Program Information Document (PID)

Concept Stage | Date Prepared/Updated: 11-May-2020 | Report No: PIDC208047

BASIC INFORMATION

A. Basic Program Data

Country	Project ID	Parent Project ID (if any)	Program Name
India	P172223		Program for Transformative Mobility and Battery Storage
Region	**Estimated Appraisal Date**	**Estimated Board Date**	**Does this operation have an IPF component?**
SOUTH ASIA	21-Sep-2020	07-Jan-2021	No
Financing Instrument	**Borrower(s)**	**Implementing Agency**	**Practice Area (Lead)**
Program-for-Results Financing	XXX	XXX Bank	Energy & Extractives

Proposed Program Development Objective(s)

The PrDO for the first phase PforR is to initiate investments in battery energy storage for both power system and e-mobility applications.

COST & FINANCING

SUMMARY (USD Millions)

Government program Cost	3,470.00
Total Operation Cost	1,070.00
Total Program Cost	1,070.00
Total Financing	1,070.00
Financing Gap	0.00

FINANCING (USD Millions)

Total World Bank Group Financing	550.00
World Bank Lending	550.00
Total Non-World Bank Group and Non-Client Government Financing	520.00

Trust Funds	200.00
Private Capital and Commercial Financing	320.00
of which Private Capital	320.00

Concept Review Decision

The review did authorize the preparation to continue

B. Introduction and Context

Country Context

1. **Over the past decade India has been one of the fastest growing emerging market economies, but Gross Domestic Product (GDP) growth has slowed in the past three years.** The current slowdown is due to the combined effects of (i) unresolved domestic issues (impaired balance sheet issues in the banking and corporate sectors, compounded by stress in the non-banking segment of the financial sector), and (ii) significant additional headwinds following the COVID-19 outbreak. These have not only prevented a sustainable revival in private investment, but also affected private consumption in FY19/20. As a result, growth is expected to reach 5 percent in FY19/20. Given the nation-wide lock-down and major disruptions to economic activity in the first quarters of FY20/21, growth is expected to slow again significantly in the current fiscal year, before recovering gradually from FY21/22 onwards. On the fiscal side, the general government deficit is expected to widen to about 7.5 percent of GDP in FY19/20, owing to tax cuts and weak economic activity, and further still in FY20/21 as a result of slow domestic activity and fiscal support to households and firms. However, the current account balance is expected to improve over FY19/20-FY20/21, reflecting mostly a sizeable contraction in imports and a large decline in oil prices. Given this, in spite of recent portfolio capital outflows, India's foreign exchange reserves are expected to remain comfortable (equivalent to over 10 months of imports).

2. **Since the 2000s, India has made remarkable progress in reducing absolute poverty.** Between FY11/12 and 2015, poverty declined from 21.6 percent to an estimated 13.4 percent at the international poverty line (US$1.90 per person per day in 2011 Purchasing Power Parity (PPP), continuing the earlier trend of rapid poverty reduction. Owing to robust economic growth, more than 90 million people escaped extreme poverty and improved their living standards during this period. Despite this success, poverty remains widespread. In 2015, 176 million Indians were living in extreme poverty, while 659 million—half the population—were below the higher poverty line commonly used for lower middle-income countries (US$3.20 per person per day in 2011PPP). With the recent growth slowdown, the pace of poverty reduction may have moderated.

3. **India's energy and transport sectors must continue to expand to drive economic growth.** India's energy consumption has grown on average at around 6 percent per annum and is expected to more than double by 2040, accounting for one-fourth of the global increase in energy demand in that same period. India is the third largest consumer of electricity in the world, with installed electricity capacity of 371 Giga Watts (GW) in December 2019. However, India's per capita energy consumption is currently only one-third the global average, and almost 200 million

people still do not have access to reliable electricity supply. Similarly, India's mobility demand is forecast to triple between 2018 and 2040[1], fueled by increased incomes, rapid motorization and shift to urban areas. At 121 vehicles per 1000 persons (102 of which motorized two wheelers) in 2015-2016[2], vehicle ownership remains low by international benchmarks. Stagnation in public transport services is however fostering rapid growth in personal vehicle ownership, with 25 million vehicles added in 2017-2018 (80 percent of which were two-wheelers), a trend only partly offset by growing shared mobility options like ride hailing companies. This sector growth has stimulated a large automotive industry, which represents 7.1 percent of GDP and 35 million direct and indirect jobs.

