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Investing in the clean energy domain

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Opportunity #1: Biomass energy – deployment of power plants and alternative applications

Stubble burning by farms in Punjab, Haryana and Uttar Pradesh in winter is a major concern in India as it leads to a decline in air quality and a rise in pollution levels in Delhi-NCR. To curb this problem, there is a need to find an alternative use of crop residue that is in line with the Government's initiative of mitigating air pollution and improving the energy situation in the country. To reduce reliance on conventional energy, at the Conference of the Parties (COP26) UN Climate Summit held in October 2021, the prime minister of India announced a target of 500 GW of non-fossil energy capacity. In addition, 50% of the country's energy needs are to be met by renewable energy sources by 2030, followed by a target of achieving net zero emissions by 2070.[1]

Currently, use of biowaste is limited primarily to co-firing in thermal power plants. Application in fully biomass-based power plants, biofuel blending, production of compressed biogas (CBG), pyrolysis of methane, and for heating purposes in buildings and industries, on the other hand, is relatively low. The Ministry of Agriculture and Farmers' Welfare[2] estimated 5,153 million metric tonnes (MMT) of crop production for the year 2020–21. Each crop leaves behind residue that forms biomass and is assessed on the basis of the crop–residue ratio (CRR) metric, which varies for different crops. Using CRR, it was estimated that 4,490 MMT of biomass residue was available in 2020–21, out of which, 1,547 MMT was surplus for industrial usage.[3] This amount can replace around 1,353 MMT of coal, which can produce approximately 1,767 MMT of CO_2. Annually, thermal plants use approximately 700 MT of coal. However, with the current Government mandate of 5% co-firing and high efficiency boiler design to handle higher silica, better carbon neutral electricity can be generated from thermal plants. The mandatory use of biomass as fuel will not only help mitigate air pollution but also reduce the crop waste burden and encourage farmers to convert crop stubble into pellets, thus giving them extra income.

However, certain challenges are impeding the significant uptake of biomass in industries:

Policy

- State policies are currently more focused on utilisation of biomass for power generation with limited or no incentives for densification of biomass into briquettes and pellets.
- 5% GST is levied on biomass briquettes or solid biofuel pellets, which makes procurement costly.
- The export of biomass pellets is banned.

Supply chain

- There is no public data on the availability of biomass surplus for industrial usage since the primary use of biomass is currently unorganised. Farmers, animal custodians and villagers, who have limited knowledge of alternative applications, therefore use it for animal fodder or roof thatching.
- Farmers have a very limited window for the disposal of biomass. They resort to open burning to clear the land and prepare for the next cropping season.
- Moreover, there is no platform to connect farmers with prospective customers. No central place exists for the collection of biomass from different parts of the country, which results in high transportation costs as the fuel cost is dependent on macro-economic factors.

1 *https://pib.gov.in/PressReleasePage.aspx?PRID=1795071*

2 *https://eands.dacnet.nic.in/Advance_Estimate/1st%20Adv.%20Estimates2020-21%20English.pdf (Advanced Agricultural Estimates 2020-–21 by the Ministry of Agriculture and Farmers' Welfare)*

