The Market Survey for the Lithium-ion Battery Production in Indian Climate of High Temperature and Humidity

Propose about the approach of the EV business at the beginning of the Market Growth

Roundtable on Innovative Battery Technology for Energy Storage

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FICCI, Federation House, Tansen Marg, New Delhi

ITSEV Inc. Japan

Electric Vehicle Technology Company

Self-introduction

Kazuo Chiba

- CEO of ITSEV
- Former Nissan engineer

  - Project manager of R32 & R33 Skyline

  - Chief Engineer of Altra EV (world's first lithium-ion based EV)
- Joined TEPCO (Tokyo Electric) to promote CHAdeMO (quick charge)
- Joined Electrike Japan to develop three-wheeled EV

Nissan R32 Skyline

Nissan R33 Skyline

Nissan Altra EV

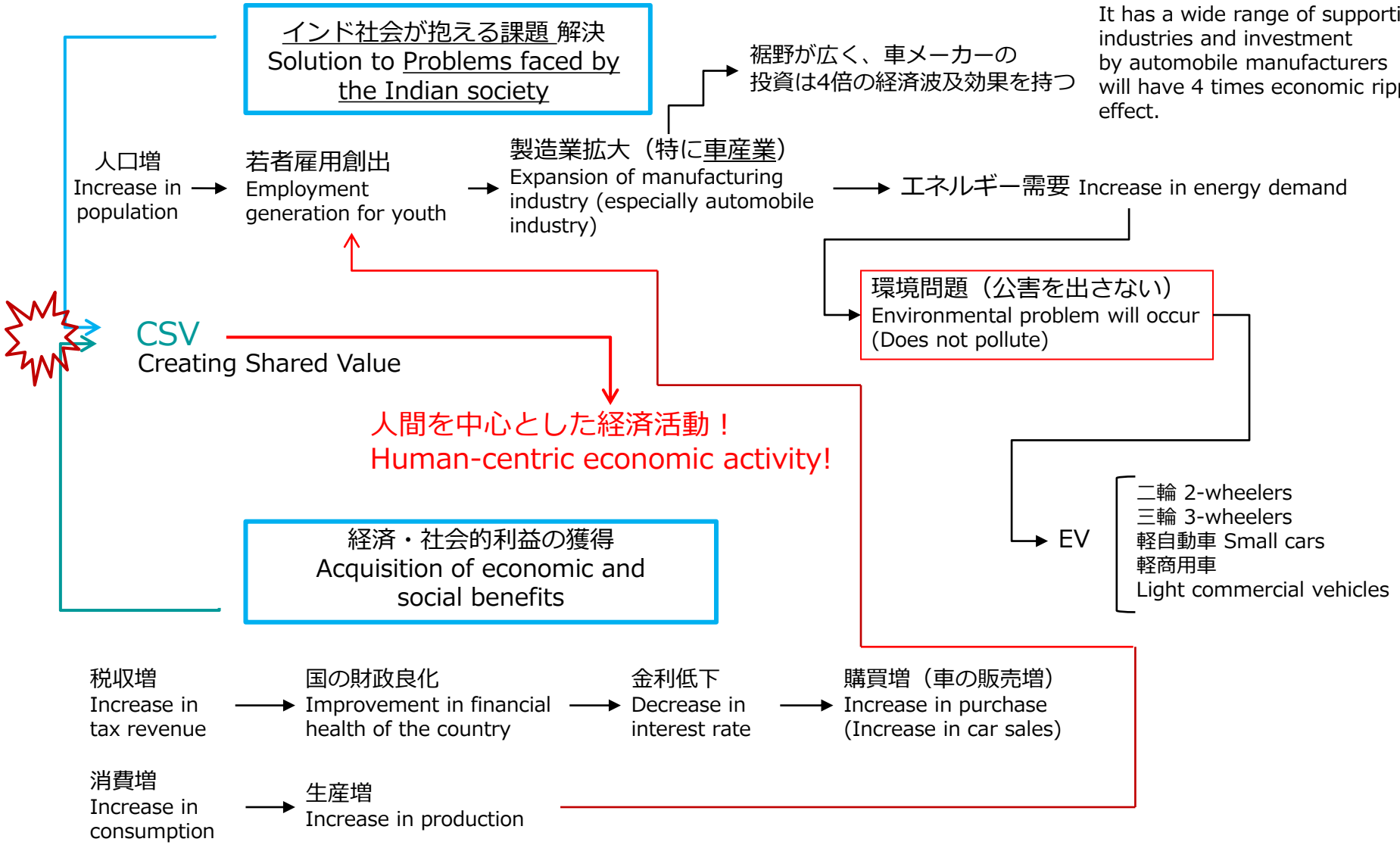
Electrike ZAE-EA

Altra EV


東京電力
TEPCO
START
STOP
Battery Charger

What kind of Lithium-ion Battery for India ?

Basic understanding at the time of inducting lithium ion battery in India



無公害社会の実現 Realization of pollution free society

無電化地域の削減 Decrease in non-electrified areas

Fundamental concept of the proposed technology

Merit of Mn series LiB
- Merit and risk is endless variety even for LiB

Positive-electrode material	Ah/g	V	Wh/g	Thermal runaway	self-discharge	Cycle	Cost
Mn	110	3.8	420	○	△	△	○
Mn(+Ni)1	125	3.8	480	○	○	○	○
Mn(+Ni)2	138	3.8	520	○	○	○	△
MN	135	4.3	580	○	○	△	○
Co	150	3.7	560	×	○	○	×
Ni	180	3.6	650	× ×	○	△	△
NCM	140	3.6	500	×	○	○	△
LFP	140	3.2	450	○	×	○	×

・Mn series seems to have a low Ah/g level, however no thermal runaway and can make a battery that higher level of performance for self-discharge and cycle characteristic. Wh/g level of Mn is equally well to LFP.

・LFP has received attention from China and the West as raw materials (Fe.P) are low price, however cost effectiveness does not meet due to different process on front-end and back-end.

Fundamental concept of the proposed technology

Merit of Mn series LiB
-Dry-room less operation suitable for Mn series LiB and it's merit

Production line for the lithium-ion battery should be inside the dry-room as it is very weak in water

Require not only an amortization of equipment but also running cost of the dry-room facility

