
- Ather Energy Partners With CredR To Introduce Two-Wheeler Exchange Program | *CarAndBike*

Case Study 4: National Thermal Power Corporation (NTPC)

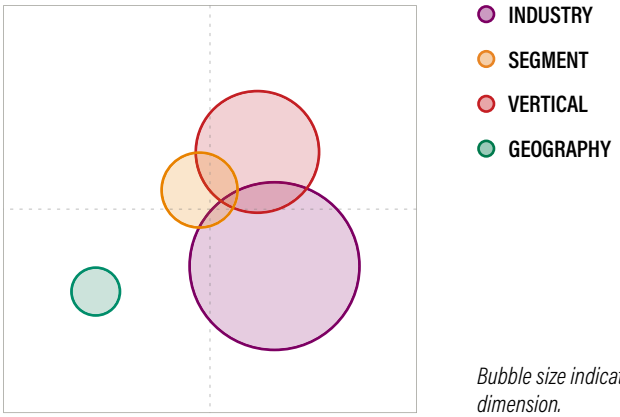
About

National Thermal Power Corporation is an Indian PSU engaged in the business of power generation since 1975. It is headquartered in New Delhi and has an annual turnover of INR 100478 crores. It currently operates 45 plants in India (24 coal, 7 gas, 1 hydro, 1 wind, 11 solar, 1 small hydro).

Strategic Move

In 2018, NTPC announced its plans to develop and setup charging stations in the country. NTPC will execute this through MoUs with 7 vehicle aggregators (Ola, Lithium, Shuttl, Bikxie, Bounce, Electrie and Zoom Car) and through MoUs with local city administrations (Navi Mumbai, Bhopal and Jabalpur).

Competitive Scope



Bubble size indicates the prominence of each dimension.

Segment

NTPC is targeting a new product segment -- EV charging solutions. This is wholly different from NTPC's parent work in thermal power generation. While providing charging solutions, NTPC will also be serving a new consumer segment – EV fleet operators (specifically through this move).

Industry

NTPC is moving from power generation to EV charging industry. Simultaneously, NTPC is also associating itself with the electric vehicle industry.

Vertical

While providing charging solutions, NTPC is integrating backwards and forward. The company procures chargers (one supplier is Exicom), obtains electricity connections, sets up cloud-based system for monitoring stations and payment gateways for EV drivers. In some ways, NTPC is drawing from its existing capacity in power generating/electricity sector. MoUs with ride aggregators brings them a ready consumer base.

Geography

The 7 vehicle aggregators operate in multiple cities in India. Partnering with them, NTPC gains an advantage of spreading its charging solution business in many cities.

Conclusion

NTPC forayed into the EV charging infrastructure segment, where they are providing the complete EV charging solution from procuring equipments and setting up electricity infrastructure to creating mobile apps for networking with the consumers. Other than their expertise in electrification and power generation, NTPC is also backed by their financial strength that helps them invest in capital-intensive charging infrastructure at scale.

Industry Transition

The move illustrates NTPC's entrance into EV charging industry from its current work in power generation industry.

Value Chain Position

Before the move:
Generating thermal power (upstream of the value chain of electricity/power industry)

After the move:
Deploying complete charging solutions (downstream of the value chain of charging infrastructure)

Policy Intersections

Central Policies:

- Amendment of the Electricity Act 2003 by Ministry of Power (delicensing of setting up EV charging infrastructure)
- Incentives under FAME

State Policies:
NTPC operates in multiple cities across India; no single state policy intersection is observed.

Sources

- Press Releases | *NTPC*
- NTPC Working on Developing EV Charging Infrastructure | *Saur Energy*
- Exicom Wins NTPC Tender to Develop EV Charging Stations in Jabalpur | *Mercom India*
- Marklines data portal
- Presentation made by NTPC at WRI India's workshop on charging infrastructure in Telangana, held on 22nd September 2020

Case Study 5: Khanij Bidesh India Limited (KABIL)

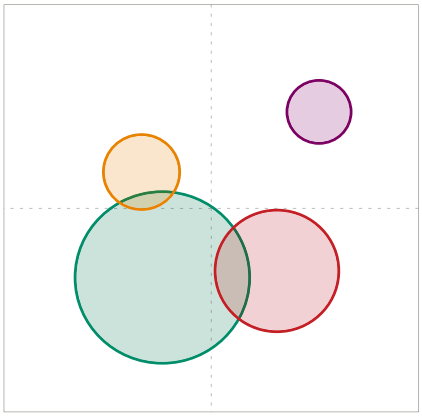
About

Khanij Bidesh India Limited (est. 2019) is a Government of India owned joint venture firm of National Aluminum Company Ltd (NALCO), Hindustan Copper Ltd. (HCL) and Mineral Exploration Company Ltd (MECL). The equity participation of the three firms is 40:30:30(NALCO: HCL: MECL) and the authorized capital is INR 100 crores. The JV aims to scout and acquire overseas mineral sources to supply to the Indian domestic market. The joint venture has identified 12 key minerals. Namely: Tin, Cobalt, Lithium, Germanium, Gallium, Indium, Beryllium, Niobium, Tantalum, Tungsten, Bismuth, and Selenium. The JV indicated its primary focus on minerals imperative for the Indian EV energy storage industry – Cobalt and Lithium which are used to make the cathode of a lithium ion battery. Lithium is currently mined in Australia, Chile, Argentina, China and Zimbabwe. Cobalt is currently mined in Democratic Republic of the Congo, China, Russia, Canada, and Australia.

Strategic Move

The JV is setup to identify, acquire, explore, develop, mine and process minerals that are crucial for the economic and strategic interest of the country from overseas sources.

Competitive Scope



Bubble size indicates the prominence of each dimension.

Segment

The constituent companies in the JV (NALCO,HCL & MECL) are expanding from their established focus on minerals like Aluminium and Copper towards the strategic minerals listed above.

Industry

Authorized investment capital of INR 100 crore to acquire mineral assets. The JV also aims to setup trade opportunities and partnerships to share in-house expertise.

Vertical

The JV will be involved in the identification, acquisition, exploration, development, mining and processing of the minerals. This is a form of backward integration.

Geography

Actively scouting for sources in Australia, Africa, Latin America. Govt. of India has signed an MoU with Australia for supply of minerals required for the energy economy.

Conclusion

The creation of KABIL by the Govt. of India intends to promote India's mineral security by ensuring a steady supply of minerals that are key in an economic and strategic sense. With the combined expertise of NALCO, MECL and HCL in the mineral production value system, the JV aims to tap into the overseas mineral market through acquisition of assets (mines), G2G partnerships and knowledge sharing. The focus on Lithium and Cobalt will benefit the Indian EV battery manufacturing industry which is highly import dependent.

Industry Transition

The companies constituting the JV (NALCO, MECL, HCL) are transitioning from mineral production from sources within the country to overseas sources.

Policy Intersections

Central Policies:
It can potentially benefit from lower import duties on host of EV components.

Sources

- Nalco HCL and MECL inks joint venture to form Khanij Bidesh India Ltd | *The Economic Times*
- Incorporation of KABIL-JV Company between HCL NALCO and MECL | *Hindustant Copper Limited*

Case Study 6: Greaves Cotton

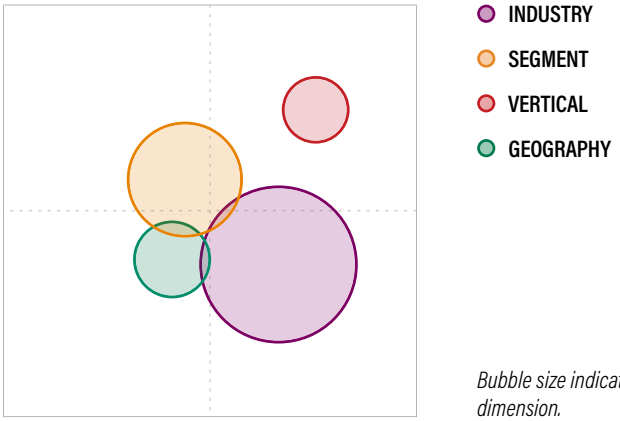
About

Greaves Cotton (incorporated 1922) is an engine manufacturer headquartered in Mumbai with an annual turnover of INR 1840 crore. They specialize in manufacturing of diesel engines, petrol engines and CNG engines for 3 wheelers and small 4 wheelers. They also make engines that cater to the marine segment (small boats) and the industrial segment. In addition to engines, they also manufacture generator sets, pump sets and construction equipment. It has 6 manufacturing facilities in India, with a majority (5) in Maharashtra (Pune-2, Aurangabad-3) and 1 in Tamil Nadu(Ranipet).

Strategic Move

In 2018, Greaves Cotton entered into electric two-wheelermanufacturing and sales through acquisition of Ampere Electric (est. 2008), an electric two-wheeler startup based in Coimbatore, Tamil Nadu. Greaves Cotton acquired a 67.34% stake in Ampere Vehicles in 2018 for INR 77 crores followed by another additional purchase of 13.89% for INR 38.5 crores in July 2019. It completed the acquisition by purchasing the remaining 18.77% stake in Ampere Vehicles for INR 60 crore in November 2019.

Competitive Scope



Bubble size indicates the prominence of each dimension.

Segment

Entered the electric two-wheelermarket by acquiring two-wheeler EV start up - Ampere Electric. Ampere Electric has over 10 years of experience in the electric two-wheeler manufacturing and sales segment in India. It has a product range of six electric scooters[7] (for individuals) and 2 scooters for industrial applications[8]. Through this move Greaves Cotton also forays into a B2C sales segment.

Vertical

Acquisition of Ampere Vehicle is a form of backward and forward integration – design, manufacturing and sales of Electric 2W. Greaves Cotton will utilize its pan India network of dealers to engage in B2C sales of the electric 2W. At the moment of acquisition Ampere Electric had 75 exclusive retail outlets which have now been increased to 180. In addition to those outlets Ampere scooters are also being sold through Greaves Cotton Retail outlets. The total number of outlets selling the scooter across the country is currently at 350.

[7] *V48 (Li-ion/Lead Acid), Zeal (Li-ion), Reo Elite (Li-ion/Lead Acid), Reo Series (Li-ion/ Lead Acid), Magnus 60 (Lead Acid), Magnus Pro (Li-ion)*

[8] *Trisul (personnel transport within factories – lead acid), Mitra (payload and cargo transport – lead acid)*

Industry
As a powertrain solution provider for last mile connectivity vehicles manufacturers (3-wheelers and small 4 wheelers), Greaves Cotton was looking to cement its position in the last mile connectivity industry. This motivation caused the entry of Greaves Cotton into the electric two-wheeler industry. Greaves Cotton invested INR 180 crores in Ampere Electric.

Geography
Greaves Cotton is utilizing its pan India retail network of dealers as a sales channel for the electric scooters. Greaves Cotton's familiarity of working in multiple geographies is advantageous to increase the market penetration of Ampere's scooters.

Conclusion

Greaves Cotton, in accordance to its strategy to expand into the last mile connectivity segment, acquired Ampere Electric through an investment of INR 180 crores. This acquisition creates a mature player in the EV two-wheeler market backed by Ampere Electric's decade of experience in EVs and by Greaves Cotton's experience in large scale manufacturing, sales and service. Greaves Cotton is leveraging its strong presence in one industry to gain traction in the other.

Industry Transition

Greaves Cotton is expanding from the IC engine manufacturing and sales industry to the manufacturing and sales industry of electric 2 wheelers.

Value Chain Position

Before the move:
Engineering, manufacturing and sales of (gasoline/ CNG) engines for automotive and industrial use (upstream of the value chain of 3 and small 4 wheelers)

After the move:
Design, manufacturing and sales of electric two-wheelers (upstream and downstream of the value chain of electric two-wheelers)

Policy Intersections

Central Policies:
- GST Reduction
- Incentives under FAME
- Benefit extension under Section 35AD(1) to incentivize EV manufacturing

State Policies:
It is not clear which state the electric two-wheelermanufacturing will take place. But since most of the manufacturing units of Greaves Cotton are in Maharashtra, they can benefit from the Maharashtra Electric Vehicle State Policy 2018. If the manufacturing takes place in Tamil Nadu, then they can benefit from the Tamil Nadu Electric Vehicle Policy 2019.

Sources

- Greaves completes acquisition of Ampere | *The Hindu*
- Greaves Cotton hikes stake in EVs maker Ampere Vehicles to 81.23% | *Mint*
- Greaves Cotton completes Ampere Vehicles acquisition via secondary purchase | *Business Standard News*

Case Study 7: L&T Technology Services

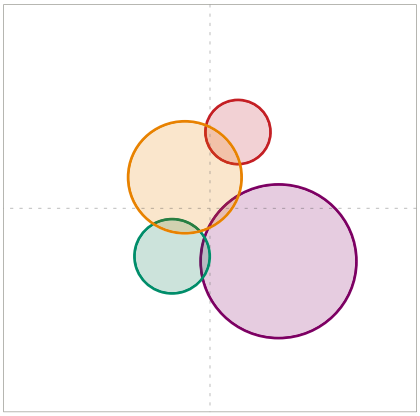
About

L&T Technology Services (LTTS) is an engineering services company headquartered in Vadodara, Gujarat. It has presence across India, North America, Europe, Middle East and Asia. LTTS's projects R&D services in product development, manufacturing and operations. It has an annual revenue of INR 48,632 million.

