Stimulus measures for accelerated economic recovery

1 Generation based incentives for decentralized grid connected ground mounted solar PV systems co-located with crops on agriculturally productive land parcels (hereinafter referred as agro-PV projects)

PM-KUSUM component A is designed to provide alternate / additional source of income and livelihood from decentralized renewable power generation for:

- Farmers of cultivable land
- Farmers or landowners of wasteland / barren / uncultivable land

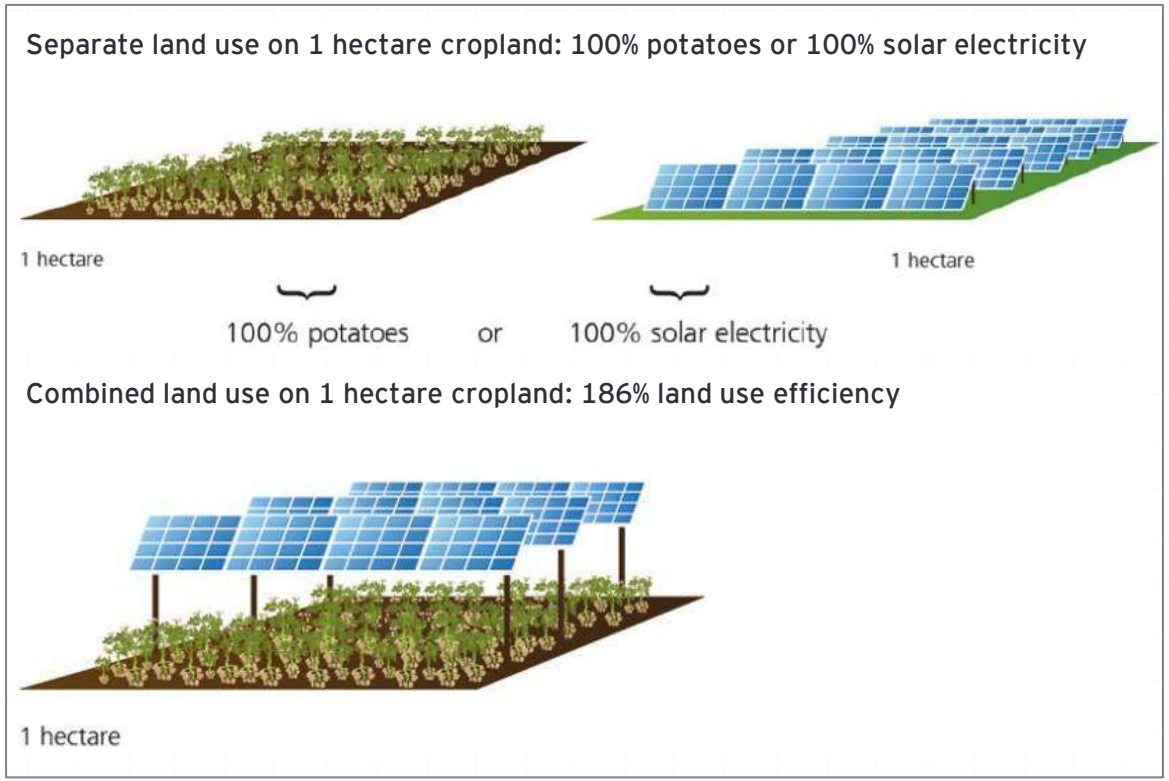
The first category of farmers would have to design and develop solar PV systems for co-location with crops on agriculturally productive land parcels. This will require elevated structures and a more dispersed solar PV array arrangement to permit sufficient sunlight for crop cultivation, thereby increasing the capital cost. A variety of innovative agro-PV solutions are emerging from successful demonstrations in Germany, Japan, South Korea, China, France, the United States and India. The Indian Council of Agricultural Research - Central Arid Zone Research Institute (ICAR-CAZRI) has successfully commissioned Solar PV systems co-located with a variety of crops in Jodhpur.