4. **Electricity generation and transportation are key contributors to air pollution and carbon emissions.** Air pollution is one of the most serious health hazards in India, which has 13 out of 17 of the most polluted cities in the world according to the World Health Organization. Coal and diesel-based power generation are two of the most significant contributors to air pollution levels. Coal-based power generation in India provides approximately 50 percent of the energy supplied to the grid, releasing around 2,000 million tons of carbon dioxide (CO_2) per annum. Privately-owned diesel generators are used in industrial, commercial and residential sectors when power supply is unreliable, and currently exceed 70 GW of capacity (more than all installed hydropower in India), growing at about 5 GW annually[3]. The International Council on Clean Transportation estimates that transportation sources account for approximately a third of particulate matter pollution in India, and an even higher proportion of nitrogen oxides which are harmful to human health. A recent study estimated 74,000 deaths were attributable to transport emissions in India in 2015[4]. While transport greenhouse gas emissions are relatively low (291 million tons in 2017 at 13 percent of the total[5]), they have more than doubled in the past decade, with transport accounting for the bulk of the 204.9 million tons of oil imports in 2017/2018, and 47 percent of oil product consumption in 2017.

5. **The Government of India (GoI) is committed to sustainable growth in the power and transport sector, particularly by strengthening the role of renewable energy and e-mobility.** GoI's commitment to renewable energy (RE) is a cornerstone of its Nationally Determined Contribution under COP 21[6], which will not only transform India's energy supply, but also have significant global impact. India intends to install 175 GW of renewable energy capacity by 2022 at an estimated capital cost of $150 billion, consisting of 100 GW of solar (40GW from grid connected rooftop solar), 60 GW of wind power and the remaining from bio-mass and small hydro. However, issues are already arising with the integration of such a large proportion of variable renewable energy in India's energy mix. **Similarly, the GoI laid out its first broad plan for a National Electric Mobility Mission Plan (NEMMP) in 2013** to promote faster adoption of electric vehicles. The plan created a first platform for government - industry collaboration with the ambitious target of 6 to 7 million e-vehicles sold by 2020.

Sectoral (or multi-sectoral) and Institutional Context of the Program

6. **India is making strong progress towards its renewable energy ambitions and had installed 37.5 GW of wind power and 35.6 GW of solar power capacity by December 2019.** As a result of significant investment, the costs of

[1] Bloomberg NEF 2019
[2] Road Transport Yearbook 2015-2016 (MoRTH 2018).
[3] Singh, S. (26 February 2016). "Economic Survey". *Economic Times*. Available: https://economictimes.indiatimes.com/industry/energy/power/economic-survey-total-diesel-generation-capacity-estimated-at-72-gw-growing-at-5gw-a-year/articleshow/51153973.cms
[4] Global Snapshot of air pollution-related health impacts of transport emissions, 2019, ICCT
[5] Source: International Energy Agency: IEA
[6] In 2015 **COP21, also known as the 2015 Paris Climate Conference,** Parties to the United Nations Framework Convention on Climate Change (UNFCCC) reached a landmark agreement to combat climate change and to accelerate and intensify the actions and investments needed for a sustainable low carbon future.

new utility-scale solar photovoltaics in India were the lowest in the world in 2018, with an 84 percent reduction since 2010[7] and renewable energy now competes directly with coal on a levelized cost basis. Consequently, India has recently increased its renewable energy targets to 450 GW of installed capacity by 2030. India's National Electricity Plan (NEP) now forecasts that during 2017-2022, only 6.4 GW of the 47.9 GW of coal-based power plants currently planned for construction would be required, due to capacity addition from renewable energy.

7. In the transport sector, the GoI has been actively taking steps to create an ecosystem for electric mobility. These include fiscal and non-fiscal measures to create demand for electric vehicles as well as to develop charging infrastructure. Under the NEMMP the Central Government developed the Faster Adoption and Manufacturing of Hybrid and Electric Vehicles Program (FAME) to develop the Electric Vehicle (EV) ecosystem in the country. The FAME 1 scheme (US$127 million), was launched in 2015 to encourage faster adoption of electric and hybrid vehicles. The FAME 2 scheme, launched in 2019, provides US$1.4 billion in financial incentives to expanding electric buses, two and three wheelers and shared/commercial EV fleets, as well as to support development of charging infrastructure. Government prioritization of shared and electrified mobility complements efforts to increase the share of renewable energy in the electricity mix and has particular potential to substantially reduce local and global pollution.

8. Integrating a growing share of variable renewable energy in the existing power grid is becoming increasingly complex. If India meets its RE capacity addition targets, then during a typical day in 2022, solar power may meet up to 44 percent of the total power demand. However, this solar power is not only variable in nature, but will be generated during off-peak periods and will not be able to meet peak demand. In addition, the variable nature of wind power means that wind capacity of 60 GW could bring about a variation in output to the power grid of up to 8 GW in as little as 5 hours.

9. The variable nature or renewable energy supply will require a combination of fast responding, high capacity energy storage to support its integration into the power system, support ramping requirements, and to service peak demand. Increasing the capacity of renewable energy production in areas where resources are most abundant may lead to transmission capacity constraints, resulting in curtailment of RE during peak production. In order to successfully integrate high volumes of renewable energy in the power system, energy storage will be essential in addressing the following issues:

- ✓ **Variability:** Generation output fluctuates as the weather condition changes (e.g. wind gusts, movement of clouds affecting solar insolation).
- ✓ **Uncertainty:** While forecasting technology is improving, there are challenges with predicting the output of RE generation to a high degree of accuracy on time scales from minutes to days.
- ✓ **Non-synchronous:** Since the resources are variable, it is not possible to generate a fixed voltage, fixed frequency and phase synchronized output consistently.
- ✓ **Non-dispatchability**: Generation from renewables is naturally determined and therefore may not provide power when it is the most valuable to the grid (e.g. solar power peak output is mid-day despite the peak typically coming in the evenings).