Strategic Move

Won a partnership with European Automotive Manufacturer[9] to assist its electric powertrain practice. Specifically, LTTS will be working with the OEM in the product testing process of the Electronic Control Unit. Such a testing will allow the OEM to verify the working potential of their ECU model through simulation before it is committed for hardware production. The partnership is a multi-year agreement announced in September 2019.

Competitive Scope



Bubble size indicates the prominence of each dimension.

Segment

Providing model-based design services and testing services for the electric control unit of the electric powertrain. The user segment is also changing from conventional to EV manufacturer (specifically, electric powertrain manufacturers).

Industry

LTTS's expertise in model-based design services and testing services for embedded technology extended to the EV industry.

Vertical

There seems to a quasi-forward integration; winning the partnership with the EU automotive manufacturer gives LTTS to extend itself in a new consumer base located overseas.

Geography

Services will be rendered in real-time through LTTS's near-shore delivery center in Munich, Germany supported by R&D hubs in India[10].

Conclusion

LTTS is using its industry experience in design and testing services for embedded technology to venture into EV product design industry. It is further using it's on-shore delivery center in Europe to provide real-time services to the OEM while the cash-intensive R&D support is provided from multiple delivery centers in India.

Industry Transition

LTTS is expanding into the EV industry (specifically, electric powertrain).

[9] *The European OEM has not been named.*

[10] *Speculation based on IT Industry outsourcing model*

Value Chain Position

Before the move:
Upstream of the value chain of ICE-vehicles

After the move:
Upstream of the value chain of EVs

Policy Intersections

No policy intersection is observed. One potential policy from which they could benefit is the budget outlay for technology platform under FAME.

Sources

- L&T Technology Services wins new electrification project from European automobile OEM - Press Release
  | *L&T Technology Services*
- L&T Technology Services Wins New Electrification Project from European Automobile OEM
  | *Business Wire*

Case Study 8: eChargeBays

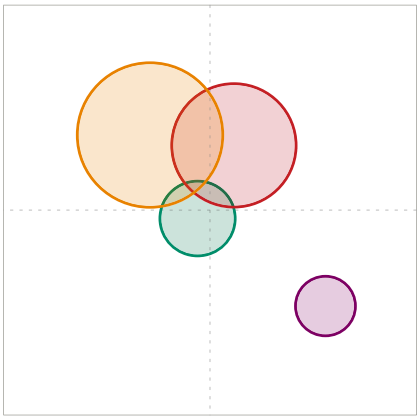
About

eChargeBays (founded 2018) is a startup headquartered in New Delhi which provides a range of EV charging solutions. Their charging solutions include at-home charging for consumers, charging stations at public spaces, quick charging[11] and shared charging services[12].

Strategic Move

eChargeBays entered a partnership with MG Motors to provide home charging solutions for its electric car owners. MG motor launched an electric SUV 'ZS EV' in January 2020. Through this partnership the owners of this SUV can get a charging station installed at their homes for no additional cost.

Competitive Scope



Bubble size indicates the prominence of each dimension.

Segment

Catering to the home-charging segment through this B2B partnership with MG Motors. eChargeBays also functions in the B2C segment where it provides quick charging and shared charging services. Therefore, the product remains same, but with home charging the ultimate user and the setting in which charging equipment is used is shifting to residential.

Industry

Partnering with MG Motors is a form of forward integration – which brings the 'home charging equipment' users to eChargeBays associating itself with the EV industry.

Vertical

eChargeBays continue to ply in the EV charging industry.

Geography

MG Motors has about 54 dealerships across 19 states and 35 cities in the country where eChargeBays can now provide their charging solutions.

Conclusion

Charging solution provider eChargeBays ventures into a B2B business model of partnering with a vehicle manufacturer, MG Motors to cross-sell their charging solution across various geographies.

Industry Transition

There is no industry transition observed in this case.

[11] *Mobile charging service when an EV runs out of charge in the middle of its journey.*

[12] *Allows consumers who own chargers to list them on an app which can be shared with other users by reserving a timeslot for charging their EVs.*

Value Chain Position

Before the move:
Providing charging solutions (downstream of the value chain of charging equipment, and that of EVs)

After the move:
Providing charging solutions (downstream of the value chain of charging equipment, and that of EVs)

Policy Intersections

Central Policies:

- Amendment of the Electricity Act 2003 by Ministry of Power (delicensing of setting up EV charging infrastructure)
- Incentives under FAME

State Policies:
They will now be providing their charging solutions across India; no single state policy intersection is observed.

Sources

- MG Motor India: MG Motor India partners eChargeBays for setting up home charging infrastructure for EVs
  | *The Economic Times*
- MG Motor India partners with eChargeBays to assist its customers with home charging infrastructure
  | *MG Motor*
- MG Car Showrooms & Dealers in India: 54 New MG Car Dealers
  | *CarAndBike*

Case Study 9: Ion Energy

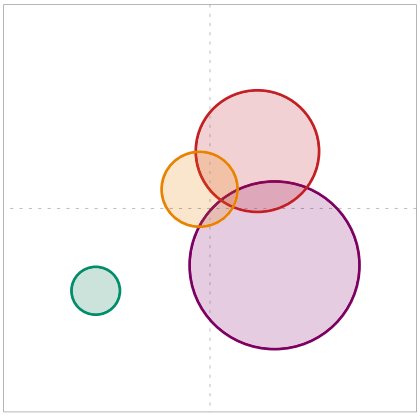
About

Ion Energy (founded 2016) is a startup based in Mumbai that functions in the battery management system industry. It provides advanced battery management systems and an intelligence platform for lithium ion batteries which are used in EVs and energy storage systems. A battery management system is a critical part in an EV powertrain: it balances the individual cells and ensure maximum efficiency & safety of the battery pack. It is also linked to other electrical components within the overall system to relay information about battery health and control input charging. Its flagship product is Edison Analytics, a cloud hosted BMS which improves battery performance and extends the operational lifetime of the battery.

Strategic Move

In 2017, Ion energy acquired French battery management firm Freemens SAS. Freemens SAS was founded in 2011 and was headquartered in Grenoble, France. Freemens provides battery management system that work for different battery chemistries and their flagship products are: FreeSafe-XT and LT battery management systems which are used in high power EVs, drones, speedboats and electric racing cars. One of their other products include the FreeWay Fleet management platform. It allows customers to remotely monitor the condition of their products and enable over the air (OTA) updates of BMS algorithms.

Competitive Scope



Bubble size indicates the prominence of each dimension.

Segment

Ion Energy continues to offer battery management systems, but it seems that Freemens' advanced cloud-based battery monitoring systems will enhance Ion energy's offerings. The customer base will now extend to manufacturers and operators of high-powered EVs and fleets. This is not an altogether new customer base for Ion Energy.

Industry

Invested in a cash plus equity deal to acquire Freemens through which they are expanding within their current industry (battery management systems, cloud-based systems).

Vertical

Teams working on engineering, as well as sales at Freemens have now been integrated into Ion energy. This indicates a mix of partial backward (in-house engineering) and forward integration (using Freemens' established capacity in sales).

Geography

Acquisition gives Ion Energy the access to the European Market through the existing client base of Freemens which include Airbus, Safran.

Conclusion

Battery Management Systems provider Ion Energy, with the intention to fortify its position in the BMS industry, acquires Freemens, a French Battery Management company in a cash plus equity deal. This gives Ion Energy the access to Freemen's technology in the BMS space which gives them (Ion Energy) a boost in their current product development stage. It also gives Ion Energy access to international markets and Freeman's existing clients such as Airbus and Safran.

Industry Transition

Ion energy's acquisition of Freemens SAS strengthens Ion energy's position in its battery management system industry.

Value Chain Position

Before the move:
Design, engineering and sales of cloud-based battery management system (downstream of the value chain of battery; upstream and downstream of the value chain of the EV)

After the move:
Design, engineering and sales of cloud-based battery management system (downstream of the value chain of battery; upstream and downstream of the value chain of the EV)

Policy Intersections

No policy intersection is observed here.

Sources

- Lithium ion: ION Energy acquires French battery management firm Freemens | *ET Auto*
- ION Energy acquires battery management company Freemens SAS | *Green Car Congress*

Case Study 10: Ion Energy

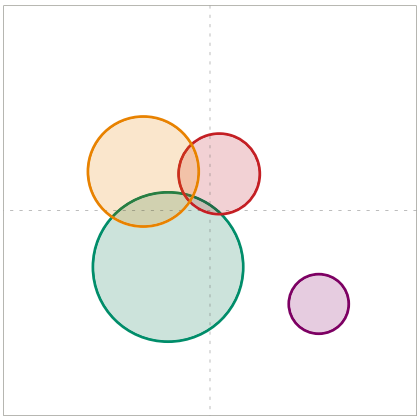
About

Ion Energy (founded 2016) is a startup based in Mumbai that functions in the battery management system industry. It provides advanced battery management systems and an intelligence platform for lithium ion batteries which are used in EVs and energy storage systems. A battery management system is a critical part in an EV powertrain: it balances the individual cells and ensure maximum efficiency & safety of the battery pack. It is also linked to other electrical components within the overall system to relay information about battery health and control input charging. Its flagship product is Edison Analytics, a cloud hosted BMS which improves battery performance and extends the operational lifetime of the battery.

Strategic Move

In November 2019, Ion energy partnered with French battery pack manufacturer firm IBS (Ion Battery Systems) to offer its battery management system and analytics platform. IBS (est. 2019) was founded to develop mobile energy storage devices using lithium ion batteries. In partnership with a leading electronic manufacturer SOCOMEC, IBS developed an electric truck with a mobile energy storage system onboard. The Ion energy BMS and analytics software are used in this mobile energy storage module.

Competitive Scope



Bubble size indicates the prominence of each dimension.

Segment

While Ion energy is offering the same product (BMS), this partnership gives Ion Energy's a larger consumer base to sell its existing BMS technology. In addition, this consumer base is located in a country where EV and related technologies have a greater penetration as compared to India.

Industry

IBS is a manufacturer of mobile energy storage systems. Ion Energy, a BMS solution provider, is extending deeper into the industry of energy storage systems.

Vertical

Compatibility between battery pack and BMS are critical to performance of batteries. Through this partnership, Ion Energy is slated to deploy 100,000 BMS and intelligence platform on IBS batteries in 2020. This is a case of forward integration.

Geography

Providing access and exposure for Ion's BMS to IBS's international EU market.

Conclusion

Battery Management Systems provider Ion Energy partners with IBS, a French Battery Manufacturing company to extend further into the energy storage system industry. Ion Energy provides IBS with a state-of-the-art battery management system and a cloud hosted analytics platform. This allows Ion Energy to foray into the European and international market.

Industry Transition

Ion Energy is actively increasing its presence in the BMS segment for energy storage systems.

Value Chain Position

Before the move:
Manufacturing and R&D for BMS (upstream of the value chain of the lithium ion battery, and that of EV)

After the move:
Manufacturing and R&D for BMS (upstream of the value chain of the lithium ion battery, and that of EV)

Policy Intersections

No policy intersection is observed here.

Sources

- France based IBS partners with ION Energy for Lithium battery pack manufacturing
  | *PV Magazine India*
- Battery pack manufacturing: Ion Energy partners with IBS for battery pack manufacturing
  | *ET Auto*

Case Study 11: Acme Cleantech

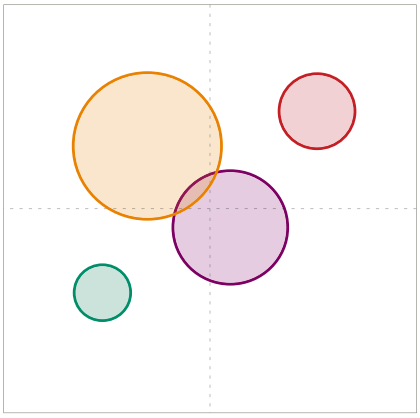
About

Acme Cleantech is a solar power developer headquartered in Gurgaon, Haryana. It was established in 2003 and has a portfolio of 5500 MWp spread across 12 states in India. It has revenue over INR 500 crore. In 2013, it also ventured into production of lithium ion batteries through an agreement with Samsung SDI and has a current capacity of 350 MWh per annum.

Strategic Move

Acme Cleantech announced in Feb 2018 that it would be increasing lithium ion production capacity[13] to 2-3 GWh at its manufacturing plant by 2020.

Competitive Scope



Bubble size indicates the prominence of each dimension.

Segment

Acme Cleantech's has been working with customers in solar industry, where lithium ion batteries are finding an increasing application as stationary energy storage devices. In addition, with the lithium ion battery it is also expanding to a new consumer base of EV makers.

Industry

Originally Acme catered to the solar industry. But through two subsequent moves in 2013 and 2018 (approximate investment of INR 500 crores*), it is in the process of increasing the production capacity of its battery manufacturing plant by 2-3 GWh by 2020, and thereby also working in the energy storage industry.

Vertical

Expanding lithium battery manufacturing capacity which defines their current position in the value chain. It is unclear from the publicly available information if Acme is going to manufacture cells or outsource them.