The operational guidelines of PM-KUSUM component A proposes competitive reverse bidding process for capacity allocation by DISCOMs, with a ceiling tariff as per latest tariff order of the respective SERC. This would necessitate that the SERCs determine the tariff for co-located agro-PV systems developed on agriculturally productive land separately. Otherwise, the commercial viability of projects for first category of farmers will be at risk. So far, SERCs have determined tariff for ground mounted solar PV systems developed on barren land only. Additionally, DISCOMs have to conduct the competitive reverse bidding process in two separate tranches of capacity allocation for projects proposed on barren and agriculturally productive land parcels. This will ensure a level playing field for all the participants.

Moreover, DISCOMs may shy away from higher cost of power procurement from co-located agro-PV systems developed on agriculturally productive land. In this scenario, generation based incentives for promoting co-located agro-PV systems will reduce the burden on DISCOMs and at the same time make these investments economically attractive.

As per a recent IRENA report (2019) that provides the future outlook of Solar PV markets, agro-PV systems combine solar PV and agriculture on the same land and consists of growing crops beneath ground mounted solar panels. Although the concept was in existence for long, it has received little attention until recently, when several researchers have confirmed the benefits of growing crops beneath the shade provided by the solar panels. These include higher electricity production, higher crop yields and less water used. Many types of food crops, such as tomatoes, grow better in the shade of solar panels, as they are spared from the direct sun and experience less water loss via transpiration, which also reduces water use while maintaining the same level of food production. A key advantage for solar panels is that their efficiency is increased. Cultivating crops underneath reduces the temperature of the panels, as they are cooled down by the fact that the crops below are emitting water through their natural process of transpiration.

The land use impact from solar energy expansion is likely to have cross cutting implications on the food security and land productivity of the country. In this regard, it is worthwhile to examine the alternative use cases of land acquired for solar energy generation and device policy pathways to reduce the land use impact. KUSUM scheme Component A can be a perfect test bed to scale up adoption of agro-PV solutions.



Source: Fraunhofer Institute for Solar Energy Systems ISE

Stimulus options:

Generation based incentive of up to INR 0.5 per kWh over and above tariff determined through competitive reverse bidding for 1 GW deployment of agro-PV projects under Component A pilot phase.

Stimulus benefits

Item	Value
Budgetary expenditure toward generation based incentive	INR 1,250 crores
Fresh jobs created in rural communities	7,416 jobs
Avoided CO_2 emissions	35 million tons of CO_2e
Total capital investment toward 1 GW agro-PV projects	INR 4,200 crores

Source: EY analysis

Other cross cutting benefits:

- Additional source of income from power generation for farmers whose livelihood rests entirely on agriculture income
- Additional income from improved crop yield as a result of cultivations under the shade of Solar PV array
- Enhanced productivity of farmlands resulting from dual use of farming and solar power generation in the same land parcel
- Reduced threat to food security from solar power generation on farm lands

2 Dedicated financing facility for improving farmer access to low cost debt funds and boosting commercial viability of 1–2 MW scale ground mounted Solar PV projects on CAPEX mode (own investment from farmers)

PM-KUSUM component A is designed to provide alternate / additional source of income and livelihood from decentralized renewable power generation for:

- Farmers of cultivable land
- Farmers or landowners of wasteland / barren / uncultivable land

The MNRE operational guidelines for component A allows both CAPEX and OPEX mode of developing decentralized grid connected ground mounted Solar PV projects. Under CAPEX mode, farmers can invest in solar PV power plants by arranging own funds, collaborate with EPC contractors/System Integrators for setting up ground mounted solar PV power plants on turnkey basis, operate and maintain the plant during the PPA tenure.

The guidelines propose competitive reverse bidding process for capacity allocation, with a ceiling tariff determined by the respective SERC. The capital cost and cost of capital are the two critical determinants of this ceiling tariff. Typically SERCs adopt 14% rate of return on equity and 10.5% interest rate on debt with 70:30 debt to equity ratio while determining these tariffs. Therefore, farmers willing to invest own funds will need access to low cost debt instruments to remain competitive. This is one of the principal bottlenecks for driving investments under CAPEX mode.

The Hon'ble Finance Minister, Government of India, recently announced INR 1 lakh crore Agri Infrastructure Fund as stimulus funding to mobilize medium - long term debt financing for investment in viable projects for post-harvest management infrastructure and community farming assets through incentives and financial support.