10. The challenges of RE variability are already complicating grid management in India's RE rich states. At present even with regulatory provisions for priority access and must-run status [Indian Electricity Grid Code (IEGC) 2010], instances of curtailment are witnessed across RE rich states of Tamil Nadu, Rajasthan, Andhra Pradesh, Madhya Pradesh and Karnataka. For instance, in Tamil Nadu which has wind capacity of around 8,500 MW, curtailment

[7] https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2019/May/IRENA_Renewable-Power-Generations-Costs-in-2018.pdf

averaged 30-35 percent of total generation during peak season in 2012-2015, and 20-25 percent in recent years. This translates into an annual loss of production of between 3000 and 5,500 GWh[8].

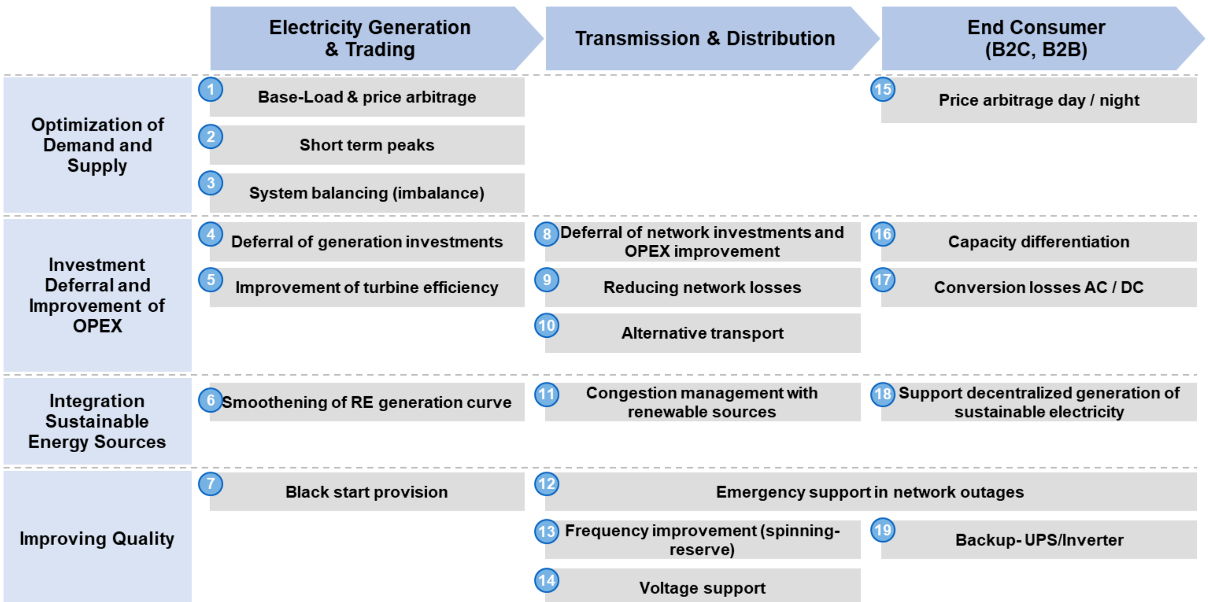
11. As the economics of electric vehicles become more favorable, volumes will grow, presenting new challenges and opportunities to the power grid. Electric vehicles require significant ancillary investment in charging infrastructure and grid strengthening to support additional power system load. Large volumes of EV will significantly increase electricity demand, and if unmanaged could increase peaks in power consumption, network overload and compromise power quality. In a study from United Kingdom, a 10 percent hypothetical market penetration of EVs resulted in increased peak load of 18 percent[9]. Distribution utilities will need to encourage electric car owners to charge at the times when there is surplus power, for instance when levels of renewable energy production are high. Hence, there will be a need to plan interventions like Battery Energy Storage System (BESS) in distribution networks to manage the large-scale deployment of EVs

12. Energy storage is not only a promising solution to the challenges involved in integrating larger volumes of renewable energy, but also promises other significant value within India's power system. In addition to supporting integration of renewable energy by smoothing variable production, energy storage can play multiple other valuable roles within the power system: optimizing demand and supply, through base-load and price arbitrage; increasing the capacity utilization of, and deferring investment in transmission and distribution infrastructure; deferring investment in peaking generation; replacing expensive and polluting diesel power backup; and, improving the quality of power supply through ancillary services including through frequency control and voltage support. Integrating energy storage solutions with EV charging infrastructure can also mitigate the grid management challenges of peaking power from e-mobility, and also enable EV batteries to not only act as a source of demand, but also a source of supply, providing valuable power system support.