Geography

Acme will be expanding the capacity of its existing plant in Rudrapur, Uttarakhand.

Conclusion

Solar power developer, Acme Cleantech, initially manufactured[14] lithium ion energy cells to supplement its solar power projects. Leveraging the supplier base for the existing product, Acme is developing a lithium ion battery solution for EVs. Given the rise in demand for EV battery packs in the country, the company plans on increasing its production capacity.

[13] *Industry watcher speculates that the expansion will need INR 500 crores.*

[14] *Partnership with Samsung SDI to manufacture lithium ion batteries (2013).*

Industry Transition

Acme Cleantech diverging from its primary business focus of solar power to manufacturing of lithium ion batteries.

Value Chain Position

Before the move:
Deploying solar projects (downstream of the value chain of solar)

After the move:
Manufacturing / assembly of lithium ion battery pack (upstream of the value chain of lithium battery, and that of EVs)

Policy Intersections

Central Policies:

- Incentives under FAME
- Investment-linked income tax exemption under Section 35AD of Income Tax Act and other indirect tax benefits

State Policies:

- Incentives under Uttarakhand Electric Vehicle Policy 2018

Sources

- ACME Cleantech plans 2-3 GWh lithium ion battery manufacturing by 2020 | *PV Magazine India*
- ACME Cleantech to ramp up battery making capacity by April 2019 | *The Hindu Business Line*

Case Study 12: Indian Oil Corporation

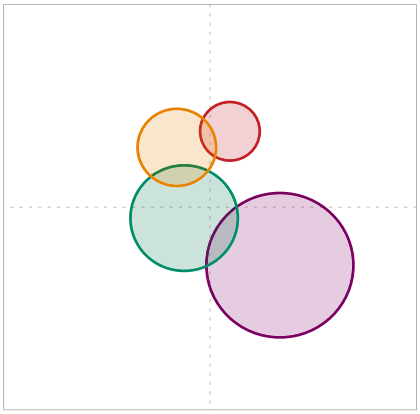
About

Indian Oil Corporation (est. 1959) is a government owned oil and natural gas company headquartered in New Delhi. It is India's largest commercial oil company and it functions in exploration, refining, transportation, and marketing of petroleum products. It has a retail network of 29,000 fuel stations across the country.

Strategic Move

Entered a partnership with Israeli startup Phinergy to develop and manufacture aluminum air batteries. Phinergy (est. 2008) headquartered in Tel Aviv is startup working on metal air batteries. It has raised $50 million in funding. Its primary focus is the aluminum-air battery. A metal air battery works with the metal (aluminum) as an anode, air as a cathode and an electrolyte solution. IOCL has acquired a minority stake in Phinergy and is in the process of creating a joint venture in India. As the technology is still in a developmental stage there is no concrete timeline for the creation of the joint-venture.

Competitive Scope



Bubble size indicates the prominence of each dimension.

Segment

Entering the alternative energy segment by acquiring a minority stake in Phinergy, a startup that is developing aluminum air batteries. Given the long range of metal-air fuel cells, this will address the range anxiety of EV aspirants.

Vertical

Diverging from its traditional business functions in oil and gas, IOC is planning on integrating the development, assembly and sale of aluminum air batteries into its existing operations through the establishment of a JV in India.

Industry

Undisclosed amount invested to acquire minority stake in Phinergy. Also proposed joint-venture with Phinergy to set up aluminum air battery manufacturing plant in India. This indicates IOC's shift from the traditional oil and gas into the alternate energy sources industry. This strategic move also has the potential to reduce India's dependence on lithium and cobalt as raw materials in the battery value chain.

Geography

Localizing the manufacturing of Al-air batteries in India through the investment and joint venture. India has vast sources of Aluminum which could serve as raw material for local manufacturing of aluminum-air batteries in India.

Conclusion

Indian Oil and Gas company acquires a minority stake in Phinergy, an Israeli startup that is developing aluminum air batteries. IOC plans on foraying into energy storage applications through this investment. Once this technology attains maturity, it could offer an option of non-Lithium, non-Cobalt based battery storage system for EVs. More so, India is the 5th largest reserve of Bauxite (Aluminium ore) in the world. Finally, IOC's move into the energy storage industry is synonymous with that of its global peers in the oil sector, who are increasingly investing in clean technology applications.

Industry Transition

IOC is expanding into the energy storage industry by investing in Phinergy.

Value Chain Position

Before the move:
Refining to retail distribution of petroleum products (upstream, barring extraction, to downstream of the value chain of the oil sector).

After the move:
Development, assembly and sale of aluminum air batteries (upstream and downstream of the battery value chain; upstream of the value chain of the EV).

Policy Intersections

The technology is still in the developmental stage. IOC can benefit from incentives under FAME once the technology is developed and the manufacturing begins in India.

Sources

- IndianOil buys stake in Phinergy of Israel for manufacturing of aluminium-air batteries
  | *ET Energy World*
- Indian Oil Corp acquires stake in Israeli battery developer Phinergy
  | *The Financial Express*

Case Study 13: Log9 Materials

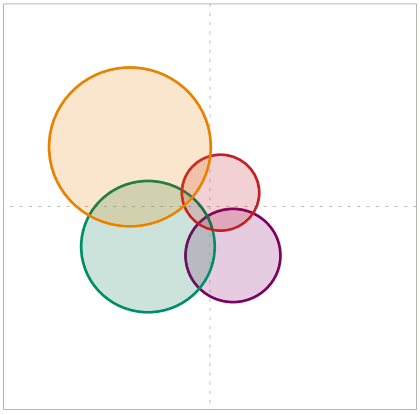
About

Log9 Materials (est. 2015) is nanotechnology startup headquartered in Bengaluru. Its area of expertise lies in utilizing graphene for various commercial purposes. One of its products include 'Sorbene' - an oil spill sorbent pad made of graphene which can absorb oil, petrochemicals, and other hydrocarbon-based liquids up to 86 times its weight. It raised $ 3.5 million dollars in its series A round of funding led by Sequoia India's scale up program - Surge and Exfinity Venture Partners.

Strategic Move

In 2018, Log9 materials entered the alternative energy sources segment through development of Aluminum air fuel cells using graphene. This fuel cell is proposed to run on water and aluminum. It will require a change of aluminum bars every 1000kms. It offers an alternative to lithium ion batteries for EVs and the crucial difference being that Al-air batteries would not require an extensive charging network and will reduce the range anxiety of an EV user. Graphene is key in reducing the cost of the fuel cell while increasing its operational life. Charging stations will cost comparatively lesser than traditional lithium ion (has a high setup cost). Refueling will take less than a minute as it just involves swapping aluminum plates.

Competitive Scope



Bubble size indicates the prominence of each dimension.

Segment

Offering a new product -- aluminum air fuel cells – targeted for EV OEMs, a new user segment for Log9.

Industry

Entered the energy storage industry, through the development of Al-air fuel cells. Originally, the firm was working in Graphene industry.

Vertical

No information on vertical integration is publicly available. But Log9 is using aluminium – an abundantly available raw material in India – which is comparatively easier to procure. Therefore, it would make backward integration easier.

Geography

Log9 is using its capacity in nano technology to devise an aluminium based battery cell. Geographically, India has abundant Aluminium reserves, as opposed to Lithium which is concentrated in a handful of countries overseas.

Conclusion

Nanotechnology startup Log9 Materials forays in EV energy source segment through its research and development of aluminum air fuel cells. Development of this critical technology can reduce India's dependence on lithium ion batteries that require importing of raw materials.

Industry Transition

Log 9 Materials is foraying into the alternate clean energy sources industry through development of the aluminum air fuel cell.

Value Chain Position

Before the move:
R&D and manufacturing (upstream of the value chain of graphene-based products)

After the move:
R&D and manufacturing of Aluminium-air batteries (upstream of the value chain of the EV)

Policy Intersections

Central Policies:

- Incentives under FAME
- They can potentially also benefit from the investment-linked income tax exemption under Section 35AD of Income Tax Act and other indirect tax benefits, if eligible[15]

State Policies:

- Incentives under Karnataka Electric Vehicle and Energy Storage Policy 2017[16]

Sources

- Log9 Materials Looks To Overhaul 'Ancient' EV Charging Tech | *Inc 42*
- 1000 km range with this electric car battery! Log9 Materials bets on aluminium fuel cells | *The Financial Express*

[15] *Component makers such as solar electric charging infrastructure and lithium storage batteries and other components are eligible.*

[16] *The place where the manufacturing will take place has not been mentioned. Since the company is based out of Bengaluru, it can take advantage of the incentives provided through the Karnataka EV Policy.*

Case Study 14: Bharat Petrolium (BPCL)

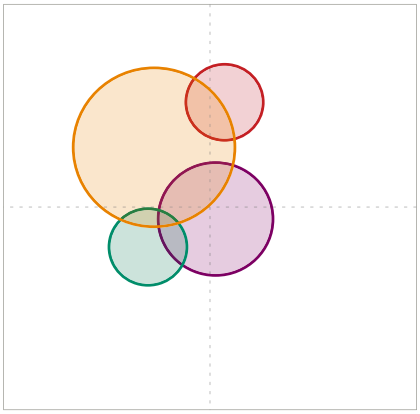
About

BPCL (est 1952) is an Indian oil and natural gas company headquartered in Mumbai, India. They produce a variety of petroleum fuels and lubricant oils. The company has an annual turnover of INR 3,37,600 crores and over 16000 retail outlets spread across the country.

Strategic Move

Partnered with EV-maker Kinetic Green Energy and Power Solutions to provide battery swapping facility at its retail outlets. Kinetic Green Energy and Power Solution is a part of the Kinetic and Firodia Group. They manufacture electric 3 wheelers at their Ahmednagar plant in Maharashtra. Their battery swapping technology uses lead acid batteries that are manufactured by Amaron.

Competitive Scope



Bubble size indicates the prominence of each dimension.

Segment

BPCL is now working on a new product segment - battery swapping of electric 3 wheelers. This move caters to the customers in the fleet operation or fleet charging business.

Industry

Through this partnership with Kinetic Green Energy, BPCL is expanding into the battery swapping industry (more specifically the last mile mobility industry). They have partnered with IIT Madras for technological support.

Vertical

No information on whether BPCL has a role in manufacturing of battery swapping system. But BPCL will acquire batteries from Amaron, which the 3-wheeler drivers will swap. Vehicles owners will therefore, not have to pay for the batteries, bringing down the cost of the vehicle by as much as 30-40%.

Geography

BPCL will be leveraging its retail network as physical locations for setting up battery swapping points for electric three-wheelers. Acquiring retail spaces costs as much as 10% of the total cost of setting up electrical infrastructure. Solution is currently being piloted at Kochi and Lucknow. Plans to launch in 7 cities in the next phase.

Conclusion

Oil and natural gas company BPCL forays into the EV battery swapping segment backed by the network of 16000+ retail outlets which constitute as possible locations for EV battery swapping stations. The company enters this segment through a partnership with EV-maker Kinetic Green Energy and Power Solutions to provide swapping stations for electric 3 wheelers. This move allows Kinetic Green to sell its electric three-wheeler for a lesser price (under INR 1 lakh) as it does not have to sell the battery. The batteries will be owned by BPCL and will be available for swapping for the owners of the electric three-wheelers for a minimal price. This will increase the adoption of electric three-wheeler across the cities it is deployed in as it reduces operational cost for users.

Industry Transition

BPCL is expanding into the battery swapping industry through this partnership with Kinetic Green & Power Solutions.

Value Chain Position

Before the move:
Refining, processing and retail distribution of petroleum products (upstream and downstream of the petroleum industry)

After the move:
Deploying battery swapping system (downstream of the value chain of battery swapping system; downstream of the value chain of electric 3-wheelers)

Policy Intersections

Central Policies:

- Incentives under FAME
- Benefit extension under Section 35AD(1) to incentivize EV manufacturing

State Policies:
Bharat Petroleum has retail outlets in multiple cities across India; no single state policy intersection is observed.

Sources

- BPCL: BPCL forays into swappable lithium ion battery supply for EVs | *ET Energy World*
- BPCL forays into swappable lithium ion battery supply for EVs | *Energy Infra Post*
- Kinetic Green in talks with PE to raise up to Rs 300 crore | *The Economic Times*

Case Study 15: Ola Electric Mobility

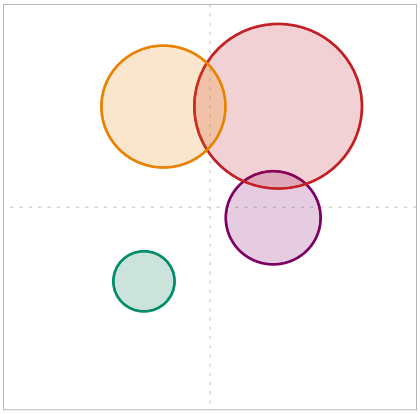
About

Ola Electric Mobility is the electric mobility division of Ola, India's largest ride-hailing division. Ola Electric Mobility was setup as separate entity (from the ride aggregator) in 2019 and has received investments from Tiger Global ($ 56 million), Hyundai & Kia Motors ($300 Million), Tata & Sons (Undisclosed) & SoftBank ($250 Million). It is currently valued over $1 Billion. It is headquartered in Bengaluru, India. Ola Electric Mobility plans to convert 40% of Ola's fleet to EVs by 2026. In 2017, Ola partnered with the Govt. of India, Mahindra & Mahindra to launch a pilot in Nagpur. Ola invested $6.96 million in the pilot to build charging infrastructure and bring 200 EVs under their ride hailing application.