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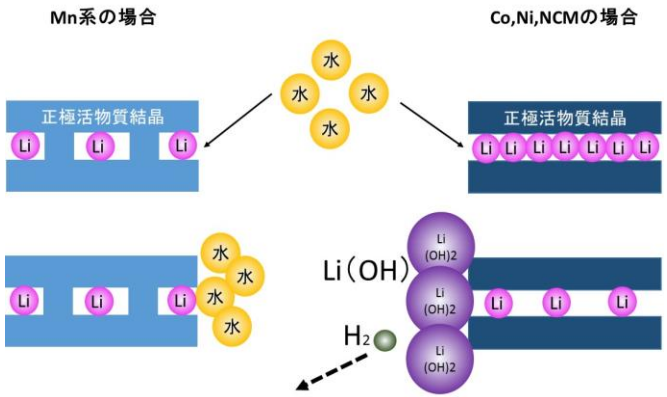
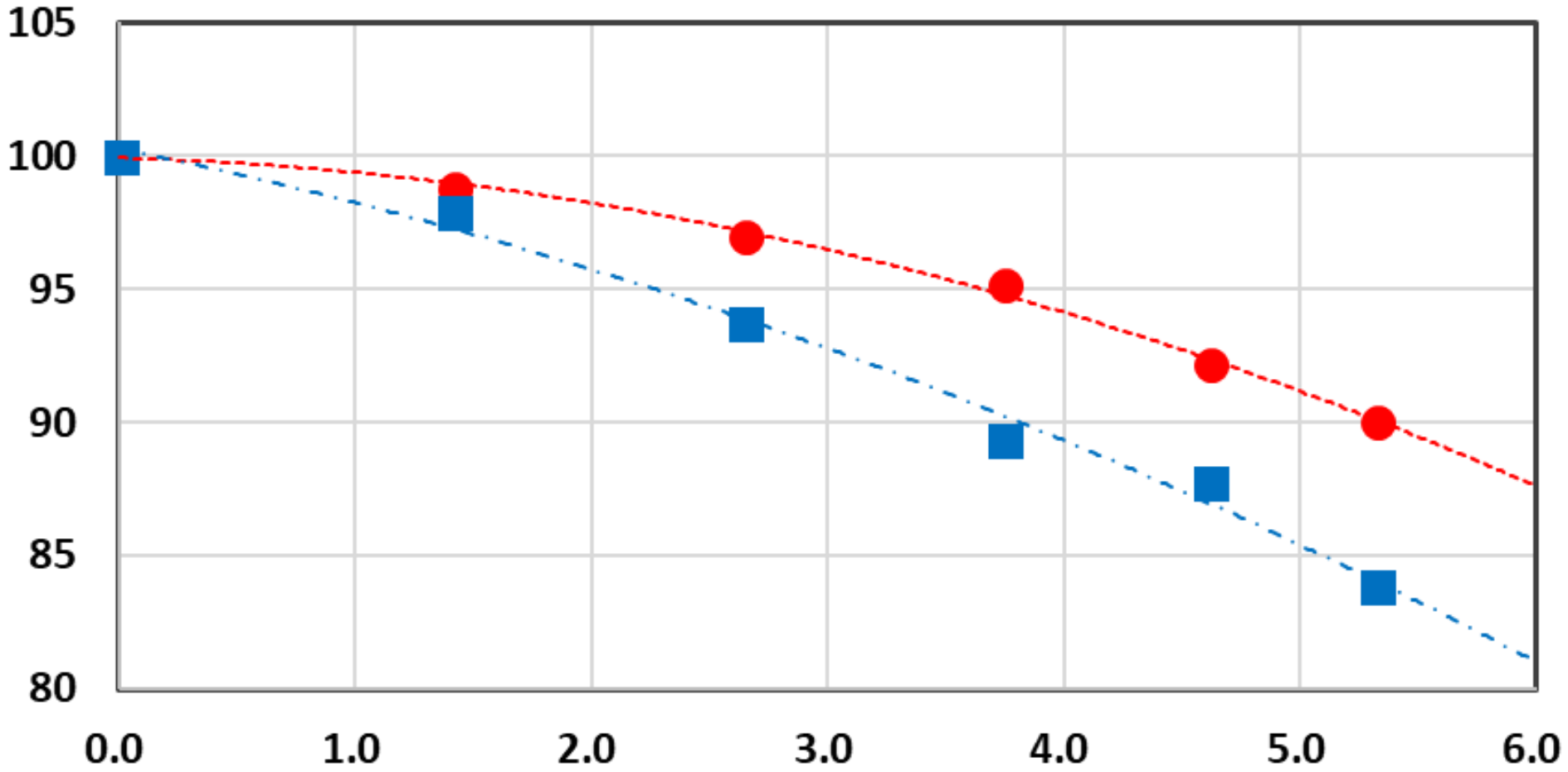


Mn system active material can be dehydrated by drying as Li in the crystal is stable even it gets wet

On the other hand, Co, Ni, and NCM impossible to recover if they get wet as their active material react with water