13. Even though battery energy storage remains costly, international experience has demonstrated that it can be economically and financially viable, through stacking of revenues from the various value streams that battery storage can generate. The various value streams for battery storage are shown in Figure 1 below. It shows the various roles that the energy storage can play in electricity generation and trading, transmission and distribution and at the consumer end for both Business to Consumer (B2C) and Business to Business (B2B) .

[8] Down to Earth, 2019
[9] Qian, Kejun, Chengke Zhou, Malcolm Allan, and Yue Yuan. "Modeling of load demand due to EV battery charging in distribution systems." *IEEE Transactions on Power Systems*26, no. 2 (2011): 802-810.

Figure 1: Role of energy storage across the electricity value chain



14. The market for advanced battery energy storage systems on India's grid remains nascent, for a number of reasons. Battery costs remain comparatively high, little analysis or understanding of the various value streams for batteries in the power system exists, business models and a policy and regulatory environment to support investment have not been developed, and there is little track record of battery performance and revenue generation to support investor confidence. Grid scale energy storage in India is mostly in the form of pumped hydro projects, with 5.8 GW of capacity operating or under construction[10]. Battery energy storage in India has traditionally employed lead-acid batteries for residential power back-up power, and two and three-wheeler vehicles. The current lead-acid battery market in India totals 5 GWh of annual sales. During 2015-2018, over 1 GWh of advanced energy storage solutions have been deployed for back-up power across telecom towers. In 2017, Power Grid Corporation of India Limited (PGCIL) installed its first pilot battery energy storage project for frequency regulation in Puducherry, and in 2019 Tata Power Delhi Distributed Limited deployed a 10 MW battery as a pilot within its distribution system. Most of the storage pilots in India are financed largely by sponsors' or owners' equity, or with external grant support.

15. The key constraints to the development of a battery energy storage market in India are: (a) a lack of regulatory structure to explicitly enable revenue from the various value streams batteries represent or to manage environmental issues related to battery management and disposal; (b) lack of institutional capacity, particularly within publicly owned distribution utilities (Discoms), to enable ownership, placement and sizing of energy storage; (c) the slow pace of development of the e-mobility market, (d) non-availability of finance at reasonable terms due to perceptions of market and technology risk; and lastly (e) the current high-comparative cost of batteries which will only be affected by continued significant market growth.

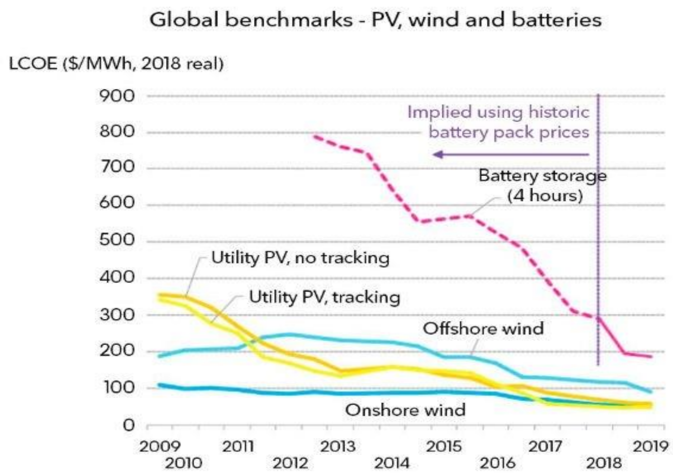
16. Globally, there has already been significant localized development of battery storage markets, where supportive regulatory and market structures exist. Global energy storage installations (not including pumped

[10] IEEFA (March 2019). "Pumped Hydro Storage in India". https://ieefa.org/wp-content/uploads/2019/03/IEEFA-India_Pumped-Hydro-Storage_Mar-2019.pdf

hydropower) are expected to increase from 9GW/17GWh in 2018 to 1,095GW/2,850GWh by 2040[11]. The capital cost of battery energy storage has declined by 87 percent since 2010[12], and although battery costs remain comparatively high, BESS is now an economically viable alternative for multiple grid support services, particularly when the battery is operated to provide multiple value streams. Korea, China, the United States, Australia and Germany have led the development of battery energy storage markets, alongside a commitment to relatively aggressive renewables growth targets. Lithium-ion continues to dominate the battery storage market, constituting nearly 85% of all new capacity installed. The long-term cost of supplying grid electricity from today's lithium-ion batteries is falling even faster than expected, making them an increasingly cost-competitive.

17. India could contribute significantly to the depreciation in battery energy storage costs globally. If India is able to recognize the value BESS in its power and transport sectors alone, the potential scale of deployment could contribute to a sixteen percent further reduction in global battery prices – having a transformative global impact[13].