Strategic Move

In 2020, Ola Electric Mobility acquired Dutch two-wheeler EV startup, Etergo. Etergo was founded in 2014 and has developed an e-scooter with a swappable battery and a range of 240KM. Ola Electric Mobility plans to launch the scooter in India in 2021.

Competitive Scope



Bubble size indicates the prominence of each dimension.

Segment

Entered into the electric two-wheeler segment which is highly relevant to India' mobility profile.

Industry

With a few pilot tests under its belt, Ola has been both – a player in and a customer of the EV industry. Through the acquisition of Etergo, Ola has now invested also in manufacturing of EV – in the two-wheeler segment.

Vertical

From being a shared ride provider, Ola forays into electric two-wheeler manufacturing. The company seems to be re-structuring itself from a fleet operator to an engineering company. This is a quasi-backward integration.

Geography

Acquisition of an EU firm for gaining R&D and innovation capacity. Ola plans on setting up engineering, design and manufacturing facilities in India.

Conclusion

One of the key-learnings from Ola Electric's pilot in Nagpur was that electric two-wheeler and three-wheeler will be crucial towards electrification of India's fleet. Considering this, Ola Electric Mobility forayed into the electric two-wheeler segment through the acquisition of the Dutch two-wheelerstartup. Ola is creating a charging infrastructure network across the country for its ride-hailing fleet of EVs which can also be leveraged by the owners of the electric two-wheelerby Ola Electric Mobility. This leads to maximum utilization of their charging infrastructure. Considering the economies of scale, it would also bring down the cost of setting up charging infrastructure for Ola and Ola Electric.

Industry Transition

Ola Electric Mobility is expanding from ride-hailing services towards the electric two-wheeler manufacturing.

Value Chain Position

Before the move:
Serving rides to customers (downstream of the EV/ICE-vehicle value chain)

After the move:
R&D, design, engineering and manufacturing of electric two-wheelers (upstream of the EV value chain; it naturally follows that Ola will continue to serve rides through its technology platform, but no explicit information is available on this)

Policy Intersections

Central Policies:

- Incentives under FAME
- Amendment of the Electricity Act 2003 by Ministry of Power (delicensing of setting up EV charging infrastructure)
- Benefit extension under Section 35AD(1) to incentivize EV manufacturing

State Policies:
It is not clear where the manufacturing of the scooter will take place. The charging infrastructure is network is being created across the country.

Sources

- Ola Electric acquires Etergo, looks to launch electric scooters in India by 2021 | *Mint*
- How Ola Electric Mobility (OEM) is trying to revolutionize EVs | *Quartz India*

Case Study 16: Innolia Energy

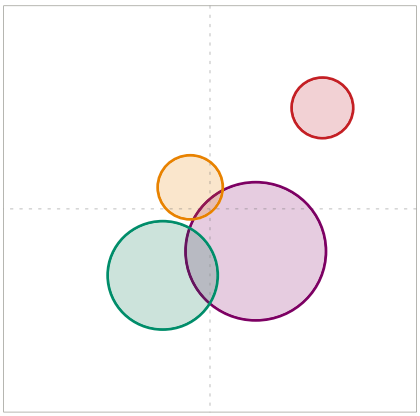
About

Innolia Energy (est. 2012) is solar power and energy storage (lithium ion) manufacturer. It is headquartered in California, USA, with its Indian arm in Hyderabad India. Its integrated manufacturing facility (solar and lithium ion) is in Choutupal, Telengana. It has an installed capacity of 100MW for solar power and 200 MWH for lithium ion battery production under the same roof. The setup of this factory sought an investment of INR 30 crore. It has been operational since October 2019. In addition to the manufacturing of lithium ion cells, they also manufacture their own patented battery management systems.

Strategic Move

Innolia Energy announced in September 2019 its plans on investing INR 225 crores to develop an integrated manufacturing facility for Solar Panels and lithium ion batteries. The location for the manufacturing plant is E-City in Hyderabad. It has a size of 1,00,000 sq. feet and will have a manufacturing capacity of 300 MWh solar and 1 GWh of lithium ion batteries.

Competitive Scope



Bubble size indicates the prominence of each dimension.

Segment

Innolia Energy will continue to offer the same products (lithium ion battery and BMS), but the customer profile will change as it manufactures and sells in India. Earlier it was catering to US based customers – where the fleet profile has greater share of large vehicles, city driving includes longer distances, climatic conditions and finally their grid is relatively more advanced for V2G applications.

Industry

Investing INR 225 crore in increasing their existing manufacturing capacity in the Solar Power and Energy Storage industry – in an integrated fashion. There isn't sufficient information to conclude if Innolia will be making battery cells, as opposed to only assembling them into a pack.

Vertical

There is no major integration taking place via this move. But a partial backward integration can be seen; Innolia owns a patented battery management system, which when paired with the lithium ion battery will create an integrated offering for its customers

Geography

This investment will take advantage of the incentives provided at the Electronic Manufacturing Clusters in E-City, Hyderabad.

Conclusion

Innolia energy is expanding its foothold in its current industry through this investment which will increase its manufacturing capacity. The investment is being made in e-city electronics manufacturing hub in Hyderabad, where the Telengana government has created a set of incentives for firms in electronic manufacturing.

Industry Transition

No industry transition is observed in this strategic move. There is expansion in the existing industry.

Value Chain Position

Before the move:
Manufacturing lithium battery packs, battery management system (upstream of the value chain of an EV)

After the move:
Manufacturing lithium battery packs, battery management system (upstream of the value chain of an EV)

Policy Intersections

Central Policies:

- Incentives under FAME
- Investment-linked income tax exemption under Section 35AD of Income Tax Act and other indirect tax benefits

State Policies:

- Incentives under Telangana Electric Vehicle Policy 2017

Sources

- Innolia Energy setting up solar panels, lithium battery pack plants | *The Hindu*
- Two electronics parks in Telangana get Centre's nod | *Telangana Today*

Case Study 17: Exide Industries

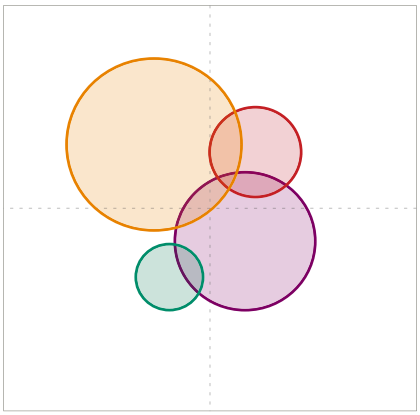
About

Exide Industries (est. 1947) is an Indian battery manufacturing company headquartered in Kolkata, West Bengal. It produces lead acid batteries for the automotive industry (four-wheelers, two-wheelers, three-wheelers, e-rickshaws, inverters, gensets and home UPS systems), industrial applications (power, solar, railways, telecom) and submarine. Its annual turnover is INR 9,857 crores. It has 9 manufacturing facilities in India, of which 7 are dedicated to batteries and 2 manufacture Home UPS Systems. West Bengal (Shyamnagar, Midnapore), Haryana (Bawal), Maharashtra (Pune, Taloja, Ahmednagar) Tamil Nadu (Hosur), Uttarakhand (Roorkee, Ranipur).

Strategic Move

In June 2018, Exide Industries created a JV (75:25) with Leclanche SA, called Nexcharge to assemble lithium ion batteries in India. The plant will be in Gujarat. Leclanche SA (est. 1909) is a Swiss energy storage manufacturer. They manufacture battery storage technology for both stationary (energy sector) and e-transport applications. Their portfolio also includes battery management systems and software. At present, the cells are being imported from Leclanche's plant in Germany. Indigenous production of cell will begin soon at the local plant in Prantij (Gujarat) with a capacity of around 1.5GWh.

Competitive Scope



Bubble size indicates the prominence of each dimension.

Segment

Entered into a new product segment of lithium ion batteries. Customer base remains the same – automotive and industrial clients.

Industry

Invested INR 100 CR into the battery assembly plant in Gujarat. Further there is a proposed investment of INR 100 crore in this JV. Overall, Exide is expanding into lithium ion battery from lead acid battery industry.

Vertical

Exide will assemble lithium ion batteries from cells at a new plant planned in Gujarat (with a planned capacity of 750 MWh). This is an example of backward integration. It also plans to produce the cells at a plant in Gujarat.

Geography

The JV will take advantage of its location in Gujarat, where the state government also plans on converting the Dholera region into a lithium ion manufacturing hub.

Conclusion

Exide Industries, a seasoned player in the energy storage industry, adds lithium ion batteries to its product portfolio. The company seems to be aligning itself with the transition of technology from lead acid to lithium ion – that is prevalent in its customer base of automotive OEMs and industrial users.

Industry Transition

Industry transition from lead acid battery production to lithium ion battery manufacturing.

Value Chain Position

Before the move:
Lead acid battery manufacturing (the entire set of activities upstream of the lead acid battery value chain)

After the move:
Lithium ion Battery manufacturing (upstream of lithium ion battery)

Policy Intersections

Central Policies:

- Incentives under FAME
- Investment-linked income tax exemption under Section 35AD of Income Tax Act and other indirect tax benefits
- Nil custom duty on lithium ion cells

State Policies:

- Incentives under Gujarat State Policies

Sources

- Exide and Leclanche JV to Begin Li-ion Battery Manufacturing Soon | *Saur Energy*
- Exide JV to start lithium ion battery mfg in Guj by 2019 | *Times of India*

Case Study 18: Hitachi ABB Power Grids

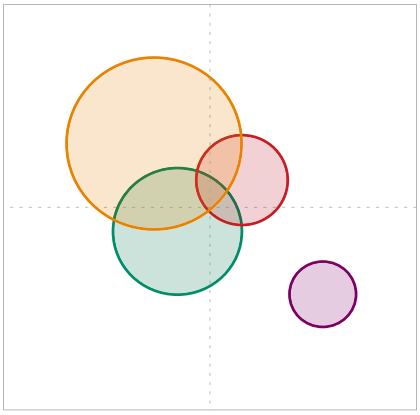
About

Hitachi ABB Power Grids is a joint venture between Hitachi and ABB power grids. ABB sold its power grids business (80.1%) to Hitachi in a deal that completed in July 2020. It is headquartered in Zurich, Switzerland. Their four global business units include: Grid automation, Grid Integration, High voltage products, and Transformers. The Indian division is headquartered in Bengaluru, Karnataka.

Strategic Move

Hitachi ABB Power Grids signed an MOU (Jan 2020) with bus manufacturer Ashok Leyland to co-develop a bus with ABB's flash charge technology and Grid eMotion fleet solution. Known as the Grid eMotion Flash Solution (or TOSA), it connects the bus to the charging infrastructure where in 15 seconds the batteries are charged with a 600-kilowatt power boost. Hitachi ABB Power Grids' is responsible for planning, design, engineering installation and commissioning of the flash charging system. Ashok Leyland will manufacture and supply electric buses compatible with the TOSA technology. In July 2020, Hitachi ABB Power Grids also announced that it will extend its Grid eMotion Fleet solution as part of the MoU. This solution is a grid to plug EV charging system designed for large public transport fleet. The primary advantage of the Grid eMotion fleet solution is that it uses DC technology thus enabling it to connect to any power network. Compared to conventional charging solutions it also offers a 60% decrease in space needed for the chargers and a 40% decrease in cabling.

Competitive Scope



Bubble size indicates the prominence of each dimension.

Segment

Through this MoU with Ashok Leyland, Hitachi ABB Power Grids serves a new customer base of e-buses manufacturers and operators in India.

Geography

The MoU gives Hitachi ABB Power Grids a means to deploy their flash charging and fleet charging solutions in the states where Ashok Leyland is deploying its buses. Ashok Leyland has a 44.86% market share of bus sales in India.

Vertical

A forward integration is observed in Hitachi ABB's value chain. By offering its existing technology (first developed overseas) to Ashok Leyland under an MoU, it is getting access to the e-bus customers in India. The company has a pilot project running on the flash charging (TOSA) technology in Geneva.

Industry

No industry transition is observed in this strategic move.

Conclusion

Hitachi ABB Power Grids enters into an MoU with Ashok Leyland in order use the latter's expertise and foothold in India to deploy its flash charging and fleet charging solution. Ashok Leyland's recent orders of over 4300 conventional busses with various state transport unions (Chandigarh, Uttar Pradesh, Tamil Nadu) consolidates/proves its position as a leading supplier of buses for public transport. In addition to that, Ashok Leyland has a 44.86% market share of buses sales in India. This combined with Hitachi ABB Power Grid technology will boost the electrification of the public transport in India.

Industry Transition

No industry transition is observed in this strategic move.