Mn system
Unnecessary dry-room

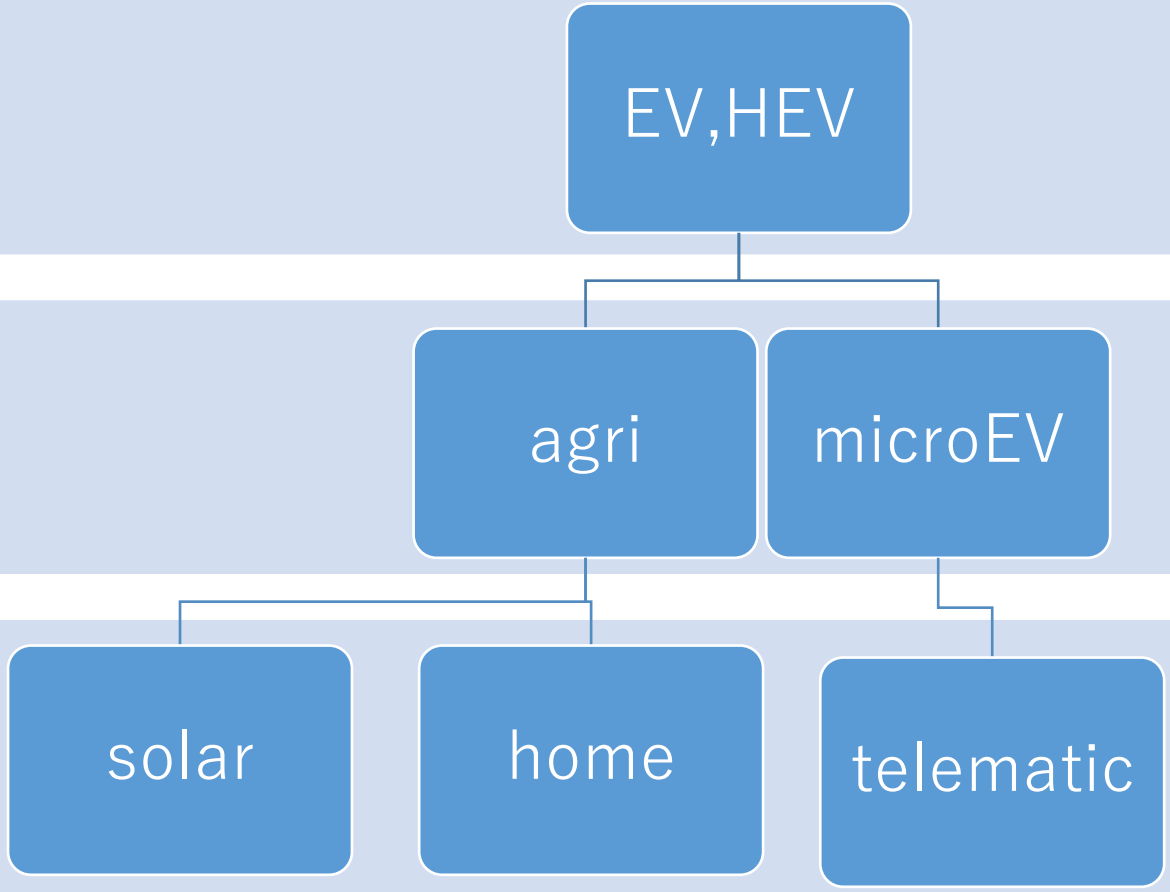

105
100
95
90
85
80
0.0
1.0
2.0
3.0
4.0
5.0
6.0
Days square root

Battery cascade use

Automobile

Low speed

Stationary



!! Main units of the EV related business

- **Battery** for EV -high energy Li-ion battery

  Battery should be **made in India**,

  durable in **high temperature**

  supported by raw material viability
- **EV system integration** for battery use
- **Charging point** –useful location and operation

  Number of charging station should be **twice of the number of EV**

  at the beginning of the market
- Electricity supply – sufficient quantity and just in time and place

  Solar panel seems to be suitable for the small EV charging purpose

Module Type Portable Battery (Prototype)

正面

背面

上面

AC100Vコンセント

AC充電アダプター

表示部

【主要諸元】（目標値）

	2モジュールタイプ	4モジュールタイプ
バッテリー容量	約 600Wh	約1200WH
合計最大出力	Max1500W	Max1500W
パソコン（30W）	約14時間	約28時間
液晶テレビ（60W）	約7時間	約14時間
LED室内灯（10W）	約40時間	約80時間
重量	20Kg	28Kg
大きさ	460L*450H*315W	
入力	AC充電アダプター 100V　50-60Hz 12V　シガライター	
出力	ACコンセント100V　3口	
充電時間	約4時間	約8時間

Scheme of Renting Portable Lithium-ion Battery to the Village

Village Solar Park → Charging Points → EV Business Model

One Solar Panel per villager installed by VARE with the financial support by the Central and the State Government.

Charging

LiB

Design the LiB which can be used for 5 hour a day and cam make it possible to use 2 LED lighting Fixtures, PC,TV and Ceiling Fan.