Credit guarantee coverage will be available for eligible borrowers from this facility for loans up to INR 2 crore. The fee for this coverage will be paid by the Government. Moreover, all loans under this financing facility will have interest subvention of 3% per annum up to a limit of INR 2 crore. However, there is no clarity as to whether decentralized renewable power generation projects developed under PM-KUSUM scheme will be eligible for financing under this facility. Farmers willing to invest under CAPEX mode will need debt financing between INR 2.5–5 crores for setting up 1–2 MW grid connected ground mounted Solar PV projects.

Stimulus options:

Establish a dedicated financing facility of ~INR 25,000 crore on the lines of Agri Infrastructure Fund to enable farmers access low cost debt financing for setting up 5 GW of decentralized renewable energy projects on CAPEX mode under PM-KUSUM component A.

Amend Agri Infrastructure Fund guidelines for making decentralized renewable power generation projects developed under PM-KUSUM scheme eligible for borrowing under this facility.

Item	Value
Direct annual savings in access to electricity	INR 235 crores
Fresh jobs created in rural communities	61,800 jobs
Avoided CO_2 emissions	86 million tons of CO_2e
Investment to boost rural economic activity	INR 9,000 crores

Source: EY analysis

Pipeline of projects for original RE equipment manufacturing

5

Solar PV cell and module manufacturing

Introduction

As per the MNRE, Government of India, the current installed capacity for manufacturing solar PV cells and modules in India is ~3 GW and 10 GW respectively. The Modified Special Incentive Package Scheme (M-SIPS) scheme of the Ministry of Electronics & Information Technology, Government of India provides for 20–25% subsidy for investments in capital expenditure for setting up of electronic manufacturing facility such as solar PV cells and modules. On the demand front, the government schemes including Central Public Sector Undertaking (CPSU) scheme, MNRE phase 2 of grid connected rooftop solar scheme and the PM-KUSUM scheme mandate domestic content requirement for sourcing solar cells and modules. Additionally, the Production Linked Incentive (PLI) schemes announced by the Ministry of Commerce & Industry, Government of India, will have a huge role to play in achieving size and scale in manufacturing by incentivising incremental production for 13 key sectors. The total budgetary outlay for funding PLI in all 13 sectors is estimated INR 1.97 lakh crores or US$26 billion. On average 5% of the production value is provided as an incentive.

Shovel ready projects for implementation

Approx. ~8 GW capacity of projects for manufacturing solar PV cells and modules are currently in pipeline at various stages of development. These projects are envisaged in the states of Gujarat and Tamil Nadu with a CAPEX outlay of INR 21,307 crores creating direct employment potential for ~30,000 fresh jobs in the next 2–3 years. The MNRE has notified basic customs duty of 40% and 20% on imported solar PV modules and cells respectively with effect from 1st April, 2022. This is likely to reduce demand for imported solar PV modules and cells, especially for utility scale projects. In this context, the project pipeline identified will benefit from the potential rise in demand from project developers thereby raising the investor interest to fast track these projects.

Project Pipeline for Manufacturing Solar PV cells and modules

Scheme	Project promoter type	Project Status	Production Capacity (MW)	Project location	Year of announcement
SECI Manufacturing linked Solar Auction	Private	Permitting	1,000	Not reported	2020
	Private	Permitting	2,000	Gujarat	2020
NA	Private	Announced	2,000	Gujarat	2020
NA	Private	Announced	3,000	Tamil Nadu	2020

Project Pipeline for Manufacturing Solar PV cells and modules (cont.)

Scheme	Estimated date of project commissioning	Total CAPEX outlay *(INR crores)*	Equity mobilization *(INR crores)*	Debt financing *(INR crores)*	Number of jobs created
SECI Manufacturing linked Solar Auction	Beyond 2022	3,200	960	2,240	4,475
	Beyond 2022	6,400	1,920	4,480	8,950
NA	Beyond 2022	6,400	1,920	4,480	8,950
NA	Beyond 2022	5,307	1,592	3,715	7,542
	Total	**21,307**	**6,392**	**14,915**	**29,917**