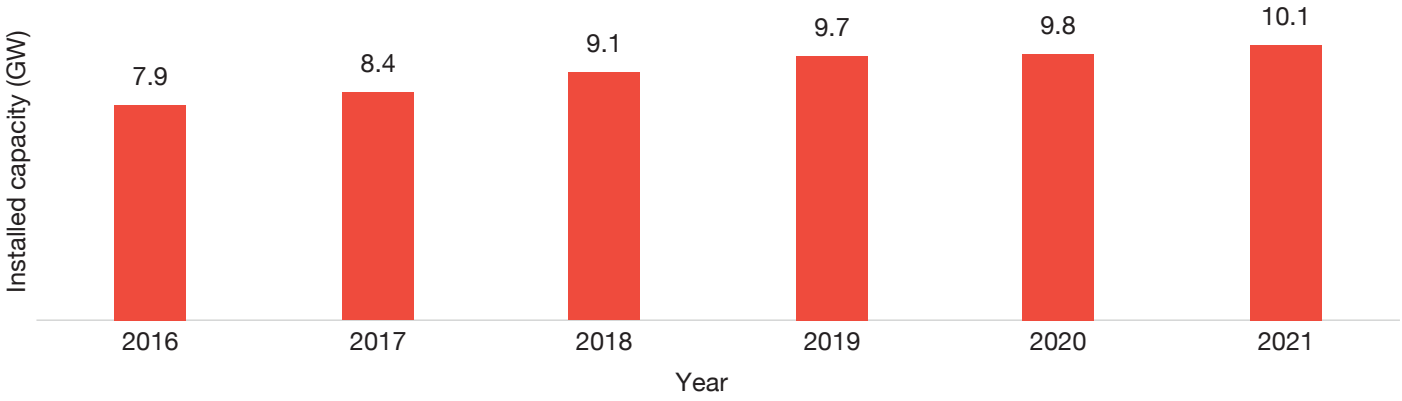
3 *CRR and surplus factors have been estimated based on Government sources and reliable industry benchmarks based on their research.*

Financial support

- As the main revenue stream from biomass is through electricity trading, and since the sector has seen a high incidence of non-performing assets (NPAs) – due to the unreliable supply chain – the lending cost becomes high.

However, despite the above challenges, significant progress has been made in this sector in the last couple of years. As of January 2022, India has an installed capacity of 10.1 GW of biomass power. This capacity has been growing at a compound annual growth rate (CAGR) of approximately 5% since 2018.[4] Efforts are being made by the Government to introduce better policies to support the deployment of biomass. One of the sustainability measures announced in the Union Budget 2022–23 focuses on biomass co-firing. Finance Minister Nirmala Sitharaman, in her budget speech this year, announced that thermal plants have been mandated to make biomass pellets 5–7% of their fuel mix by 2023.[5] This move would help to cut down CO_2 emissions by 38 MMT annually. It would also mitigate the problem of stubble burning in agricultural fields and provide farmers with an additional income. A rough estimate shows that nearly 25–30 MT of biomass pellets will be required for a 100-GW capacity thermal plant.[6] Companies like National Thermal Power Corporation (NTPC) are running bids aggressively to procure biomass for co-firing. Moreover, the NTPC Dadri plant is co-firing coal and biomass with an up to 10% mix.[7] There is potential to replace 50–100 MT of coal, thus cutting emissions by 90–180 MT from the thermal power sector by 2030.[8] In February 2022, Asia's largest biogas plant – with a capacity of 550 MT of waste, output of 17.5 MT of gas and 100 MT of high-quality compost per day – was inaugurated.[9]

Annual installed capacity of biomass in India (GW)



Source: Ministry of New and Renewable Energy (MNRE)

Below are a few policies that govern the biomass sector and aim to promote the use of this fuel:

- **Ministry of New and Renewable Energy (MNRE):** Schemes to promote biomass-based cogeneration projects in sugar mills and other industries
- **Ministry of Power (MOP):** Schemes to promote usage of biomass through co-firing and pulverised coal-fired boilers
- **Ministry of Petroleum and Natural Gas (MoPNG):** Policy on biofuels to promote blending of ethanol in vehicular fuel; signing of MoU between MoPNG and companies/institutes to facilitate the set-up of 5,000 CBG plants by 2023–24 with a cumulative capacity of 15 MT of CBG per annum
- **Indian Renewable Energy Development Agency (IREDA):** Recently introduced scheme to support biomass projects, as well as orders by state governments, the National Green Tribunal, and Supreme Court that restrict open crop burning.

Although there are several Government schemes and policies in place to boost the biomass utilisation for commercial purposes, there is a need for greater private sector intervention in order to fast-track this growth. This intervention would include upskilling farmers, offering better financing options and optimising the supply chain of raw materials.