Stock of Portable Lithium-ion Battery

+ GPSによる位置情報(CDOTと協業)
+ GPS location information with CDOT support

Return
Used One

Rent
Recharged One

Rental fee

Villager

Villager

Villager

Villager

ID Number

12 digit number

・顔面像 Face image
・指紋 Fingerprint
・目の虹彩 Iris of the eye

Public Sector
・Central Government
・State Government

Private Sector
(Ex. Maruti Suzuki India)

Aadhaar Pay

指紋等を使った
自動決済システム

Automatic Payment of the rental fee by Aadhaar Pay System

生体認証システム
Biometric Authentication System

補助金
Subsidy

銀行口座

Banking Account

農村地域住民の
銀行口座開設促進

Increase Banking Account of the Villagers

How to prepare EV charging points in Indian market ?

!! Charging Point(CP) operation for 3-wheeler

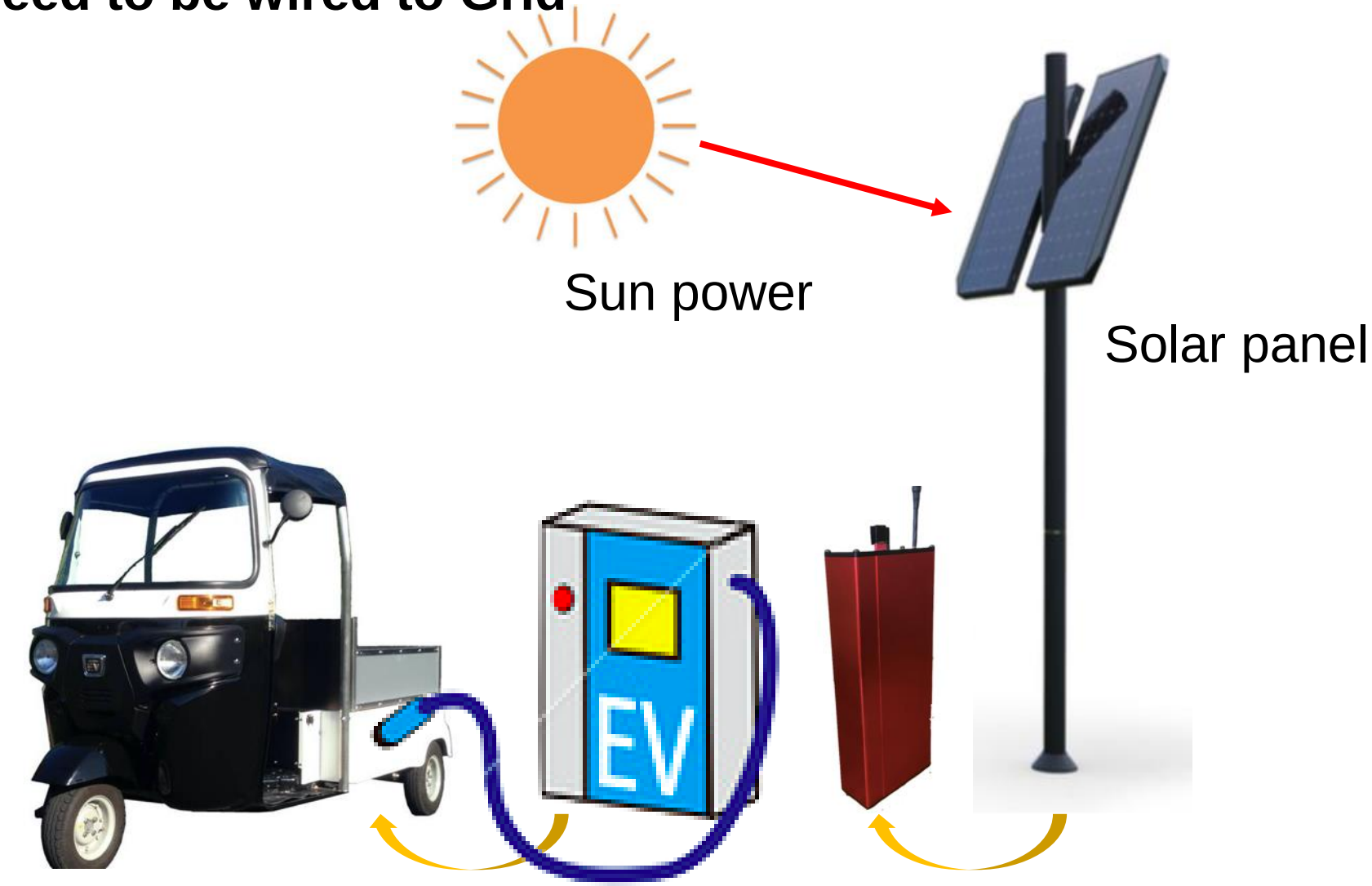
- **Solar charging point** can support the operation that requires no connection to grid and no energy cost for import or transfer.