Source: EY analysis

Lithium Ion Battery Cell manufacturing, module and pack assembly lines

Introduction

Energy storage will play a crucial role in providing the necessary flexibility for Indian power system, which is at the cross roads for decarbonisation with massive renewable energy capacity addition planned with intermittent sources such as solar and wind. While there are a number of long-standing storage technologies, such as pumped hydro, and some emerging technologies, such as compressed air or stacked concrete blocks, the majority of investment to date has been directed toward large-scale lithium-ion batteries, such as those found in electric vehicles, mobile phones and laptops.
Uptake of the technology has been driven by dramatic cost reductions. The PLI scheme will have a huge role to play in achieving size and scale in advance cell chemistry battery products manufacturing.

Shovel ready projects for implementation

Several projects targeting different components in the value chain of lithium ion battery manufacturing are currently in pipeline. All of these projects are led by private sector and located in Gujarat, Karnataka, Haryana and Tamil Nadu. ~INR 27,000 crores of capital infusion is expected for operationalizing the project pipeline. These projects will play critical role in hybrid RE power project development in future that integrates battery energy storage for peak power supply or round the clock supply. Over 10,000 fresh jobs will be created for operationalising the project pipeline.

Project Pipeline for Manufacturing Lithium Ion Batteries

Product	Project promoter type	Project Status	Production Capacity	Project location	Year of announcement
Lithium Hydroxide	Private	Announced	20,000 LCE *(Lithium Carbonate Equivalent)*	Gujarat	2019
Lithium Ion Battery Cell	Private	Under construction	30 Million cells per annum	Gujarat	2019
Lithium Ion Battery Active Materials, Cell, Pack Assembly, Recycling	Private	Under construction	10 GW per annum	Gujarat	2019
Li-ion pouch cell battery modules	Private	Permitting	1.5 GWh per annum	Gujarat	2020
Lithium-ion Polymer (LIP) batteries	Private	Land acquired		Haryana	2020
Lithium Ion Batteries	Private	Announced		Karnataka	2020
Lithium Ion Batteries and EVs	Private	Announced		Karnataka	2020
Lithium-ion Battery Cell and Pack Assembly Line	Private	Land acquired	1000 MW	Tamil Nadu	2021

Source: EY research

Stimulus measures for accelerated economic recovery

1 Boost demand for high efficiency solar PV modules and advanced chemistry cells (ACC) battery solutions

The government of India in its budget for 2020-21 announced PLI for domestic manufacturing of high value products in 13 sectors including the high efficiency solar PV modules and advanced chemistry cell batteries with budgetary allocations of INR 4,500 crores and INR 18,100 crores respectively. This is a welcome step to boost research and development efforts by existing domestic Original Equipment Manufacturers (OEM) players, attract new investments and make domestically manufactured products competitive in the global supply chain context.

Considering the top 7 domestic solar PV module manufacturers in 2019, high efficiency mono-Si PV modules constituted only 13% of PV production, while 87% comprised of multi-crystalline (or multi-Si) PV modules. However, the share of mono Passivated Emitter and Rear Cell (PERC) modules is expected to increase to 25–30% of all utility-scale solar installations in 2020.

The government must also gradually intervene to boost demand for high efficiency solar PV modules, cells and advanced chemistry cells battery solutions in its existing schemes. The existing schemes including CPSU scheme, MNRE phase 2 of grid connected rooftop solar scheme and the PM-KUSUM scheme mandate domestic content requirement (DCR) for sourcing solar PV systems.

Each of above schemes mandating DCR can have a mechanism to incentivize adoption of high efficiency PV modules. The current benchmark capital costs for solar PV systems for availing subsidy under the rooftop scheme has no incentive for adopting high efficiency modules / cells. The government's order on benchmark cost does not differentiate between PV systems adopting mono-Si and multi-Si efficiency modules / cells. In a race to secure the lowest cost for consumers, the state nodal agencies and the technology vendors are incentivized to supply only multi-Si modules in the current scenario.

Stimulus action

Amend the benchmark cost orders under rooftop and KUSUM schemes to differentiate between PV systems adopting mono-Si and multi-Si efficiency modules / cells.

Formulate an incentive mechanism under these schemes to adopt high efficiency PV modules and ACC battery solutions