Figure 2: Falling prices for Battery storage[14]



Source: BloombergNEF. Note: The global benmark is a country weighed-average using the latest annual capacity additions. The storage LCOE is reflective of a utility-scale Li-ion battery storage system running at a daily cycle and includes charging costs assumed to be 60% of whole sale base power price in each country.

18. Recognizing the transformative potential of battery energy storage, India launched a National Mission on Transformative Mobility and Battery Storage (NMTMBS, 2019), which promotes clean, connected, shared and holistic mobility initiatives, and clean energy through battery storage technology. It also recognizes the potential for jobs growth in manufacturing of batteries and includes phased manufacturing programs to support establishment of large-scale, export-competitive battery manufacturing plants in India. The mission will support the deployment of battery storage in both e-mobility and across the power sector, with the objective of reducing India's energy import dependence, by reducing direct oil demand, and increasing the uptake of renewable energy in the power sector. The mission seeks to establish a leadership role for India in the transition to clean energy, and electrified transport through high volume deployment of battery storage and a concomitant depreciation in battery storage costs.

[11] BNEF's Energy Storage Outlook 2019

[12] Bloomberg New Energy Finance (December 2019). https://about.bnef.com/blog/battery-pack-prices-fall-as-market-ramps-up-with-market-average-at-156-kwh-in-2019/

[13] Niti Aayog & Rocky Mountain Institute (2017). "India's Energy Storage Mission: A Make-in-India Opportunity for Globally Competitive Battery Manufacturing". Available: http://niti.gov.in/writereaddata/files/document_publication/India-Energy-Storage-Mission.pdf

[14] BNEF (March 2019). "Battery power's latest plunge in costs threatens coal, gas". https://about.bnef.com/blog/battery-powers-latest-plunge-costs-threatens-coal-gas/

19. The success of India's NMTMBS will require the simultaneous development of local demand for battery energy storage across the power sector (stationary storage) and in the e-mobility sector. It will also require the development of the supply-side, through a large-scale manufacturing base for battery storage, and supply chains to support this manufacturing base. Early success will be dependent upon the ability of the program to develop an ecosystem (from regulation through to availability of finance), which supports high early volume of demand and investments in battery storage, and through this produces rapid price declines in battery storage technology. The NMTMBS has outlined Government plans to develop the battery storage supply side, through incentives for large scale manufacturing, and it recognizes the need for further support to the demand side, and the development of a supportive ecosystem for investment in battery storage applications either within the power system or in e-mobility market.

20. Demand for battery storage is expected to be driven simultaneously by e-mobility and power system applications. Early analysis shows a potential cumulative market for battery storage in India of around 130 GWh over the period 2017-2022[15], with roughly half of this demand coming from power system applications and the other half derived from the demand for batteries for e-mobility. Growth in stationary storage within the power sector is expected to occur at different levels of the transmission and distribution system, with early volumes expected to displace diesel generation for power backup in industry and telecoms, alongside support for curtailment and ancillary services, and for greater penetration of distributed generation (solar rooftops in particular). Within the e-mobility sector the areas of initial growth are expected to be in the electrification of bus fleets, 2 and 3 wheelers, with later progression to car fleets and individual vehicles.

21. Development of a market, and high volume demand for stationary storage within India's power system will require: (a) the identification of clear, remunerable value propositions for battery storage; (b) the development of business models that are able to generate investments in battery storage to capture these value streams; (c) access to capital and financing at reasonable rates; and (d) a clear policy and regulatory structure that supports investments in battery energy storage systems and appropriate remuneration for the value that can be provided by battery energy storage. Several recent studies, including a 2017 Energy Sector Management Assistance Program (ESMAP) and International Finance Corporation (IFC) study "*Energy Storage Trends and Opportunities in Emerging Markets*", have identified the lack of affordable financing and poorly organized energy markets as significant constraints to the uptake of battery storage deployment in India. A 2018 World Bank, ESMAP and UITP[16] paper on "*Electric Mobility and Development*" identified key challenges for e-mobility development and in particular the need for strong institutional mechanisms and continuous engagement.

22. One of the key impediments to the development of demand for e-mobility, and therefore for battery storage in this market segment is the lack of access to charging infrastructure. Growth in the e-mobility sector will require early access to safe, reliable, accessible, and affordable charging infrastructure or battery swapping, appropriate for each market segment (buses, 2/3 wheelers, etc.). It will also require strengthening of distribution infrastructure in critical load-growth areas. Experience of countries such as China and Norway indicate that availability of charging infrastructure was a key driver for mass EV adoption, that emerged through close coordination of the various stakeholders. Government policy is now evolving to support development of charging infrastructure that enables greater EV penetration. The Government's FAME 2 policy allocates INR 1,000 crore (US$140 million) in incentives to establish 2,700 charging stations across the country, and a few Indian States have also announced fiscal and non-fiscal incentives to develop charging infrastructure in their respective States. However, these programs are limited in scope

[15] Energy Storage Market Landscape Report (India), 2018, UK Government
[16] UITP (*Union Internationale des Transports Publics*) is the **International Association of Public Transport** and a passionate champion of sustainable urban mobility

and significant further support is required to develop bankable business models for the deployment of charging infrastructure. Discoms have expressed interest in the EV charging business, either directly or through public private partnership models, but would require significant investment and advisory support to establish charging stations and seamlessly manage the subsequent increase in load in day-to-day operations. Similarly, demand for e-mobility and battery storage in this market segment will require the development of bankable business models for charging infrastructure, along with access to affordable financing and a supportive policy and regulatory environment.