4 MNRE, Physical Progress, January 2022; https://mnre.gov.in/the-ministry/physical-progress

5 https://pib.gov.in/PressReleasePage.aspx?PRID=1794470

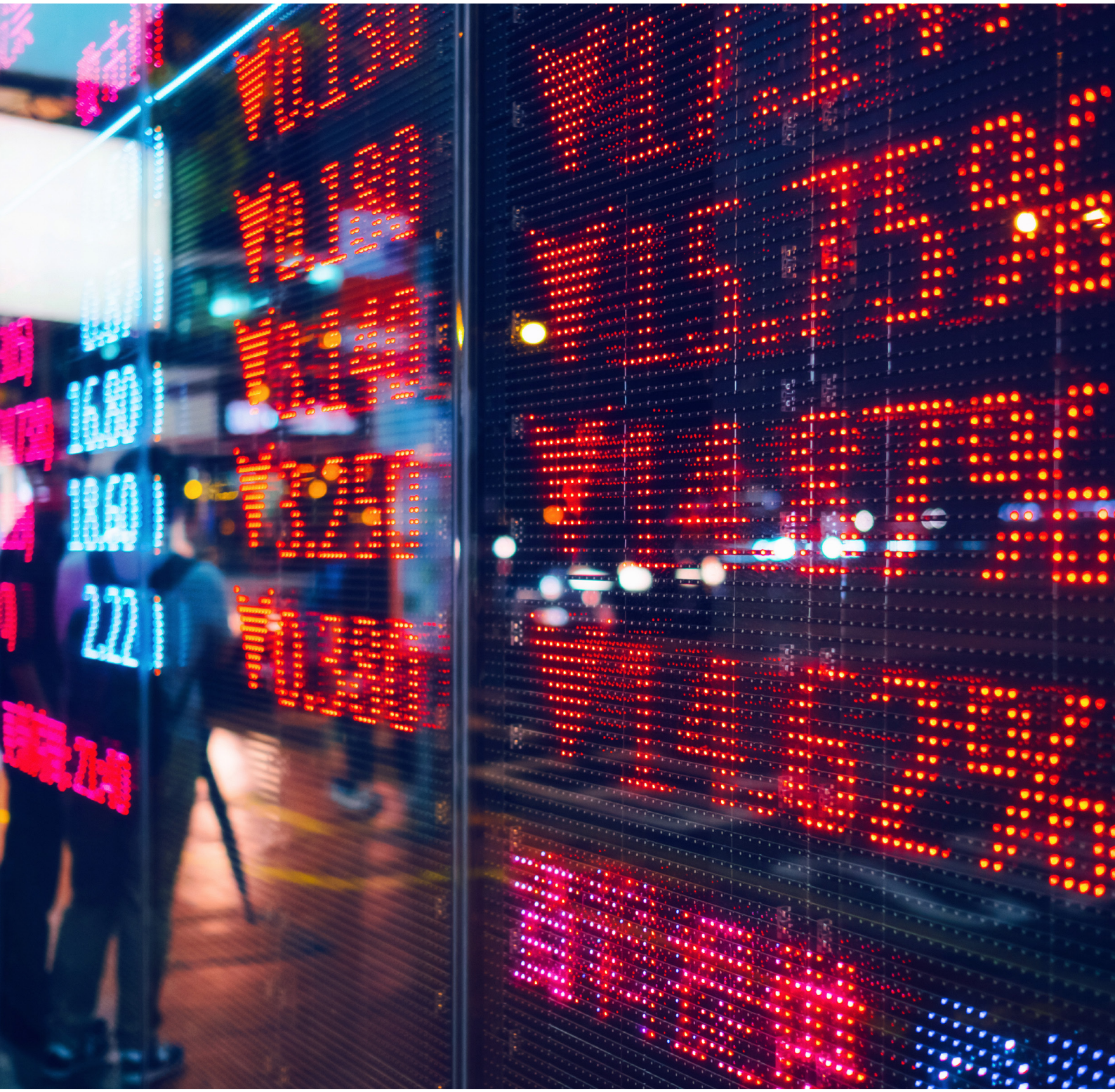
6 https://www.downtoearth.org.in- 1 February 2022