- Charging point should be operated by **public sector** or to be supported by incentive.(for import fuel reduction and electricity supply grid investment of the public obligation)

- Solar charging point needs **battery storage** for quick charging or night time usage.

- **Public budget** will help the start up demand for our battery industry, to introduce the charging points.

Solar Panel and Battery equipped CP do not need to be wired to Grid



Charging Point in IIT Hyderabad

Main Gate Bus stop

Why Solar ?

!! We will use Renewable Energy for EV

- We need to set up the electricity supply pass to EV
- Renewable energy from the solar panel
- Facility to deliver electricity(infrastructure)
- Storage battery is the key device

Wiring for EV in India

Indian electricity delivery has some problem now.

Why EV 3-wheerer in India ?

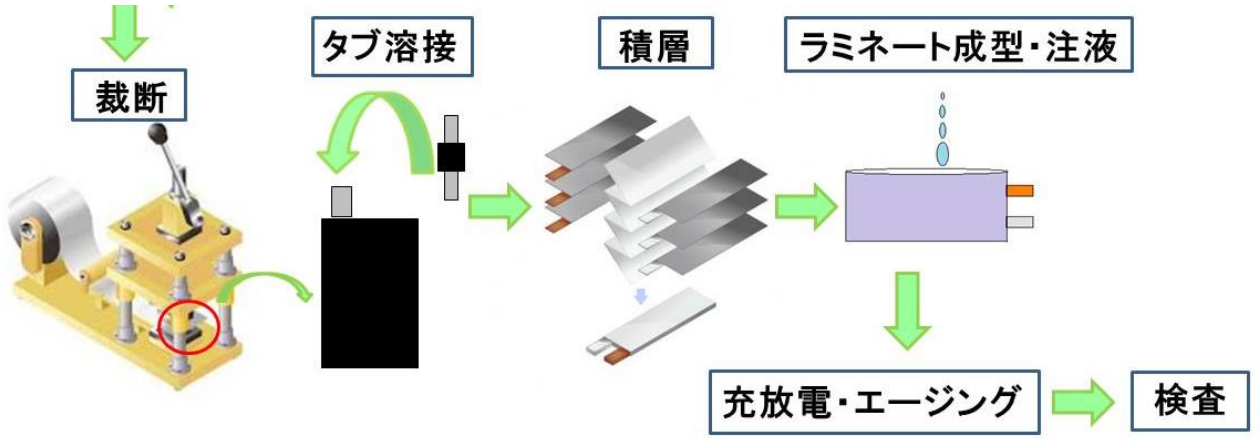
!! Application in the vehicle category 3-wheeler

- As for the Indian transportation market needs, **3-wheeler** is very popular in the society
- Small size in battery pack which could be amortized by gasoline cost in shorter time during the operation business (as SIAM reports)
- We already studied the system integration of EV 3 wheeler in Japan.
- Market size –total production of 3-wheeler **500,000 units /year** now