Relationship to CAS/CPF

23. The proposed World Bank support to E-mobility and Battery Storage is consistent with the Country Partnership Framework (CPF) for India (FY18-22). The CPF outlines Bank support to India under the three focus areas of Resource-efficient Growth, Enhancing Competitiveness and Enabling Job Creation and Investing in Human capital.

24. The proposed program is aligned to these priorities, and particularly the focus on Promoting Resource-efficient Growth through increasing access to sustainable energy and improving systems for controlling air pollution and Enhancing Competitiveness and Enabling Job Creation through increased access to quality, market relevant skills development. Under Resource-efficient Growth, the program will directly help achieve one of the intended outcomes of the CPF, which is to increase total generation capacity of renewable energy, and one supplementary progress indicator, which is to increase the volume of private sector finance leveraged for cleaner technologies, including electric vehicles. Battery storage and e-mobility market development also has linkages to job creation. In addition, the operation conforms to the emphasis on GoI's "Finance-Plus" approach, whereby the Bank's value-added goes beyond financing and contributes to the transfer of knowledge and international best practice, reform of processes and systems, strengthening of institutional capacity, and exploration of innovative financing mechanisms.

25. The Program will also be an opportunity for the Bank to build on the work it is already doing to increase female participation in the power sector work force through the WePOWER Program. The Program will focus training, skills development and capacity development programs on increasing female labor force participation in this emerging power sector market.

26. The Program is aligned with the Bank's support to GoI's National Clean Air Program (NCAP) for adoption of cleaner technologies in cities. It is also aligned with IFC's FY 17-21 India Country Strategy which aims to reduce air pollution through renewable energy investments and shared, electric mobility.

Rationale for Bank Engagement and Choice of Financing Instrument

27. The proposed Program for Transformative Mobility and Acceleration of Battery Storage in India adopts a Multiphase Programmatic Approach (MPA) to catalyze early investments and mobilize private capital and commercial financing for battery energy storage and e-mobility markets. Over its several phases the MPA aims to create a sustainable market for battery energy storage.

28. An MPA will allow the Bank to undertake a series of operations to build the market and associated ecosystem for battery storage. Phase 1 will catalyze early signaling investments and demonstrate the feasibility of battery energy storage; Phase 2 will support scale-up through increasingly commercial investments; and, Phase 3 would support market consolidation to the extent that a fully commercial, self-sustaining market for battery energy storage exists both across the power sector and e-mobility sectors.

29. The MPA (i) signals a long-term commitment to developing electric mobility and battery storage through public and private sector instruments in a transparent, affordable and sustainable manner; and (ii) is an agile response to evolving market conditions with streamlined documentation and approval processes and is therefore more responsive to an evolving investment climate.

30. It is proposed that the MPA will provide financing of US$750 million (US$550 million IBRD, US$200 million concessional) over three US$250 million phases. Phase 1 of the MPA will be a US$250 million PforR aimed at catalyzing early investment and signaling further investment opportunities in battery energy storage systems, EV charging infrastructure, and battery swapping infrastructure. Phase 2 and 3 will extend the PforR through additional financing depending upon how quickly the market for battery storage develops or will support specific investments in battery energy storage systems, EV charging infrastructure or EV fleets where these have a catalytic effect or establish entry points for private and commercial investment.

31. The proposed MPA will be designed around the findings and recommendations of a significant ASA program currently being executed by the Bank. This ESMAP funded ASA program identifies value propositions, bankable business models and necessary policy and regulatory development to support investments in battery energy storage systems for the power system, and to accelerate the transition to electric vehicles and the development of an e-mobility market. In addition, a mainstreaming grant from IFC supports the development of commercially viable e-mobility solutions in two states, with focus on the viability of electric bus schemes.

32. Investments under the MPA will require a supportive policy and regulatory framework that establishes remunerable business models for battery storage, charging infrastructure, battery swapping, and e-fleet development, and incentivizes investments that will be required in distribution infrastructure. A parallel Development Policy Loan (DPL) ($250 million, proposed) will support the policy, regulatory and institutional development necessary to establish a sustainable market for battery energy storage and e-mobility.

Rationale for a PforR in Phase 1 of the MPA.

33. The first tranche of US$250 million under the MPA is proposed as a PforR, implemented through a financial intermediary, to immediately catalyze investment in battery storage. This Phase of the MPA will focus on discounting financing to early catalytic investments to prove feasibility and signal further commercial investment.