7 https://www.argusmedia.com/en/news/2257807-india-asks-coal-plants-around-delhi-to-use-biomass

8 https://www.downtoearth.org.in/news/energy/union-budget-2022-23-national-biomass-co-firing-policy-mooted-by-cse-in-focus-81349

9 https://www.ndtv.com/india-news/pm-modi-to-virtually-inaugurate-asias-biggest-bio-cng-plant-in-madhya-pradeshs-indore-2775746

There is a need to educate relevant stakeholders about the alternative uses of biomass other than power generation. Creating depots for biomass storage, processing at the district or block level and having a biomass trading platform for pan India trade of biomass will help regularise the supply chain. Also, there is a need for low-cost financing options for setting up plants and for concessional financing and subsidised interest rates for briquettes or pellet manufacturing. This gap can be filled with the participation of the private sector and policy advocacy by the Government. Moreover, having power purchase agreements (PPAs) from biomass electricity generation in place will secure the revenue generation from power plants. PPAs ensure revenue stream to a power plant and once revenue is stable, the probable risk of a plant going default – i.e. NPA due to improper/unstable revenue source – decreases.



Opportunity #2: Energy storage technologies

Currently, India is heavily dependent on oil (80% of which is imported)[10] to meet its energy requirements. To reduce this dependence on oil and improve the energy situation in the country, the Government of India (GoI) has been focusing on introducing clean energy sources. As per the estimates of the Central Electricity Authority (CEA), by 2030, the share of renewable energy generation would increase from 27% to 44%, while that of thermal energy will reduce from 78% to 52%. Further, based on the January 2022 data obtained from the MNRE, the total capacity of renewable energy projects was around 106 GW. To meet the target of 500 GW of renewable energy capacity with 50% of energy needs from renewable energy sources by 2030, there is a need for more efficient batteries that will be used to store electricity and reduce the solar energy cost by 66% as compared to the current cost.

Energy storage technologies are classified on the basis of storage and utilisation of energy. These include pumped hydro storage, flywheels, supercapacitors, compressed air and thermal energy storage. Advanced chemistry cells (ACCs) are the new generation of storage technologies that can store energy in the form of electrochemical or chemical energy and convert it to electrical energy as and when required.[11] These batteries dispatch electricity in seconds and offer power backups that can last anywhere from a few minutes to several hours. Moreover, ACCs have a huge potential to support different applications owing to their rapid response, easy modularisation and flexible installation. At a grid level, ACCs can help in frequency regulation, peak shifting and integration with intermittent renewable energy sources, and provide efficient power management through round-the-clock supply. Although stationary application of batteries is already in place, it can be scaled up given the challenges faced by a grid due to high penetration and future targets of renewables. One of the major applications and segments benefiting from ACCs is electric vehicles (EVs). ACCs can be deployed in different categories of vehicles like two-, three- or four-wheelers and buses – providing a clean mobility alternative.

The overall market for advanced cells, particularly Li-ion, has expanded at an exponential rate. Most of this growth has been due to the usage of these cells in EVs, and it has been further accelerated owing to a rise in their demand in consumer gadgets. By 2030, the total potential for battery storage in India will be 550 GWh, with EVs making up a large chunk of this projected demand. This will be followed by grid applications like integration with wind and solar energy, ancillary services and rural electrification. As per the CEA's forecast model on optimal generation capacity mix for 2029–30, India will need a capacity addition of 27 GW/108 GWh of battery energy storage to support grid stability. The cost of battery energy storage in India is also expected to fall from INR 7 crore per MW in 2021–22 to INR 4.3 crore per MW in 2029–30.[12]

As per the India Energy Storage Alliance (IESA), the EV market is expected to expand at a CAGR of 44% between 2020 and 2027, reaching 63.4 lakh unit annual sales by 2027 in the base case scenario. Furthermore, annual battery demand is forecasted to grow at 32% to hit 50 GWh by 2027, with Li-ion batteries accounting for 40 GWh or more.