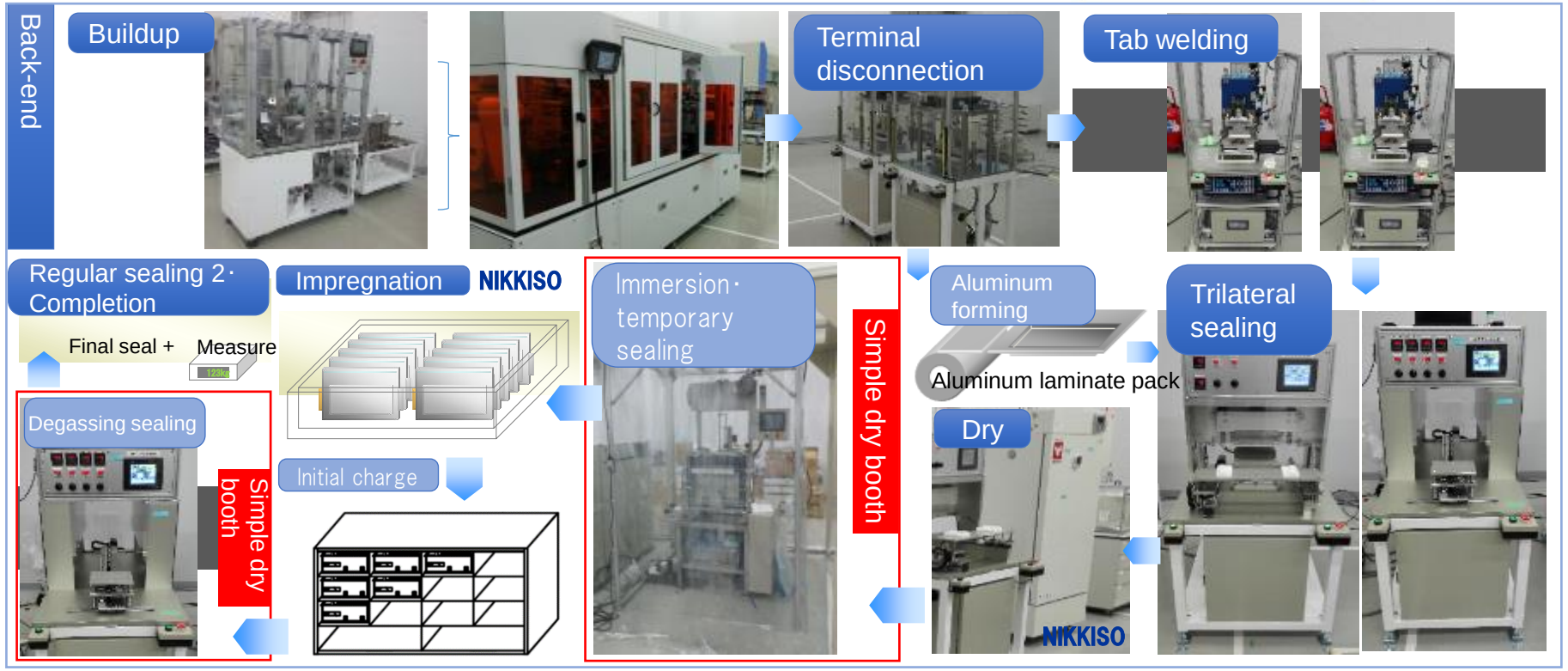
How to start Lithium-ion Battery production for EV 3-wheeler in India ?