34. A PforR instrument has been proposed for the following reasons:

- A PforR will provide financing to catalyze market development across the full range of business models and investments targeted by Government of India's NMTMBS;
- The Bank has similar experience in using this instrument to catalyze market development - a similar approach was followed for an ongoing WB project, the *Grid Connected Rooftop Solar Program*. This program catalyzed a market for solar rooftop in India by providing concessional finance and providing technical assistance to build the ecosystem to facilitate solar rooftop deployment. The program has not only been able to kickstart the solar rooftop market by financing around 432 MW, but it has resulted in the mobilization of over US$4 billion of commercial finance as this market has grown.
- the nature and methodology of investments in battery energy storage, and charging/battery swapping infrastructure is quickly evolving, and a PfoR provides the flexibility required for the Bank to finance a wide range of investments and business models.

- Experience gained through the development of a commercial solar rooftop market has demonstrated that a PforR supported by a deep and broad capacity development program will result in significant early market growth. The nominated financial intermediary will act as a force multiplier in promoting market investments and supporting other financiers in developing comfort with investments in a nascent market.

35. Under the proposed first Phase PforR, concessional financing for battery storage and charging infrastructure will be made available to the battery energy storage and charging infrastructure markets through a commercial bank. A significant grant-funded technical assistance program will support necessary analytical work, capacity and institutional development, market development, policy and regulatory development and awareness raising.

C. Program Development Objective(s) (PDO) and PDO Level Results Indicators

36. MPA Program Development Objective(s)
The PrDO for the MAP is to increase investment in battery energy storage for both power system and e-mobility applications.

37. Program Development Objective (Phase 1 PforR)

The PrDO for the first phase PforR is to initiate investments in battery energy storage for both power system and e-mobility applications.

PDO Level Results Indicators: MPA and first phase PforR

38. PDO level results indicators for MPA and PforR:

- Increase in installed capacity of battery storage in power sector (GWh/year): This indicator has been selected to align the Bank Program with GoI's battery storage program and target and to facilitate Battery Storage.
- Increase in number of charging stations (No. added/ year): This indicator has been selected to align the Bank Program with GoI's battery storage program and facilitate E mobility.
- Increase in batteries installed in e-fleets (No./year): This indicator will help measure actual penetration in one of the largest market segments.
- Reduction in CO_2 emissions (metric tons/ year). This indicator will help GoI measure the GHG emission reduction contributions of the National Mission on Transformative Mobility and Battery Storage by facilitating RE integration and E mobility.

D. Program Description

PforR Program Boundary

Government Program:

39. In 2019 the Union Cabinet approved the NMTMBS. The Mission will finalize and implement strategies for transformative mobility and ensure holistic and comprehensive growth of the battery manufacturing industry in India. It includes a five-year phased manufacturing program to set up "a few large-scale, export-competitive integrated batteries and cell-manufacturing Giga plants in India".

40. The multi-disciplinary Mission has an Inter-Ministerial Steering Committee and is chaired by Chief Executive Officer of NITI Aayog. The Steering Committee is comprised of Secretaries from Ministry of Road Transport and Highways, Ministry of Power, Ministry of New and Renewable Energy, Department of Science and Technology, Department of Heavy Industry, Department for Promotion of Industry and Internal Trade, and Director General, Bureau of Industrial Standards. This Committee will develop policy measures for demand creation for battery storage across stationary storage and e-mobility.

41. The government is aiming to subsidize creation of up to 50GWh of battery capacity production per year, with an annual subsidy expenditure at Rs 700 crore (about US$100 million). It is expected zero-duty imports would be allowed for lithium, iron and cobalt to produce batteries with the advanced cell chemistry in place of the traditional lead batteries. The plan seeks to make the country self-sufficient in the most advanced batteries for electric vehicles and stationary storage.

42. The mission is technology agnostic and includes Advanced Chemistry Cells (ACCs) defined as the new generation technologies that can store electric energy either as electrochemical or as chemical energy and convert it back to electric energy as and when required. Globally manufacturers are investing in these new generation technologies to meet the expected boom in battery demand through 2030.

43. Funding being provided under the GoI Program will focus on supply side development, however, the Government Program also establishes that policy and regulatory development, and structured interventions will be required to develop demand for battery storage across both the power system and e-mobility sectors.

44. The Government's Program can be defined as the set of activities required to develop a strong self-sustaining domestic market for battery energy storage in both the power system and e-mobility sector. These will include both demand and supply side market development. Within the Government Program Boundary, the Bank PforR will focus specifically on demand creation.