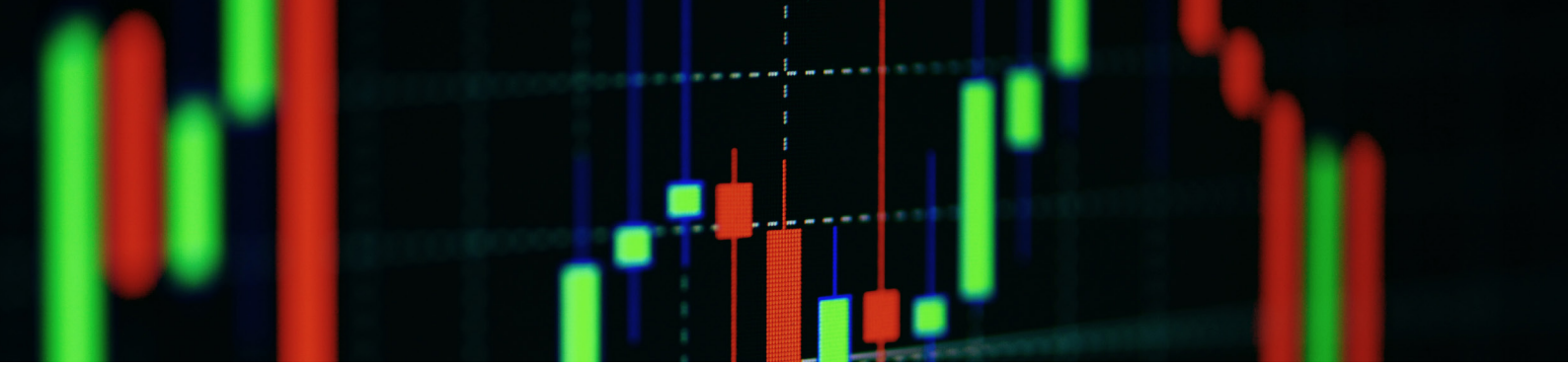
As per NITI Aayog,[13] if India aims to achieve 100% EV adoption across all types of personal vehicles by 2030, a minimum of 20 giga-scale battery manufacturing plants would be required to collectively produce an energy storage capacity of 800 GWh per year. NITI Aayog has forecast 80% market penetration for EVs in the two- and three-wheeler segment and 30% and 70% penetration in the passenger and fleet vehicle (four-wheelers) segment, respectively, by 2030. In the case of buses, it has projected 40% market penetration by 2030.

10 *https://newsonair.com/2022/03/18/india-highly-dependent-on-imports-for-meeting-its-energy-requirements/*

11 *https://pib.gov.in/PressReleasePage.aspx?PRID=1717938*

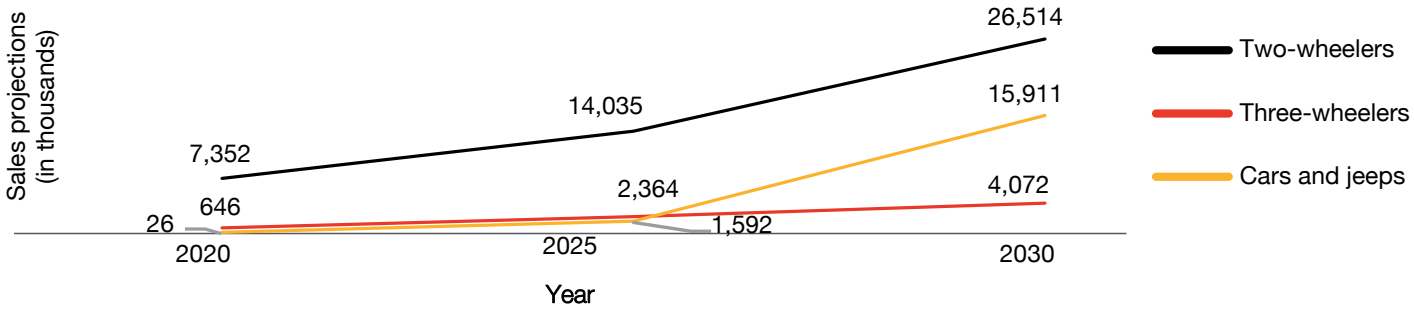
12 *Report on optimal generation capacity mix for 2029–30, CEA; https://cea.nic.in/old/reports/others/planning/irp/Optimal_mix_report_2029-30_FINAL.pdf*