Fundamental concept of the proposed technology

Merit of Mn series LiB -Outline of manufacturing equipment



Basic line running at Tohoku University



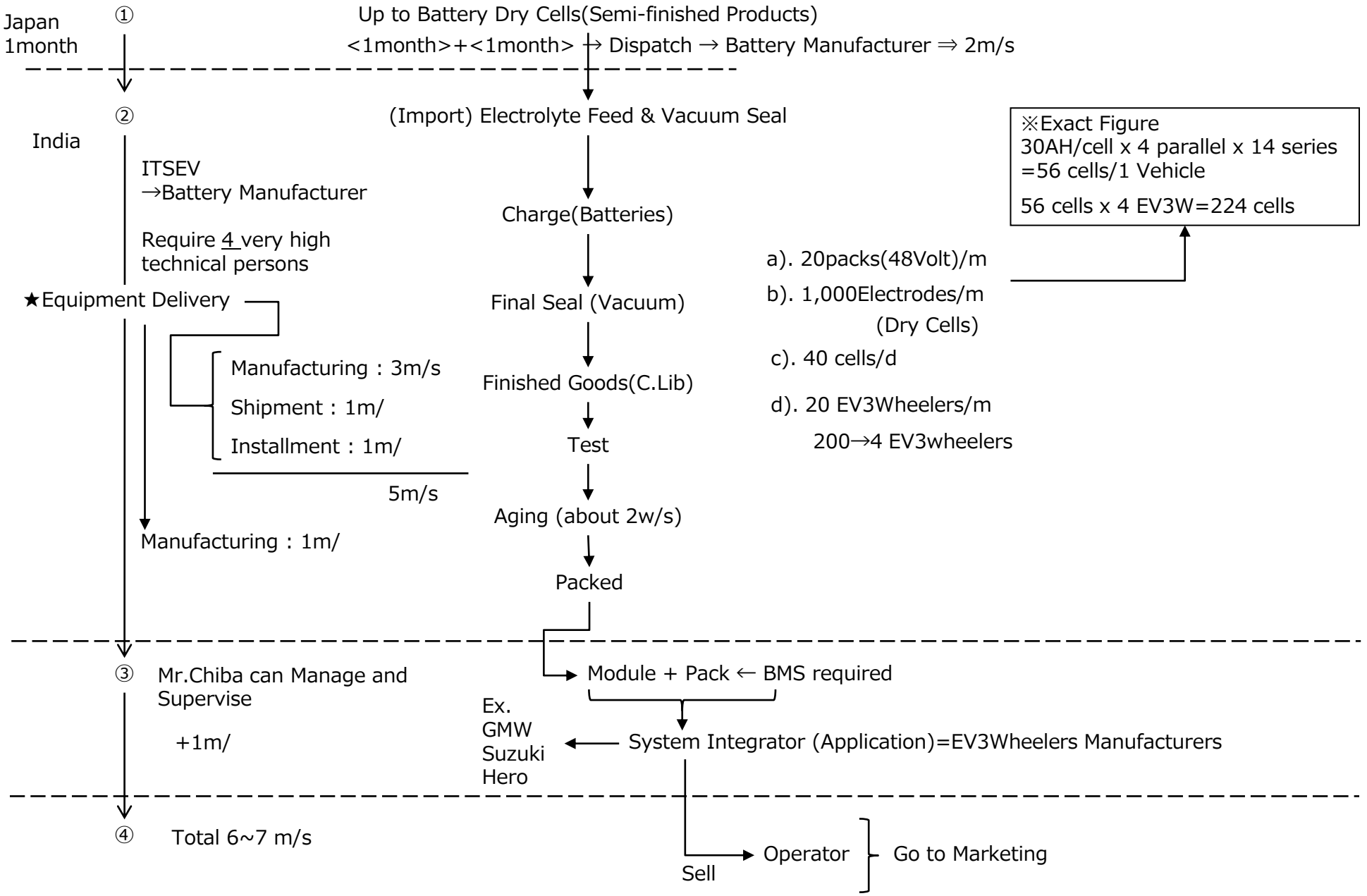
Resources for the 3-wheeler's EV Battery Business Start up - about 10M$

- Investment for tooling: tooling cost in Japan **5M$**

The production volume 200,000 cells /year
(30Ah 3.8V cell,22,800kWh/y at first) may increase volume up to **40,000kWh**, which will cover the 1% EV

- Raw material supply chain
- Sales network at start
- Negotiation power to government for the incentive and the regulation
- Human resource, facility, etc..

Road to the Production of Chiba Lithium Ion Battery: C.Lib



Advantages than existing Japan/Korea/China batteries

Advantages

- Middle class plant (200K cells/year) with less investment (US$5M)
- Only back-end process can be chosen without complicated front-end process
- Last back-end process can only be chosen to start up
- Japan made electrode
- Sellable in low volume market
- Tohoku University provides education
- Doable cost

Patent granted battery assembly line is developed

Business plan

- Hi investment (US$50M) for large production line (1M cells/year)
- Full process = long time with hi risk
- Lowest cost is possible in case high volume production

Battery Price Trend
($/kWh)

	New Production	Reuse
Mass Volume Trade	**350**~200	175~100
Small Volume Trade	700~400	350~200

Battery Production Cost Trend ($/kWh)

	Material Cost	Direct Labor Cost
Mass Volume Production	**150**~100	50~**25**
Small Volume Production	300~200	100~50

Who will drive this Project ?

Thank you!