Value Chain Position

Before the move:
Developing the TOSA technology with e-buses as the target customer (upstream of the technology value chain)

After the move:
Deploying TOSA technology in integration with e-buses (downstream of the value chain of technology and e-bus segment)

Policy Intersections

Central Policies:

- Incentives under FAME (Hitachi will indirectly benefit from the Scheme)

Sources

- Hitachi-ABB Partners With Ashok Leyland To Launch Fleet EV Charging Systems In India
  | *Drive Spark News*
- Hitachi ABB Plans To Launch New EV Charging System In India Under Partnership With Ashok Leyland
  | *CarAndBike*

Case Study 19: Exicom Power Solutions

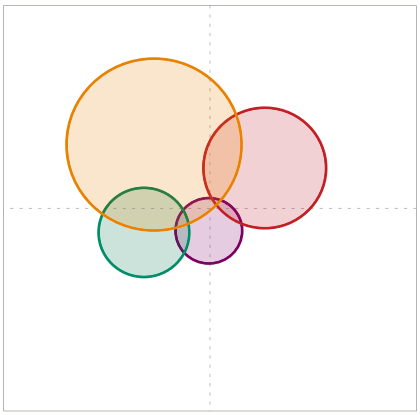
About

Exicom Power Solutions was established in 1994 as a joint venture between Himachal Futuristic Communications Limited (HFCL) and Exicom Australia to manufacture telecom power equipment in India. It now functions in 3 key business areas: Telecom Power Solutions, Energy Storage and Electric Mobility. It is headquartered in Gurgaon, India. Its energy storage and electric mobility product portfolio contains lithium ion batteries (for two-wheelers, three-wheelers, four-wheelers and buses), charging infrastructure (AC & DC fast charging ranging from 1kW to 150kW), battery management systems, analytics and fleet management software. In addition, they also provide a range of services in EV battery and charging space such as training, installation and commission, and remote monitoring. Exicom operates a battery assembly plant in Gurgaon. For its battery assembly process the company imports lithium ion cells while manufactures the BMS, PCB, casing, cabling and sensors in house. The company has also announced plans to set-up another manufacturing facility in South India.

Strategic Move

In November 2019 Exicom Power Solutions enters into a partnership with MG Motors, a Chinese-owned British motor company to recycle its used battery packs from its SUV, the ZS EV. The ZS EV was launched in India in January 2020. The battery packs used in the ZS EV are manufactured by CATL, a Chinese battery manufacturer. CATL predominantly uses the Lithium-Nickel-Cobalt-Manganese chemistry for its electric passenger vehicle batteries. The used battery packs acquired will be re-used in non-automotive application like home invertors and renewable energy storage.

Competitive Scope



Bubble size indicates the prominence of each dimension.

Segment

Exicom PS enters into the EV battery re-use / recycling segment. Re-used batteries will be used in non-automotive battery applications such as home inverters, renewable energy storage and industrial UPS.

Vertical

Integrating retired lithium ion batteries into the ambit of its current manufacturing (BMS) and assembly operations. This creates a circular business advantage where the EV batteries retired from vehicles are re-purposed and/or recycled instead of entering the landfills.

Industry

Exicom PS is furthering its presence in the battery industry – specifically second-life applications through this partnership with MG Motors.

Geography

One advantage of partnering with MG Motors is that it can facilitate easy collection of retired batteries at its retail and service outlets across the country. Further, this move will give Exicom PS a local source of raw material for lithium ion cell, and thereby relaxing dependence on foreign sources.

Conclusion

Exicom Power Systems has 2 decades of experience in the electronic manufacturing industry. Through these strategic moves it plans on strengthening its foothold in the EV energy storage and charging industry. Through its partnership with MG motors it is exploring the potential of the battery second life industry. This is key considering the high influx of EV vehicles in the country will generate a large quantity of used batteries in the years to come.

Industry Transition

An industry expansion is observed from BMS manufacturing and battery assembly to the battery re-using/ recycling (second life) industry.

Value Chain Position

Before the move:
Exists in multiple inter-connected value chains; Assembly of battery packs (upstream of battery value chain), manufacturing of BMS and electronics (upstream of BMS and electronics), manufacturing, installation and monitoring of battery charging infrastructure (upstream and downstream of the battery charging value chain)

After the move:
End of the battery value chain (downstream); if batteries are recycled, the raw materials extracted will join upstream activities. If batteries are re-purposed, they will once again enter the downstream of the use scenario (in telecom, renewables, etc.)

Policy Intersections

Policies for recycling of batteries are still in process.

Sources

- Exicom and BHEL sign MoU on EV charging infrastructure | *PV Magazine India*
- Exicom Is Focussing On Supporting India's Electric Mobility Push | *Auto Tech Review*

Case Study 20: Bharat Forge

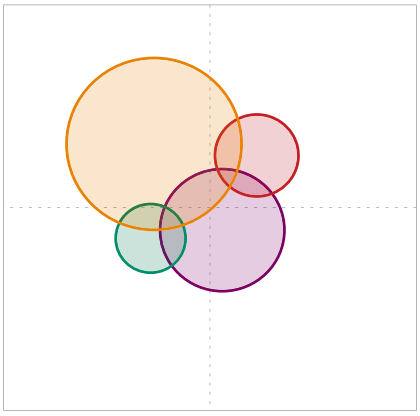
About

Bharat Forge (est. 1966) is a component manufacturer serving the following industries: automotive, power, oil & gas, construction & mining, locomotive, marine and aerospace industries. It is headquartered in Pune, India and is a part of Kalyani Group, a privately held industrial conglomerate. Bharat Forge has an annual revenue of $1.6 billion. It is India's largest manufacturer and exporter of automotive parts. In India it has 5 manufacturing facilities in Mundhwa (Pune), Satara (Maharashtra), Baramati (Pune) and Chakan (Pune) and Nellore (Andhra Pradesh). Its international manufacturing sites are in Germany (2), Sweden (1), France (1) and USA (1).

Strategic Move

1A. In 2018, Bharat Forge picked up stake in Tevva Motors (UK) for INR 90 crores. Tevva Motors is a Chelmsford, UK based developer of electrification systems for commercial medium duty trucks (7.5 tons -14 tons). It has also received a cornerstone investment from the AngelCo Fund, a British Govt. owned business bank. Bharat Forge has acquired a license for commercializing Tevva technology within India. Bharat Forge will also use this investment to boost its research and development in the e-mobility space, with a focus on EV powertrains.
1B. In 2018, Bharat Forge announced its acquisition of a 45% stake in Tork Motors, an Indian electric motorcycle manufacturing company. The investment made in 2018 amounted to INR 30 crores. In June 2019, it raised its stake to 48.8% through an investment of INR 4 crore. As a part of this investment, Bharat Forge will provide Tork Motors with critical components such as invertors and die-cast enclosures for its battery and other power components. Tork Motors is set to launch its T6X motorcycle in 2020. It will run on a 6 KwH battery and provide a range of 100 kms.
1C. In 2018, Bharat Forge set up an R&D center in UK at MIRA Technology Park, Warwickshire. MIRA technology park is e-mobility R&D hub with a presence of over 40 automotive companies. Bharat Forge's R&D center is aimed towards R&D in electric powertrain solutions. This center will also aim to complement the work of KCTI (Kalyani Centre of Technology and Innovation) and KCMI (Kalyani Centre for Manufacturing Innovation) the two R&D centers that work under Bharat Forge's parent company, Kalyani Group.
1D. In Sept. 2019, Bharat Forge entered into a JV (50:50) with Refu Electronik. Headquartered in Pfullingen, Germany, REFU Elektronik specializes in power electronics (inverters, DC-DC converters and on-board chargers) for e-mobility applications. The JV with Bharat Forge will focus on marketing and manufacturing on-board controllers and components - such as: drives, invertors, converters (including AC/DC), related power electronics and battery management systems (BMS). Bharat Forge has invested EUR 11.35 million through equity shares in this JV.

Competitive Scope



Bubble size indicates the prominence of each dimension.

Segment

Forayed into 2 new segments of EV component manufacturing:
1. EV powertrains
2. EV onboard electronics.
Alongside, Bharat Forge also has a stake in making electric two-wheeler motorcycle that Tork is developing.

Vertical

Integrating capabilities from R&D to manufacturing and sale of electric powertrains under its ambit. The JV reflects a mix of backward and forward integration; manufacturing and sale of EV electronic components such as drives, invertors, convertors and BMS.

Industry

Investment of INR 90 crore in Tevva Motors, INR 34 crores in Tork Motors, Investment of EUR 11.35 million in the JV with Refu Elektronik. There is an industrial transition from component manufacturing for ICE to manufacturing and development of EV components, and commercial and passenger EVs.

Geography

Proximity to international OEMs at the MIRA tech park provides an international talent pool for R&D services. JV with Refu Elektronik gives Bharat Forge access to advanced European EV technology.

Conclusion

The company has made the aforementioned strategic moves in-line with its strategy to expand its presence in the e-mobility industry and to increase its CPV (content per vehicle). It has announced its focus on electric transmission (powertrains) and in EV power components. Through Tevva and Tork Motors it gets access to low-voltage and high-voltage electrification technologies which will support its target of increasing its CPV. The JV with Refu Elektronik also initiates the development of EV power electronics for Bharat Forge's Indian customers.

Industry Transition

Bharat Forge is expanding from component manufacturing for ICE vehicles to component manufacturing for EV vehicles.

Value Chain Position

Before the move:
Manufacturing of components for ICE vehicles (upstream of automotive value chain)

After the move:
Manufacturing of powertrain and non-powertrain components for EVs (upstream of automotive value chain). Manufacturing of power electronics and BMS additionally place Bharat Forge in the value chain of power electronics and EV batteries.

Policy Intersections

Central Policies:
- Incentives under FAME

Sources

- Annual Report | *Bharat Forge*
- Bharat Forge forms JV with Germany's Refu Electronik for EV components | *Business Standard News*
- Tork Motor: Bharat Forge acquires additional stake in EV startup Tork Motor | *The Economic Times*
- Bharat Forge: Bharat Forge picks up stake in Tevva Motors for Rs 90 cr | *ET Auto*

Case Study 21: Force Motors

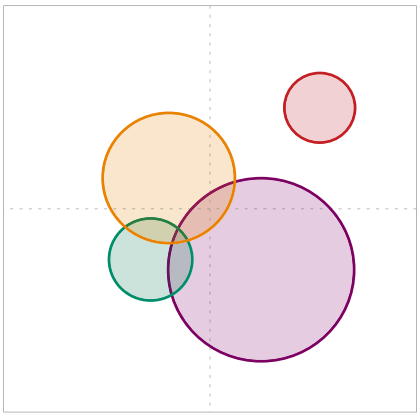
About

Force Motors (est. 1968) is an agricultural and commercial automobile manufacturer headquartered in Pune, Maharashtra. In its agricultural vehicle portfolio, it manufactures and sells 4 tractors variants. In its commercial portfolio it manufactures buses, light commercial vehicles (e.g. Traveller), goods carriers, and multi-utility vehicles (e.g. Trax). In addition to this, Force Motors also manufactures engines and axles for Mercedes Benz India and BMW which accounts for a third of their revenue. Force Motors has manufacturing facilities at Akurdi and Chakan (Maharashtra), Pithampur (Madhya Pradesh), and Chennai (Tamil Nadu). Its turnover in 2020 was INR 3,080 Crores.

Strategic Move

In Jan 2020, Force Motors introduced an electric platform named T1N. Platforms are a set of common design, engineering and production efforts that are created in the automotive industry to reduce development costs. In the current scenario, the T1N platform is designed to accommodate 3 different types of powertrains: Diesel, CNG, and electric. The van with T1N platform, based on their flagship Traveller van, is expected to go into sale by the end of 2020. The company announced that over INR 1,000 crores was spent to develop this platform and it took a period of 4 years.

Competitive Scope



Bubble size indicates the prominence of each dimension.

Segment

Entered into the new product segment of electric van manufacturing (eLCVs – Electric Light Commercial Vehicles). This new product will, however, be built on the T1N platform that will be shared with its conventional (CNG/ diesel) counterparts. Invested INR 1000 crores in the development of common platform (T1N).

Industry

Overall, Force Motors is expanding to EV industry -- from the traditional ICE vehicle manufacturing. But it stays in the commercial vehicle segment through the development of a common platform T1N which will be used in both conventional and EVs.

Vertical

Lack of data to conclude the presence of vertical integration through this strategic move.

Geography

These platforms will be manufactured at the existing Pithampur factory in Madhya Pradesh for which a state-of-the-art facility is being set up. Force Motors is also planning to launch the T1N platform in select markets in the Middle East, Africa, ASEAN and South America.

Conclusion

Force Motors is looking to expand its product portfolio to accommodate EVs. Given that the adoption rates of electric LCV are low across the world, the mobility platform developed by Force Motors will be able to work with ICE as well as electric powertrains. This move addresses the need of electrifying commercial vehicles in India. The dependence on ICE by this user segment is significant and must be addressed through the right product development, pricing and marketing strategies.

Industry Transition

An industrial shift is observed from traditional ICE vehicle manufacturing to EV system assembly.