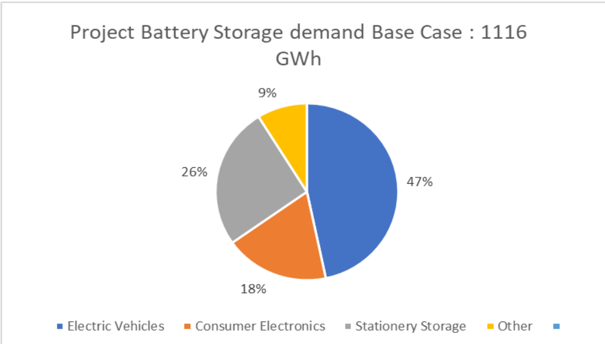
Proposed PforR Program Boundary:

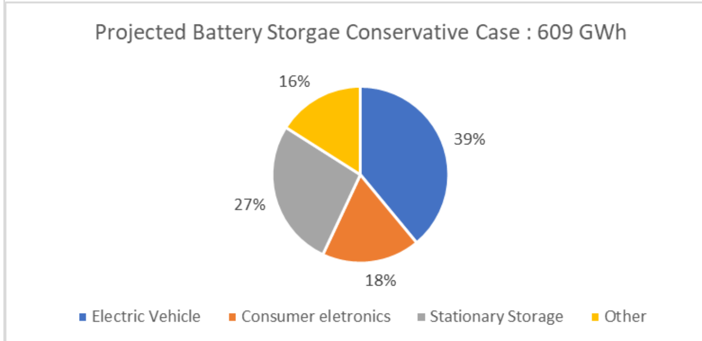
45. The Proposed Program will provide support for a critical component of the Government's Program - focusing on activities and investments that will support development of demand for battery energy storage.

46. A study by Rocky Mountain Institute (RMI), forecasts that in the base case the projected demand for battery storage in India by 2030 is 1116 GWh and demand in a conservative scenario is 609 GWh. The majority of this demand is expected from growth in EVs followed by stationery storage.

47. The proposed program will seek to catalyze early market development so that this forecast demand is met as quickly as possible.

Figure 4 & 5: Projected Battery Storage (Base and Conservative case)





		Government program	Program supported by the PforR (PforR Program)	Reasons for non-alignment
Objective		To facilitate the uptake of battery storage solutions in power system and in clean mobility solutions	Develop market structures which will support investment in battery energy storage systems, charging infrastructure, battery swapping and e-fleets; B) Increase investment in battery energy storage systems; C) Strengthen the capacity of relevant institutions to support the deployment of battery energy storage.	
Duration		*2020-2030*	*2020-2025*	*Supporting the first phase through the proposedP4R*
Geographic coverage		*All the country*	*All the country*	*Priority engagement for the Bank*
Coverage		GoI support for implementation of battery manufacturing at giga-scale	Support the development of demand for battery storage through awareness creation, capacity development and availability of finance.	*The total program will cover development of both the supply side and demand side of a battery storage market. Both Government and Bank investments will be aligned and mutually supportive*

Results areas		RA1: Capacity of manufacturing plants set up in India RA2: Percentage of Local supply in the manufacturing units RA3: Increase in installed capacity of Battery storage in power sector RA4: Increase in no. of charging infrastructure: () RA5: CO2 emissions reduced	RA3-5	*The PforR operation does not contribute to RA 1 and RA2.*
Overall Financing		$1 billion	$250 million	

E. Initial Environmental and Social Screening

48. An environmental and social systems assessment (ESSA) which is a prerequisite under a MAP-Program for Results operation shall be conducted to assess the adequacy of the environment and social systems. The proposed Program is likely to have social and environmental impacts. The typical environmental impacts envisaged are (a) health impacts, (b) appropriate disposal of batteries, etc. The Ministry of Environment, Forests and climate Change (MoEFCC), GoI has notified the ‘Batteries (Management and Handling) Rules 2001’ which provide for ensuring safe disposal and recycling of discarded lead acid batteries. The Rules require proper control and record keeping on the sale or import of lead acid batteries and recollection of the used batteries by registered recyclers to ensure environmentally sound recycling of used batteries. The Contractors are required to ensure compliance to this Rule. The above Rules, however, do not cover Lithium or Lithium-ion batteries which are now being increasingly used in the hydro-met equipment/stations. A recent report by the Central Pollution Control Board (CPCB) under MoEF – ‘Status Review Report on Implementation of Batteries (Management and Handling) Rules, 2001 (as amended thereof)’, 2016 has recommended under Paragraph 9(iv) that “*Batteries rules may cover other types of batteries (like Lithium Ion batteries, Nickel-Cadmium batteries, etc.) placed on the market, for which the definition of battery may be re-defined. Guidelines may be evolved by CPCB for recycling of other batteries also*”. ESSA will provide GoI the opportunity to explore above management issues and address them through Ministry guidelines.

49. The Program will build on the experience of other Bank projects of this nature and other relevant projects to mainstream environmentally and socially friendly practices in the Program to ensure program is gender responsive and socially inclusive and transparent. The grievance redress system will be designed to address complaints associated with access to information, stated benefits, etc. during the planning and implementation stage of the Program.

50. An ESSA will be initiated once contours of the Program is finalized and will be planned to be completed before appraisal.

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