Battery Storage Manufacturing in India: A Strategic Perspective¹

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Battery storage manufacturing in India is driven by an emerging market

India is one of the few countries with a Nationally Determined Commitment (NDC) that is consistent with the 2-degree Celsius emission goal set under the 2015 Paris agreement (Climate Action Tracker 2019). Some of the major milestones under India’s NDC are the country’s renewable energy targets of 175GW by 2020 and renewable energy as 40% of installed power generation capacity by 2030 (Varadhan 2019).

However, renewable generation is typically not only variable and intermittent but also inflexible in nature. Given the predominantly inflexible nature of the Indian power grid due to high reliance on coal-based generation and lack of gas-based generation, higher renewable penetration under India’s NDC will likely result in requirements of various flexible technologies (Udetanshu, et al. 2019).

One such technology gaining momentum globally is battery energy storage, specifically Lithium-ion batteries. This is mainly attributed to the rising demand for battery powered electric vehicles globally (Stubbe 2018). According to an estimate, energy storage global demand is projected to rise 17GWh in 2018 to 2,850GWh by 2040 with India emerging as the third largest market (Bloomberg New Energy Finance 2019).

This emerging market potential has motivated Indian policymakers to consider developing India into a global manufacturing hub for battery storage. However, this motivates us to ask questions such as: What is the minimum set of barriers India must overcome to develop domestic manufacturing competencies around new battery storage technologies? What are the different factors policymakers should consider for allowing successful deployment of battery storage technologies? Etc. In this research paper, we focus on the first question.

¹ This is based on a recently developed working paper, which has also been submitted to the Journal of Energy Storage.
Developing battery manufacturing competencies would require a strategic perspective

In order to prescribe a strategic manufacturing perspective to developing battery storage manufacturing competency in India, we first identify the various pathways India could potentially embark on. We find that there are mainly two approaches that have been successfully adopted by various countries: one, a research focused approach or the top-down approach; and two, a manufacturing focused approach or the bottom-up approach. The top-down approach comprises of the country first developing the necessary knowledge base through investment in research and development. This is then followed by followed by commercialization of technology and development of full-fledged manufacturing prowess. Conversely, the bottom-up approach involves the country capturing the market share initially through development of manufacturing competency and then followed by moving up the value chain to more research intense activities.

Given India’s limited experience in developing new generation battery technologies (such as Lithium-ion) and its late arrival in the industry, the bottom-up approach may be more appropriate (Sampath, Sarma and Shukla 2016). With this as the basis, we develop and verify a critical barrier framework which highlights the minimum set of barriers that need to be overcome for obtaining industrial competency in battery storage.

We build this framework by combining learnings from two diverse strands of literature – namely industrial science and management science. Specifically, we assess multiple literature on industrial catch-up (Malerba and Nelson 2011, Lee 2005, OECD 2005, Fagerberg and Godinho 2003) and Porter’s Diamond Theory of National Advantages (1990). While the literatures on industrial catch-up dictates the general approach for our framework, its critical elements are identified from Porter’s theory. Within this framework, we identify three main barriers: (1) Getting to Scale, (2) Infrastructure and Resources, and (3) Global Competitiveness. We posit that industrial competency can only be achieved when all these barriers have been overcome.

We verify the critical barrier framework by case study research method, with the cases carefully selected to provide ample variation across the dependent and independent variables (Stake 1978, Seawright and Gerring 2008). We test the framework across various successful and struggling industries such as: Indian Automobile Industry, Indian Pharmaceutical Industry, Chinese Solar PV Industry, United States Solar PV industry, Indian Solar PV Industry. From these cases studies, we find that all the three barriers have been overcome by successful industries whereas at least one of the barriers from our framework has not been overcome by the struggling industries.

Based on this framework, we suggest that Indian policymakers start by developing demand side policies with an emphasis on protection to domestic manufacturers from foreign competition. Once domestic manufacturers achieve economies of scale through capturing domestic as well as international demand, Indian policymakers may allow foreign competition within the country which will result in increased market efficiencies thereby making domestic manufacturing globally competitive. In this context, while any short-term infrastructure and resource requirements can be met by the industry, policymakers should also invest in them in parallel to further bolster them. Further, they should also consider developing policies that promote research and development early on since this would be crucial for the growth of any manufacturing industry in the long-term.
References