Value Chain Position

Before the move:
Commercial ICE vehicle manufacturing (upstream of the value chain)

After the move:
Commercial EV platform (upstream of the EV value chain)

Policy Intersections

Central Policies:
- Incentives under FAME
- Benefit extension under Section 35AD(1) to incentivize EV manufacturing

State Policies:
- Incentives under Madhya Pradesh Electric Vehicle Policy 2019

Sources

- Force Motors reveals all-new electric van | *Force Motors*

Case Study 22: Bajaj Auto

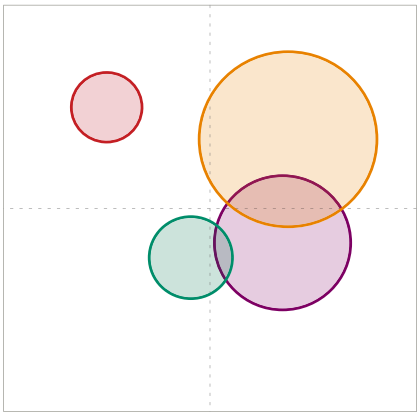
About

Bajaj Auto (est. 1926) is headquartered in Pune, India. It is the world's fourth largest three and two-wheeler manufacturer. Bajaj Auto has 4 manufacturing locations in India: Akurdi (Maharashtra), Waluj (Maharashtra), Chakan (Maharashtra) and Pant Nagar (Uttaranchal). Bajaj Auto along with Pierer Mobility owns KTM AG, an Austrian motorcycle company. The alliance benefits Bajaj Auto with technology sharing. KTM's advanced technology is being used in some way by Bajaj in its well-known regional two-wheelers (Pulsar and Dominar). Bajaj is the sole producer/exporter of KTM motorcycles under 400cc. Bajaj Auto manufactures the KTM motorcycles in its plant in Chakan, Pune.

Strategic Move

In June 2019, Bajaj Auto announced that it will be jointly developing a common electric two-wheelerplatform with KTM. The company announced that it will be a 48V platform with outputs ranging from 3 – 10 KW. This EV architecture will be used as a base for scooters and mopeds. These EV platforms will be manufactured at Bajaj's Chakan plant and it will begin in 2022. The EV platforms will be used to develop two-wheelers under both the brands (Bajaj and KTM). Consequently, Bajaj Auto also designed, developed and launched an electric scooter (Chetak) in 2020. It further announced that the KTM scooters will share Chetak's platform.

Competitive Scope



Bubble size indicates the prominence of each dimension.

Segment

Entering the developing and manufacturing of electric two-wheeler architecture segment in partnership with KTM.

Industry

A recent industry shift is observed in this case. Bajaj Auto is an existing player in the two-wheelermanufacturing industry, and it has expanded into electric two-wheelermanufacturing. The KTM-Bajaj partnership began in 2007 for IC engine two-wheelers. With this move it is expanding the scope of its position into the EV two-wheelermanufacturing. Bajaj has 12% market share in the conventional two-wheelermarket in India.

Vertical

No vertical integration is observed in this strategic move.

Geography

Manufacturing facility in Chakan, Pune will be benefited by the Pune automotive cluster.

Conclusion

Bajaj Auto intends to be a global player in the electric two-wheeler industry. In line with this strategy, it seems to believe that developing a modular platform will allow the flexibility for it to be used with different brands of two-wheelers. This combined with cost efficient manufacturing in India and its manufacturing location in the Pune automotive cluster will render an effective electric 2- wheeler platform for Bajaj and KTM.

Industry Transition

A recent industry transition is observed in this case where Bajaj Auto has transitioned from traditional two-wheeler manufacturing to electric two-wheeler manufacturing.

Value Chain Position

Before the move:
Design, development, manufacturing (upstream of the value chain of ICE scooters and motorcycles)

After the move:
Design, development, manufacturing (upstream of the value chain of electric two-wheelers)

Policy Intersections

Central Policies:
- Incentives under FAME
- Benefit extension under Section 35AD(1) to incentivize EV manufacturing
- GST reduction (Indirect benefit)

State Policies:
- Incentives under Maharashtra State Electric Vehicle Policy 2018

Sources

- KTM: Bajaj Auto may drive in EVs this year | *ET Auto*
- Bajaj's electric Chetak to share platform with KTM, Husqvarna | *Mint*

Case Study 23: Manikaran Power Ltd. (MPL)

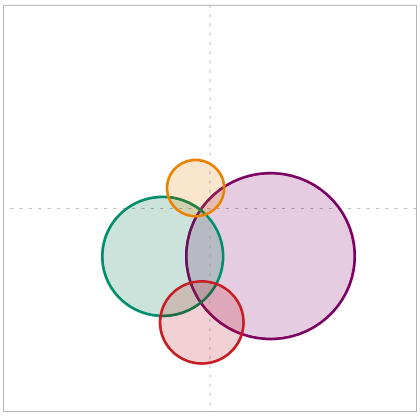
About

Manikaran Power Ltd. (est. 2005) is a power trading services provider headquartered in New Delhi. Its mission is to facilitate transfer of power from a surplus area to a deficit area through Power Exchange Platforms such as Indian Energy Exchange (IEX) and Power Exchange India Ltd (PXIL). It also specializes in the trading of Renewable Energy Certificates on Power Exchanges platform. It is a licensed (Central Electricity Regulatory Commission - CERC) inter-state trader of electricity.

Strategic Move

In 2019, Manikaran Power Ltd signed an MoU with Neometals (an Australian mineral exploration company specializing in lithium, titanium, vanadium and nickel projects) to initiate a jointly financed feasibility study on developing India's first lithium refinery with a nominal annual capacity of 20,000 tonnes. The three companies enlisted to conduct the study are: Primero Group(Australia), Sichuan Calciner Technologies (China) and Veolia HPD (USA). The areas of assessment are feasibility studies, finalization of contractors, consultants/OEM reviews and site evaluation. According to the timeline, the study will tentatively finish by the December 2020. The assessment results will help MPL and Neometals make investment decisions for the formation of a 50:50 joint venture to develop the lithium refinery, starting March 2021. The cost of this study is estimated at $1.3 million.

Competitive Scope



Bubble size indicates the prominence of each dimension.

Segment

This strategic move indicates MPL's entrance into a new product segment of lithium refining. Lithium once refined is used as a raw material in the manufacturing of batteries. MPL will, hence, work with a new customer base of battery manufacturers, who in turn supply to EV manufacturers.

Industry

This strategic move indicates that

MPL is transitioning to new industry of lithium refining from power trading industry, where it is situated currently.

Vertical

If the feasibility studies indicate a positive result then MPL will undertake the process of lithium refining that will contribute to the overall EV and battery value chain in India.

Geography

The possible collaboration in setting up a JV with Neometals would provide the proposed lithium refinery a steady source un-processed lithium from Neometal's Mt. Marion mine in Australia. It will also help reduce the dependence of Indian lithium ion battery manufacturers on foreign sources of lithium.

Conclusion

MPL's foray into lithium ion refining aims to address India's growing EV battery needs. Through its proposed lithium ion refining plant with Neometals, Australia it will potentially setup a domestic downstream manufacturing of lithium ion batteries in India. This move will likely reduce the dependence of Indian EV battery manufacturers on foreign sources for EV battery raw materials.

Industry Transition

MPL is transitioning from the Power Trading industry to the lithium ion refining industry.

Value Chain Position

Before the move:
Downstream of the power sector value chain

After the move:
Lithium procurement and refining (raw material procurement and refining, upstream of the lithium ion battery value chain)

Policy Intersections

They are doing a feasibility study, no policy intersection at this moment.

Sources

- Manikaran Power Limited and Neo Metals commence joint feasibility study for lithium refinery in India
  | *Green Car Congress*
- (Press Release) Manikaran Power Limited and Neometals commence joint feasibility study for Lithium Refinery
  | *Manikaran Power*

Case Study 24: Varroc Engineering

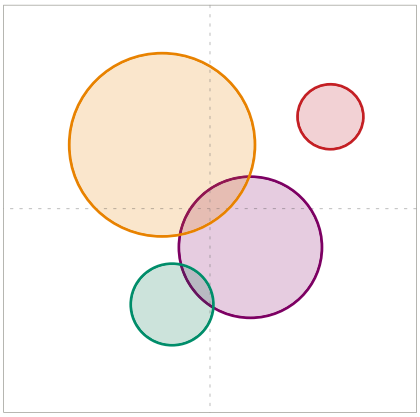
About

Varroc Engineering (est. 1990) is an automotive component manufacturer headquartered in Pune. Varroc Engineering designs & manufactures exterior lighting systems, polymer components, electrical-electronics components, and metallic components to passenger car, commercial vehicle, two-wheeler, three-wheeler OEMs. In 2020, it clocked INR 112 billion revenue in excess. It has 26 manufacturing locations in India (Maharashtra -16, Tamil Nadu – 2, Karnataka -2 , Gujarat-1, Haryana-1, NCR-1, Uttarakhand-1, Madhya Pradesh -1). Varroc Engineering's clients include Bajaj Auto Ltd, Tesla, Audi, Jaguar Land Rover, Bentley and Volkswagen.

Strategic Move

In Feb 2020, Varroc Engineering entered into an agreement with a Danish Battery Management Solution (BMS) provider – Lithium Balance A/S to manufacture EV battery management solutions for the company. Under this agreement Varroc Engineering will manufacture BMS for lithium ion batteries for two and three-wheelers at its manufacturing plant in Pune.

Competitive Scope



Bubble size indicates the prominence of each dimension.

Segment

Through this strategic move Varroc Engineering enters a new product segment of BMS. The agreement provides Varroc Engineering with surety of volume of BMS to produce, with which it can achieve economies of scale in exchange for investment in a new segment. So far Varroc hasn't dealt with customers from battery industry.

Geography

The plant manufacturing the BMS is located in the Pune automotive cluster.

Vertical

No vertical integration is observed.

Industry

Transitioning into a new industry of EV component manufacturing through this strategic move. Varroc Engineering has expertise in manufacturing electronics-electricals for ICE cars. Making a BMS shares expertise but only slightly. BMS is vital for monitoring the health and performance of a battery, and thereby is essential to an EV when compared to an electric circuit in an ICE vehicle.

Conclusion

Varroc Engineering is an existing supplier of automotive parts to ICE automobile car manufacturers. In line with its strategy to transition to into a similar position for EV manufacturers, it enters into an agreement with BMS solution provider Lithium Balance to manufacture BMS.

Industry Transition

Varroc Engineering is transitioning from the traditional ICE vehicle component industry to the EV powertrain component manufacturing industry.

Value Chain Position

Before the move:
Manufacturing auto components (upstream of the automotive value chain)

After the move:
Manufacturing battery management solutions (upstream of the electric 2/3-wheeler vehicle value chain)

Policy Intersections

Central Policies:

- Incentives under FAME

State Policies:

- Incentives under Maharashtra State Electric Vehicle Policy 2018

Sources

- Lithium ion battery: Varroc to manufacture EV Battery Management Systems for Danish company Lithium Balance | *ET Auto*
- Varroc to Develop Battery Management Systems for Lithium Balance | *Auto Tech Review*

Case Study 25: Amara Raja Batteries Ltd

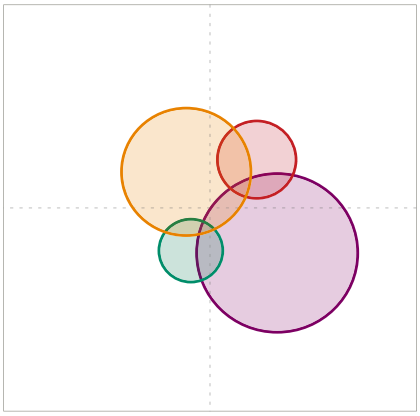
About

Amara Raja Batteries Ltd (ARBL) is one of the companies under the Amara Raja Group. The Amara Raja group was founded in 1985 and is headquartered in Tirupati, Andhra Pradesh. Amara Raja Batteries is a manufacturer of automotive and industrial lead acid batteries in India. Its automotive clients include Maruti Suzuki India Limited, Hyundai Motors India Limited, Ford India Limited, Tata Motors Limited, Mahindra and Mahindra Limited, Honda Cars India Limited, Renault Nissan, Honda Motorcycles & Scooters India Private Ltd, Royal Enfield and Bajaj Auto Ltd. Its revenue for FY19 was INR 6839.46 crores. ARBL has two plants in the Chittoor district in Andhra Pradesh.

Strategic Move

Amara Raja Batteries in collaboration with Tirupati Municipal Corporation set up EV battery charging and swapping stations in Tirupati as a part of a pilot project. It also inaugurated a fleet of electric-auto rickshaws. This pilot project is supposedly a business demonstration showcasing ARBL as an end-to-end fleet operations solution provider. ARBL also added 500 MWh lithium ion battery pack assembling capacity at its Chitoor plant. The battery charging /swapping stations were developed by ARBL's R&D facility. No information is available on who developed the electric rickshaws.

Competitive Scope



Bubble size indicates the prominence of each dimension.

Segment

Through this strategic move ARBL is entering two new segments – the product segment of lithium ion battery pack manufacturing (by manufacturing, ARBL means assembling of imported cells into battery packs) and the product segment of fleet operation solutions – i.e battery charging and swapping technology.

Vertical

In its vision to become an end-to-end fleet operations solution provider it has integrated the lithium ion battery pack manufacturing process into its value chain as well as battery charging/swapping. ARBL's R&D facility has also developed its own EV battery charging and swapping technologies.

Industry

From its current lead acid battery manufacturing it has ventured into lithium ion battery pack assembly. The lead acid manufacturing process is simpler and cheaper (in terms of costs per hour) when compared lithium ion batteries. It also has expanded into a fleet operation solution provider.

