Proposal

Name of the institute: Indian Institute of Technology Kanpur

Incubator: Doorastha Analytics Pvt Ltd (Atanu Mukerji)

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Objective: Prototyping to commercialization of mobile cooling carts for vaccine storage driven by battery and solar technologies

Type of Intervention: (Choose one)

1) Proposal on Vaccination drive community engagement

2) Proposal on Cold storages and Cold chains battery or solar operated for last mile connection (X)

3) Last stage Vaccination development

**4) Post Vaccination studies.

Details of intervention:

Abstract: The ongoing global outbreak of COVID-19, caused by the SARS-CoV-2 virus, has put tremendous strain on the healthcare systems around the world in addition to disrupting the fabric of our society and economy. An important factor compounding this current crisis is the highly contagious nature of the SARS-CoV-2 virus. Since clinical trials of vaccinations are over and we are at a stage that vaccines can be administered to civilians. It is imperative that efforts into the development of vaccine storage and transportation be pursued which can lead to accelerated vaccination drive throughout the country including the remote and off grid areas, thereby facilitating the revival of society and economy. To this effect, we propose a selfsustained and green operation utilizing mature technologies such as Si based solar cells, Li-ion batteries and DC refrigerators, to provide facile solution for reliable and cost-effective distribution of vaccines to even the most remote inhabited regions.

Methodology: The goal of the proposal is to provide a solution for safe and reliable transportation of vaccine from the Primary Health Center (HC) to the various HCs where the vaccine will be administered. We plan on utilizing widely used and commercially available vapor compression cycle-based refrigeration technology for storage and transportation of vaccines. Our objective is to develop mobile vaccination carts with battery packs and power electronics to run the refrigeration unit. These mobile carts will enable delivery of vaccination dosage to people in off-grid and rural areas and will be primed with enough battery packs to sustain cold storage of vaccination. The cold chain transportation would involve moving the vaccines in lots of 10,000 doses over a maximum time period of 48 hours without degradation of the vaccine. Online and offline monitoring of temperature of the refrigerator and availability of data on the cloud will be enabled for remote and centralized monitoring of each mobile unit.

Mobile carts will be loaded with vaccination and charged battery packs at a hospital/HC located in a district nearby. The mobile units would be supplied with two units of battery packs such that one unit is loaded on the mobile cart while the secondary unit is being charged at the primary HC. The mobile carts will have a battery autonomy of 2 days, in cases it takes upto 2- days to administer the 10,000 units. The depleted battery packs of mobile carts will be swapped with fully charged (secondary) battery packs at the primary HC using a manual lift, while loading the vaccine doses. The mobile cart would also be mounted in a handling system which is convenient to transport and enables loading on all sorts of vehicles like small vans, ambulances, and trucks.

Solar modules of suitable capacity will be installed at each primary HC for charging the secondary battery packs to make the entire operation sustainable and based on clean energy. Figure 1 shows the schematic of the proposed charging infrastructure at primary HC along with mobile cooling cart.