13 *https://www.niti.gov.in/writereaddata/files/document_publication/India-Energy-Storage-Mission.pdf*



Annual EV sales projections (in thousands)

Annual sales projections of EVs from 2020 to 2030



Source: NITI Aayog

There are several opportunities that can be leveraged for the manufacturing of battery energy storage in India. Some of these are highlighted below:

- Rising demand for EVs
- Focused supply chain
- Government policies and schemes
- Low-cost financing
- Technology partnership
- Bilateral agreements

The most important drivers of market penetration for battery manufacturing technologies are policy and regulatory frameworks. State-level evaluations are also critical, considering the numerous enablers offered by state governments in the form of electronics, industrial, EV and energy storage legislation, and deciding on the best location for battery production plants. Select policies from the Central Government aimed at supporting battery manufacturing are as follows:

National Electric Mobility Mission Plan 2020	**Faster Adoption and Manufacturing of Hybrid and Electric Vehicles (FAME)**	**National Smart Grid Mission (NSGM) (Draft) Launch of NSGM by MoP in two phases 2015-17 and 2017-20**
National Policy on Electronics	**Faster Adoption and Manufacturing of Hybrid and Electric Vehicles (FAME) – Phase II**	**National Mission on Transformative Mobility and Battery Storage**

14 https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1717938

Many states in India have been proactive in offering lucrative schemes to increase the deployment of industries and manufacturing hubs. Several special economic zones (SEZ), domestic tariff zones (DTZ) and electronic manufacturing clusters (EMCs) have been allocated to increase competition and draw investors to these states. These clusters and zones are already endowed with several industries, which have access to numerous benefits and in-house facilities:

- superior-quality infrastructure – 24x7 water availability, uninterrupted electricity supply and communication facilities
- incentivised business frameworks – capital subsidies, power subsidies, land rebates, tax concessions, etc.
- connectivity to both domestic and international markets
- streamlined logistics networks – proximity to container ports, inland container depots (ICDs), internal road networks.

In May 2021, the GoI approved the implementation of the Production Linked Incentive (PLI) Scheme, allocating INR 18,000 crore to achieve a manufacturing capacity of 50 GWh of ACCs and 5 GWh of niche ACCs through the National Programme on Advanced Chemistry Cell Battery Storage. Currently, the Government is focusing on the development of battery storage, with multiple tenders at different stages of bidding. The NTPC has invited bids for 3,000 MWh of energy storage systems; the Solar Energy Corporation of India (SECI) has floated a tender for 2,000 MWh of standalone battery energy storage system (BESS); and Bharat Heavy Electricals Limited (BHEL) has invited an expression of interest (EOI) for a BESS Gigafactory under the PLI Scheme. As part of the Budget 2022–23 announcements, the finance minister announced an additional allocation of INR 19,500 crore for PLI for the manufacturing of high-efficiency modules, with the integration of manufacturing units from polysilicon to solar photovoltaic (PV) modules being prioritised. This was done to boost the ‘Make in India’ initiative and reduce the dependence on imports.

Thus, increased Government support, along with private sector participation and innovation, can increase the deployment of battery storage in the country.

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