Geography

ARBL has setup lithium ion battery pack manufacturing (500 MWh) capability at its existing plant in Chittoor, Andhra Pradesh. It is also using the proximity of pilot test site (Tirupati) to its manufacturing facility to its advantage.

Conclusion

Amara Raja Batteries Ltd has entered the lithium ion technology industry to mitigate the technology risk lithium ion poses to the lead acid battery industry. Through this pilot project it is laying groundwork to position itself as an end-to-end fleet operation solution provider. It brings to the table its experience working with premier automotive OEMs in the lead acid battery industry. ARBL is also leveraging the compatibility of the battery packs manufactured in-house to its EV charging/ swapping infrastructure developed by its R&D facility.

Industry Transition

ARBL is expanding from the lead acid industry to the lithium ion technology industry. It is also expanding from the battery manufacturing industry to the EV charging infrastructure industry.

Value Chain Position

Before the move:
Upstream of the value chain of lead acid battery (manufacturing, R&D). Notably, the Amara Raja Group has subsidiaries in power electronics and distribution products, automotive batteries, battery components, energy storage solutions, metal and sheet working.

After the move:
ARBL places itself in three inter-linked value chains – EV battery, charging / swapping solution, and electric rickshaw. Firstly, it locates itself upstream and downstream of lead acid battery value chain, and downstream of lithium ion battery value chain. Further, the Tirupati project, despite being only a one-off pilot, initiates ARBL's links in the upstream (R&D and manufacturing) and downstream (installing and implementing) of the charging/swapping infrastructure value chain – to fulfill its role as an end to end fleet solution provider.

Policy Intersections

Central Policies:

- Incentives under FAME
- Amendment of the Electricity Act 2003 by the Ministry of Power (delicensing of setting up EV charging infrastructure)

State Policies:

- Incentives under Andhra Pradesh Electric Mobility Policy 2018-23

Sources

- Amara Raja launches e-autos in Tirupati; sets up EV battery charging, swapping stations
  | *The Hindu Business Line*
- Amara Raja Launches Electric Vehicle Charging Stations in Andhra Pradesh's Tirupati
  | *Mercom India*

Case Study 26: Bharat Heavy Electrical Ltd. (BHEL)

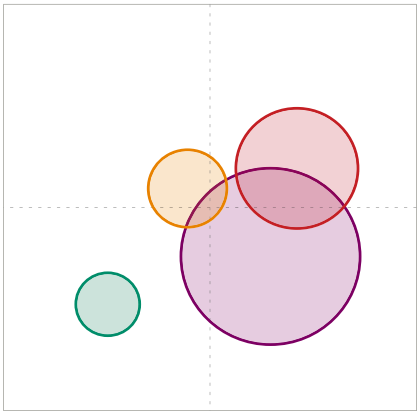
About

Bharat Heavy Electricals Limited (BHEL) is a PSU that was established in 1964 and is headquartered in New Delhi. BHEL is engaged in the design, engineering, manufacturing, construction, testing, commissioning, and servicing of a wide range of products, systems and services for the following industries: power, transmission, industry, transportation, renewable energy, oil & gas and defence. BHEL has 16 manufacturing sites spread across the country. Its turnover for FY19 was INR 20,491 crore.

Strategic Move

BHEL signs an MoU with Exicom Power Solutions for EV charging infrastructure. Exicom and BHEL will work as partners to implement wayside EV charging projects (<100 volts) across the country. The partnership plans on seeking projects through nomination or competitive bidding. In addition, Exicom will also assist BHEL in setting up an EV charger manufacturing facility.

Competitive Scope



Bubble size indicates the prominence of each dimension.

Segment

Through this move BHEL will be offering a new product segment - EV charging infrastructure. The customer base will see slight variation – public authorities, land agencies, real estate owners – which seem to have minorly interfaced with BHEL through its existing portfolio.

Industry

Largely, BHEL is expanding from its heavy electricals manufacturing industry to the EV charging industry. Its existing portfolio of work with automotive, power, renewables gives it the capacity for this expansion. In addition to hardware engineering and manufacturing, it will be working as a solution provider.

Vertical

This partnership between the companies also aims to integrate the design, engineering, manufacturing, supply and implementation of EV charging infrastructure into BHEL's operations. BHEL will also be creating a monitoring system, along with a software application to attract a network of users.

Geography

Although BHEL has 16 manufacturing facilities across the country,the publicly available information doesn't indicate if these facilities will be used.

Conclusion

BHEL has over forty years of experience in providing heavy electrical components to power, renewable, automotive industry – from design and manufacturing to servicing. BHEL is transferring this capacity for expanding into the e-mobility industry. The company has installed DC chargers at government offices in New Delhi (Udyog Bhavan) and is in the process of setting up solar-powered EV chargers on the Delhi-Chandigarh highway. The partnership with Exicom Power Solutions seems to be in line with this strategy of strengthening its position in the EV charging industry. Exicom Power Solutions has 2 decades of experience in the electric manufacturing industry – making it a potential candidate to help BHEL's foray into the EV charging segment.

Industry Transition

BHEL is expanding into EV charging industry (both infrastructure manufacturing & solution provider).

Value Chain Position

Before the move:
BHEL was located mostly upstream in the value chain of automotive (power transmission components), power, renewables; some servicing activities indicate prior work downstream of the value chain as well.

After the move:
Upstream and downstream of the charging infrastructure value chain (design, engineering, manufacturing, implementing, monitoring, interfacing with consumers through a digital platform).

Policy Intersections

Central Policies:
- Incentives under FAME
- Amendment of the Electricity Act 2003 by the Ministry of Power (delicensing of setting up EV charging infrastructure)

Sources

- Exicom and BHEL sign MoU on EV charging infrastructure | *PV Magazine India*

Case Study 27: Amara Raja Batteries Ltd

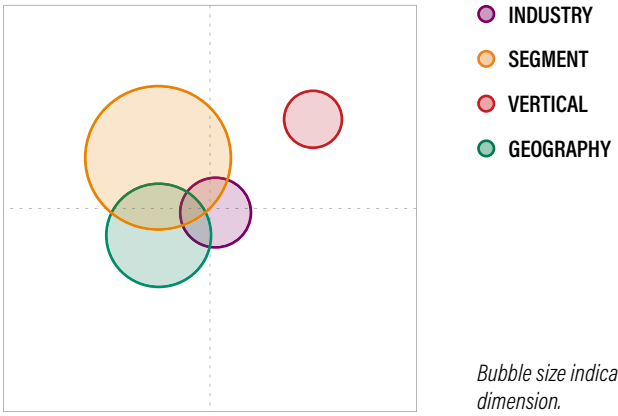
About

Amara Raja Batteries Ltd (ARBL) is one of the companies under the Amara Raja Group. The Amara Raja group was founded in 1985 and is headquartered in Tirupati, Andhra Pradesh. Amara Raja Batteries is a manufacturer of automotive and industrial lead acid batteries in India. Its automotive clients include Maruti Suzuki India Limited, Hyundai Motors India Limited, Ford India Limited, Tata Motors Limited, Mahindra and Mahindra Limited, Honda Cars India Limited, Renault Nissan, Honda Motorcycles & Scooters India Private Ltd, Royal Enfield and Bajaj Auto Ltd. Its revenue for FY19 was INR 6839.46 crores. ARBL has two plants in the Chittoor district in Andhra Pradesh.

Strategic Move

ARBL has entered into an agreement with Gridtential Energy to collaborate over silicon joule bipolar batteries. Gridtential Energy is a startup located in the Silicon Valley (California, USA) that has developed this lead acid battery-based energy storage system. Its business model is built upon a licensing approach that partners with battery manufacturing companies instead of competing with them. The Silicon Joule battery is essentially a lead acid battery with silicon in its core. This technology provides an improved power density and cycle life while reducing the battery weight by 40%. It also retains the full recycling capability of lead acid batteries. According to the agreement the companies will assemble and test the reference batteries to determine improvements in cycle life, energy density, battery efficiency, charging rates, and manufacturability. These 24V & 48V batteries can be used in hybrid-automotive and low speed EVs.

Competitive Scope



Bubble size indicates the prominence of each dimension.

Segment

ARBL is entering a new segment with EV manufacturers and OEMs as the end-customers. The technology it is working on would be a viable battery solution in the EV manufacturing segment. With this move it has also entered a new product segment of Silicon Bipolar Joule Batteries.

Vertical

No information on vertical integration is available yet.

Industry

ARBL is operating within the ambit of its current lead acid battery industry but is experimenting with a new material. Through this deal it is improving the current value proposition of lead acid batteries that might attract players from its existing customer-base (automotive, renewables) who are shifting to EVs.

Geography

Accessing state of the art technology from Silicon Valley through this collaboration with Gridtential Energy. It will potentially use its current manufacturing plants to produce these batteries after its developmental stage. This move also has the potential to reduce the dependence of ARBL and automotive OEMs on import of lithium-based energy storage solutions, whose raw materials are limited to certain geographies.

Conclusion

Amara Raja Batteries seems to be understanding the importance of being in lock-step with evolving technology. Through the deal with Gridtential Energy, it will leverage its existing experience in the lead acid battery manufacturing to further develop the Silicon Joule battery. It could also leverage its ties with automotive OEMs to test and later supply this battery solution. This move will provide automotive OEMs in India with an additional source of locally manufactured energy storage solutions.

Industry Transition

No industry transition was observed in this case. But ARBL is expanding its parent industry, by innovating with a new material.

Value Chain Position

Before the move:
Manufacturing of lead acid battery packs for automotive, commercial and renewable applications (upstream of the vehicle value chain).

After the move:
There is no information on whether the 'Silicone Joule Battery' will be made in-house at ARBL, procured ready-made or only assembled; but this move will be located on the upstream of the EV value chain.

Policy Intersections

Central Policies:
The batteries are still in the developmental stage. ARBL can potentially take advantage of FAME budget outlays for technology platforms (including testing infrastructure).

State Policies:
It is not clear where the manufacturing will take place. If ARBL uses its current manufacturing plant to produce these batteries then it can potentially take advantage of the incentives under Andhra Pradesh Electric Mobility Policy 2018-23.

Sources

- Amara Raja tie up gridtential: Amara Raja ties up with Gridtential Energy for bipolar battery technology | *ET Auto*
- Advanced Lead Batteries Gain Traction in India as Amara Raja Batteries Ltd Partners with Gridtential Energy, Inc to Collaborate on Silicon Joule™ Bipolar Technology | *PR Newswire*

Case Study 28: Hyundai Motors India

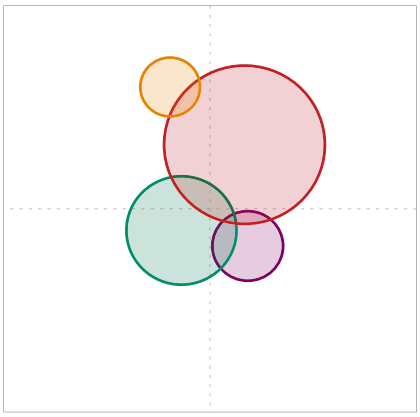
About

Hyundai Motors (est. 1967) is a South-Korean automotive manufacturer headquartered in Seoul, South Korea. Hyundai vehicles are sold in 193 countries through its network of 5000 dealerships. Hyundai Motors entered India in 1996 as Hyundai Motors India (HMI), a fully owned subsidiary. It has two manufacturing locations in India. Both the locations are in Tamil Nadu – Irungatukottai and Sriperumbudur. It has a manufacturing capacity of 7.5 lakh units a year. Hyundai has 1112 dealerships across the country. It has a market share of 16.2% and revenue of USD 5.5 billion. Hyundai currently offers 1 EV in India, the Hyundai Kona which was launched in July 2019. The Kona EVs are assembled in India from knocked-down kits that are imported from South Korea.

Strategic Move

In Feb 2020, Hyundai Motors India announced its plans to locally source a higher portion of its EV components from suppliers in India. HMI is currently developing a mass-market EV (to be launched in 2022) for India and has indicated that 90% of components will be locally sourced. The company indicated that it would setup multiple partnerships with suppliers to create an EV manufacturing ecosystem that is locally accessible.

Competitive Scope



Bubble size indicates the prominence of each dimension.

Segment

HMI plans to enter the mass-market EV segment, which comprises nearly 90% of India's 4-wheeler market. HMI has consistently led this market of cost-effective products.

Industry

HMI is looking to support its position as a systems integrator in the emerging EV industry by assisting the local component industry to grow.

Vertical

HMI intends to create a local EV manufacturing ecosystem – through partnerships with local suppliers for components of EVs (backward integration). One reason is to find a knock-down vehicles and imported components accrue taxes and several administrative costs.

Geography

It currently has two manufacturing plants in the Chennai-Hosur manufacturing cluster, which will give them access to suppliers located in the region.

Conclusion

The Govt. of India has increased the import duties on EV knockdowns to incentivize local production of EVs. In line with this development and HMI's plans to introduce a mass-market EV in India, HMI has announced its plans to locally source EV components and create an EV manufacturing ecosystem through multiple partnerships. This move has the potential to create a captive supply market for EV component manufacturers in India. This also will lead to the reduction in cost of importing components from the selling price of the EV, hence making it more accessible.