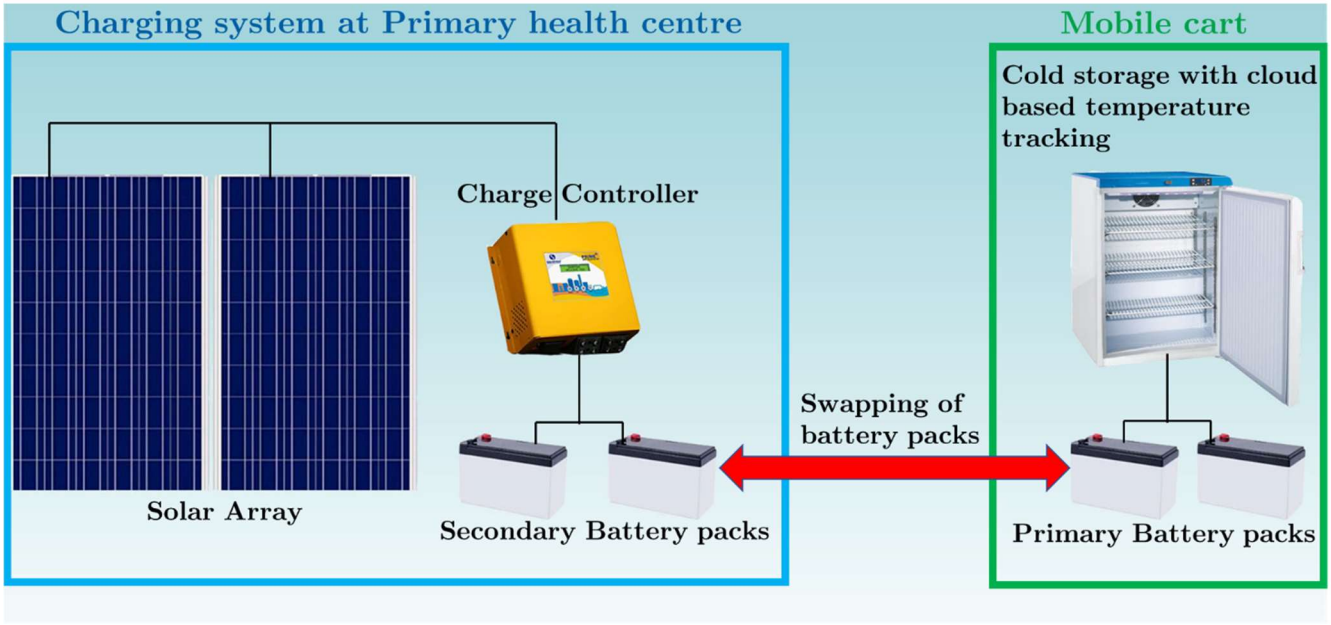

Figure 1. Schematic of renewable charging system for primary health centers and mobile cooling cart

Details about the technology and Financial Analysis:
The following technical and cost analysis are performed for the development of Mobile cart with vaccine storage capacity of 100L.

Vaccine storage (doses)	Volume needed (L)	Power requirement (W)	Transit Duration (hours)	Total Energy needed (Wh)	Total battery capacity needed with DOD (Wh)
10000	100	100	48	4800	6000

Cost calculations for development of Mobile cart with 100L capacity*:

Item Description	Specification	Cost per unit (in Rs)	Units	Amount (in Rs)
2 battery packs (Lithium ion)	6000 Wh, (e.g. 40 Ah / 12. 8 Volts, qty=12, weight~50 kg)	12,500	2 X 12	3,00,000.00
Solar panel	Total capacity needed ~2200 Wp (e.g. 270W, 24V, qty=8)	7,000	8	56,000.00
Charge controller	MPPT with load control, 40-50A charging current	10,000	1	10,000.00
Refrigeration cost (100L)	DC refrigerator 100W	45,000	1	45,000.00
Temperature monitoring and data logging module with cloud software platform subscription	To monitor a temp range of 0-10 deg C and store temp and env data at 30 mins interval for 48-96 hours with GPRS/GSM connectivity to cloud server	4000	1	4,000.00
Installation and System packaging cost	System packaging for easier loading and unloading - handling	30,000	1	30,000.00
Battery swapping Lift (50 Kg capacity)	To swap the primary with secondary battery pack	5,000	1	5,000.00
Total Product cost (A)	Total cost of the charging infrastructure, mobile cart and other accessories		1	4,50,000.00
Annual maintenance cost (10%) (B)	Cost to keep the system fully operational			45,000.00

*rough estimate of the total product cost

Engineering and Development cost (C)				
Manpower (1 Project Technician + 1 Project Associate)	20,000 + 35000 per month	55,000	12	6,60,000.00
Testing and prototyping cost	Development of temperature tracking system, charging infrastructure and mobile carts			5,00,000.00

Overhead (25%) (D)				4,15,000.00
Total Budget for 1 year (A + B + C + D)				20,70,000.00

Milestones:

M1. Identification of vendors and test site. Acquisition of key components (0-1 months)
M2. Development and testing of temperature logging/tracking system (0-1 months)
M3. Development of cold storage cart prototype and testing. Failsafe parallel operation of batteries. (1-3 months)
M4. System level packaging, ruggedization and endurance testing of cold storage cart (1-3 months)
M5. Real life data collection of the cold storage cart at nearby villages in Kanpur area. (4-12 months)

Timeline:

Milestone/Time	**2m**		**4 m**		**6 m**	**8 m**	**10 m**	**12 m**
M1								
M2								
M3								
M4								
M5								

Figure 2. Bar chart of activities for different sub-tasks as discussed in the milestone section.

Do you have State Government connection, or will you require support from CSR – Will require support from CSR.

States that you can provide technology to – All states across India

Please answer following questions depending on the intervention you choose and if applicable to you:

Can you do the Community engagement yourselves or will need help by CSR- Yes, we will need help from CSR for community engagement.

If you have a Market ready technology available, No

- **How do you plan to deploy:**
- **Number of unites available:**

Do u wish to partner with an NGO? If yes, name the NGO and provide details on how u will partner? (item wise costing should include cost to NGO for their scope of work)

At the moment we do not have any plans to partner with an NGO.