Industry Transition

Hyundai Motors India is transitioning into EV industry as a systems integrator.

Value Chain Position

Before the move:
ICE-vehicle manufacturing (automotive value chain).

After the move:
HMI's position as a vehicle manufacturer/integrator remains the same (EV value chain), but it is positively influencing the component manufacturing (situated upstream in the EV value chain).

Policy Intersections

Central Policies:

- Incentives under FAME
- Benefit extension under Section 35AD(1) to incentivize EV manufacturing
- GST Reduction (Indirect benefit)

State Policies:

- Incentives under Tamil Nadu Electric Electrical Vehicle Policy 2019

Sources

- Hyundai likely to go more local for EVs | *The Economic Times*
- Hyundai mulls options for sourcing EV components in India | *ET Auto*

Case Study 29: TATA Power Ltd.

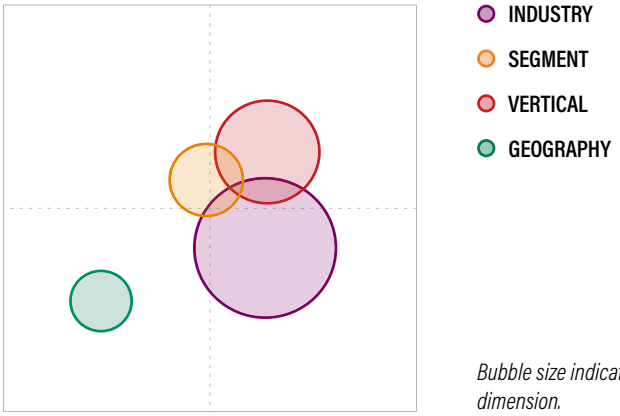
About

Tata Power Ltd. (est. 1919) is an electric utility company headquartered in Mumbai. It is a part of Tata Group, an Indian industrial conglomerate. The company, together with its subsidiaries and joint entitites, generates 12,742 MW of electricity through various plants (solar, hydro, thermal & wind) in the country. It has a revenue of USD 1.2 billion. Its verticals also include transportation and distribution of electricity. It currently generates 30% of its electricity from renewable sources.

Strategic Move

In February 2020, Tata Power Ltd. announced its plans to expand its network of 170 EV charging stations across the country to 700 stations by March 2021. Apart from public charging stations Tata Power is also looking to venture into home-charging solutions. It has signed MoUs with petroleum retailers such as HPCL, IOCL and IGL (Indraprastha Gas Ltd.) to setup commercial EV charging stations at their retail outlets. The company currently installs 15KW stations and is looking to expand into 30-50KW based on increase in demand. The Tata Power EV stations are supported by a mobile application through which EV charging services can be located, booked and paid for.

Competitive Scope



Bubble size indicates the prominence of each dimension.

Segment

TPL recently forayed into EV charging segment, thereby finding a new commercial consumer for the electricity it distributes. Additionally, in the charging infrastructure, it will serve the new product segment of home-charging solutions (it will continue to provide electricity connection for them).

Vertical

Tata Power's foray into EV charging is an example of forward integration where, through the means of EV charging solutions, Tata Power is also acquiring an additional consumer base for the electricity generated and distributed by the company.

Industry

Through this strategic move Tata Power is expanding into EV charging industry. Constructing charging stations and installing hardware requires collaboration with electricity distributors, a capacity Tata Power is equipped with. Further, the TATA ecosystem offers a ready base of suppliers of charging hardware such as Tata AutoComp Systems, and OEMs with whom Tata Power is already collaborating to deploy charging stations.

Geography

Tata Power has a geographical advantage due to the presence of Tata Group businesses across the country. Businesses such as Titan watches, Chroma, WestSide, Taj Hotels give Tata Power the option to leverage prime physical locations to install their commercial EV chargers. More so, Tata Power can pick locations that are situated proximally with respect to the electric sub-stations and distribution transformers, crucial for public charging stations.

Conclusion

As per their annual report, Tata Power aims to be the infrastructure backbone of the EV ecosystem in India. In line with this strategy mentioned in the annual report, it aims to increase the number of charging stations in the country. This also enables Tata Power to derive synergies from its other businesses such as Tata Motors through its roll-out of electric cars, while alleviating range anxiety in vehicle owners.

Industry Transition

Expanding from electricity distribution to the end-to-end EV charging solutions.

Value Chain Position

Before the move:
Distributing electricity to consumers (downstream in the electricity value chain).

After the move:
Deploying charging infrastructure (downstream in charging infrastructure value chain); distributing electricity at the charging stations (downstream in the electricity value chain)

Policy Intersections

Central Policies:

- Incentives under FAME
- Amendment of the Electricity Act 2003 by the Ministry of Power (delicensing of setting up EV charging infrastructure)

State Policies:
TATA Group operates in multiple cities across India; no single state policy intersection is observed.

Sources

- Tata Power plans to have 700 EV charging stations by 2021 | *Mint*
- Tata Power looking at expanding EV charging stations network to 700 by March 2021 - Energy News India- Power News India, Energy, Oil and Gas News | *Energy Infra Post*
- Annual Report | *Tata Power*

Case Study 30: TATA Autocomp Systems

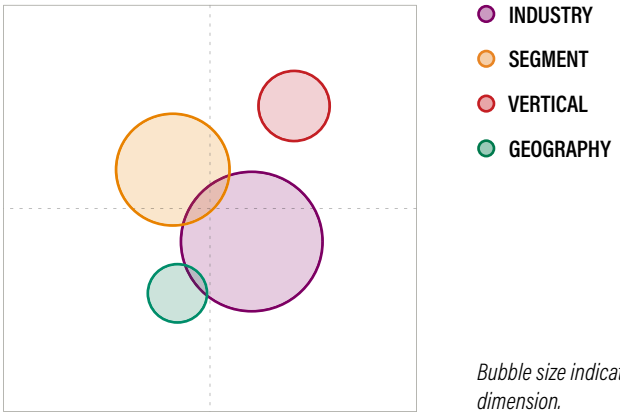
About

Tata AutoComp Systems is an affiliate company of Tata Group, an Indian industrial conglomerate. It was established in 1995 and is headquartered in Pune, India. The company manufactures and provides automotive parts and services, as well as some components of EVs. The products in its portfolio includes: automotive interior & exterior plastics, composites, sheet metal stampings, engine cooling solutions, automotive batteries, rear view mirrors, command systems like park brake lever, gear shifters, washer systems, HVAC (heating ventilation and air conditioning) solutions, exhaust and emission control systems, seating systems and electronic solutions including ADAS (advanced driver assist system), BMS, telematics, etc. for passenger and commercial vehicles as well as powertrain cooling solutions and suspensions for heavy commercial vehicles. It also offers engineering and supply chain management services to its customers. It has 37 manufacturing facilities spread across India and 9 facilities spread across North America, Latin America, Europe, and China. It had a standalone revenue of INR 1254 crores in 2019.

Strategic Move

Tata AutoComp systems has signed MoUs with 2 charging infrastructure companies:
Tritium Pty Ltd.: The MoU with the Australian charging infrastructure company was signed in March 2019. The agreement states that Tritium Pty Ltd. will supply DC fast chargers for the Indian market. These chargers are capable of charging the full range of EVs— two-wheelers, passenger vehicles and commercial vehicles.
Tellus Power Green: The MoU with the USA based DC charging infrastructure company was signed in June 2020. The agreement states that TPG will supply AC and DC EV chargers for the entire range of EVs - two-wheelers, passenger vehicles and commercial vehicles. The AC chargers will range from 3kW to 11kW and can be used for residential charging solutions. The DC chargers will range from 20kW to 300 kW and will be used for charging in public spaces.

Competitive Scope



Bubble size indicates the prominence of each dimension.

Segment

With these MoUs Tata AutoComp Systems enters into the new product segment of EV charging infrastructure – residential and public. It is now targeting a new user segment of customers looking to setup charging stations.

Vertical

Tata AutoComp Systems has also entered a JV with Guoxuan High-Tech to provide battery pack solutions. With this move it is including charging infrastructure into its product portfolio through which it has a greater probability of attaining compatibility of battery pack and charging infrastructure.

Industry

With this strategic move it is expanding from auto component industry to the EV charging infrastructure industry. Alongside, Tata AutoComp has signed numerous JV to design, engineer, manufacture, and supply EV powertrain solutions with a Chinese company. This was followed by Tata AutoComp foraying into the business of charging infrastructure under these new MoUs.

Geography

Tata AutoComp Systems seems to have an inherent advantage through its parent company, Tata Group, as well as its original work in the auto components manufacturing that has a market in India, Middle-East, Europe, and US.

Conclusion

It seems that Tata AutoComp Systems is re-aligning its focus on EVs for future growth. It envisions to be an EV component manufacturer/supplier that provides OEMs with a complete range of products to manufacture EVs. In line with this strategy it has partnered with Tritium Pty Ltd and Tellus Power Green to source AC and DC chargers for a range of EVs. This move will provide Indian EV OEMs with a source for locally acquiring EV charging infrastructure. This move will also derive synergies from Tata Motor's EV manufacturing and from Tata Power's EV charging solutions.

Industry Transition

Tata AutoComp Systems is expanding from the traditional auto component manufacturing industry to the EV charging infrastructure industry.

Value Chain Position

Before the move:
Manufacturing of auto components (ICE vehicles); upstream in the automotive value chain.

After the move:
Downstream in the electric value chain; insufficient information to assess the extent of manufacturing Tata AutoComp will undertake for charging equipment.

Policy Intersections

Central Policies:

- Incentives under FAME
- Amendment of the Electricity Act 2003 by the Ministry of Power (delicensing of setting up EV charging infrastructure)

State Policies:
TATA AutoComp Systems and TATA Group operates in multiple cities across India; no single state policy intersection is observed.

Sources

- Tata arm's DC fast chargers to 'power' EVs | *The Hindu*
- (Press Release) Tata AutoComp ties up with Tellus Power Green to set up EV Charging Stations | *Tata AutoComp*
- Tata Sons: How Tata Auto Comp plans to mount the ambitious $3 billion revenue target? | *ET Auto*

Case Study 31: Bosch

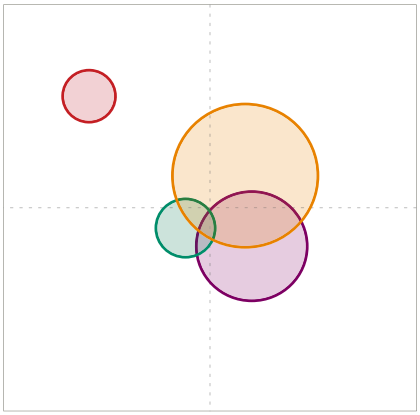
About

Bosch is a leading German provider of technology and services in the mobility ecosystem. In India, with 18 manufacturing sites, and seven development and application centers, Bosch works in the areas of Mobility Solutions, Industrial Technology, Consumer Goods, and Energy and Building Technology. It is headquartered in Delhi and has an annual turnover of INR 10,388 crore.

Strategic Move

In 2020, Bosch acquired 26% stake in Bengaluru based energy infrastructure and service provider, SUN Mobility. This acquisition was done using the investment vehicle Robert Bosch Investment Nederland B.V. SUN Mobility's energy solution includes smart swappable batteries that can be swapped at their quick interchange stations.

Competitive Scope



Bubble size indicates the prominence of each dimension.

Segment

Entering a new product segment – Smart Battery and Quick Interchange Station for battery swapping. Through this acquisition, Bosch is expanding its consumer base to fleet operators, individual car owners and charging business.

Industry

Through this acquisition, Bosch is expanding from the automotive industry to EV battery and EV battery swapping industry. Bosch will be leveraging its existing presence in the automotive industry and the industry presence of SUN Mobility.

Vertical

Bosch is moving from being an automotive component manufacturer (upstream of automotive value chain) to providing energy infrastructure solutions like battery swapping (downstream of battery value chain).

Geography

Bosch stands to benefit from the position of SUN Mobility in India. SUN Mobility is the only battery swapping provider in India with an in-depth understanding of the local consumer battery/re-fueling behaviors. Manufacturing facility of SUN Mobility is located in Bengaluru, Karnataka.

Industry Transition

An industry transition is observed in this case where Bosch is expanding into battery and battery swapping industry.

Value Chain Position

Before the move:
Providing technology and services for mobility ecosystem (upstream of automotive value chain)

After the move:
Energy Infrastructure and Services provider (downstream of EV Batteries value chain and downstream of EV value chain)

Policy Intersections

Central Policies:

- Incentives under FAME

State Policies:

- Incentives under Karnataka Electric Vehicle and Energy Storage Policy 2017 (manufacturing facility of SUN Mobility is in Bengaluru, Karnataka)

Sources

- Bosch acquires 26% stake in Sun Mobility | *ET Auto*

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WRI India, an independent charity legally registered as the India Resources Trust, provides objective information and practical proposals to foster environmentally sound and socially equitable development. WRI India's mission is to move human society to live in ways that protect Earth's environment and its capacity to provide for the needs and aspirations of current and future generations. Through research, analysis, and recommendations, WRI India puts ideas into action to build transformative solutions to protect the earth, promote livelihoods, and enhance human well-being.

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