



# Intelligent Cold Chain Transportation Project

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- Main target customers
- Hospital scenario
- Pharmacy distribution scenario



**PART 01**

# Cold Chain Market

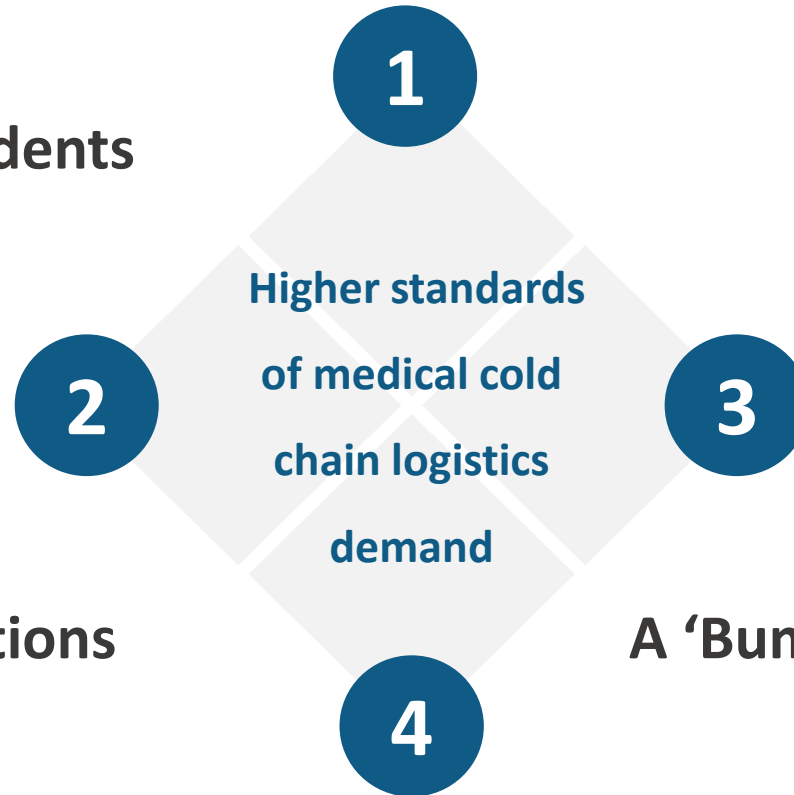


## Alerts: Drug Safety Accidents

The problem of broken cold chain can not be effectively eliminated.

## Stricter Laws and regulations

Laws and regulations in the field of medical and pharmaceutical cold chain logistics are constantly revised and improved.



## Increased Demand

Improvement of health care level

## A 'Bumper Harvest' of Vaccines

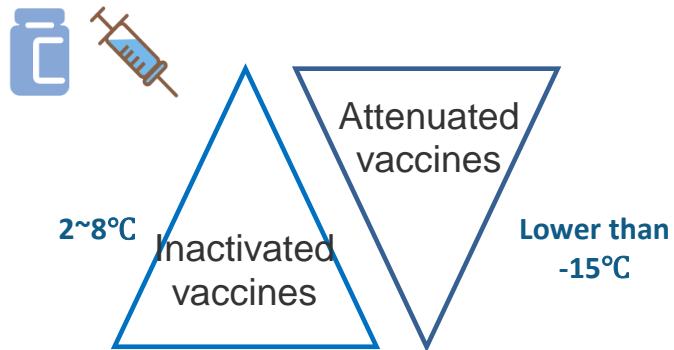
The transportation demand of vaccines will rapidly increase in the next few months, especially for the COVID-19 vaccines.



# The transportation demand of vaccines will rapidly increase

**The global demand for new crown vaccines will exceed 1.5 billion doses. In 2021, the vaccine transportation peak for COVID-19 will happen all over the world.**

Many countries' COVID-19 vaccines have entered the Phase III clinical trial. If it goes well, the vaccines of COVID-19 could be available as soon as the end of 2020.



Current R&D progress of COVID-19 vaccines:

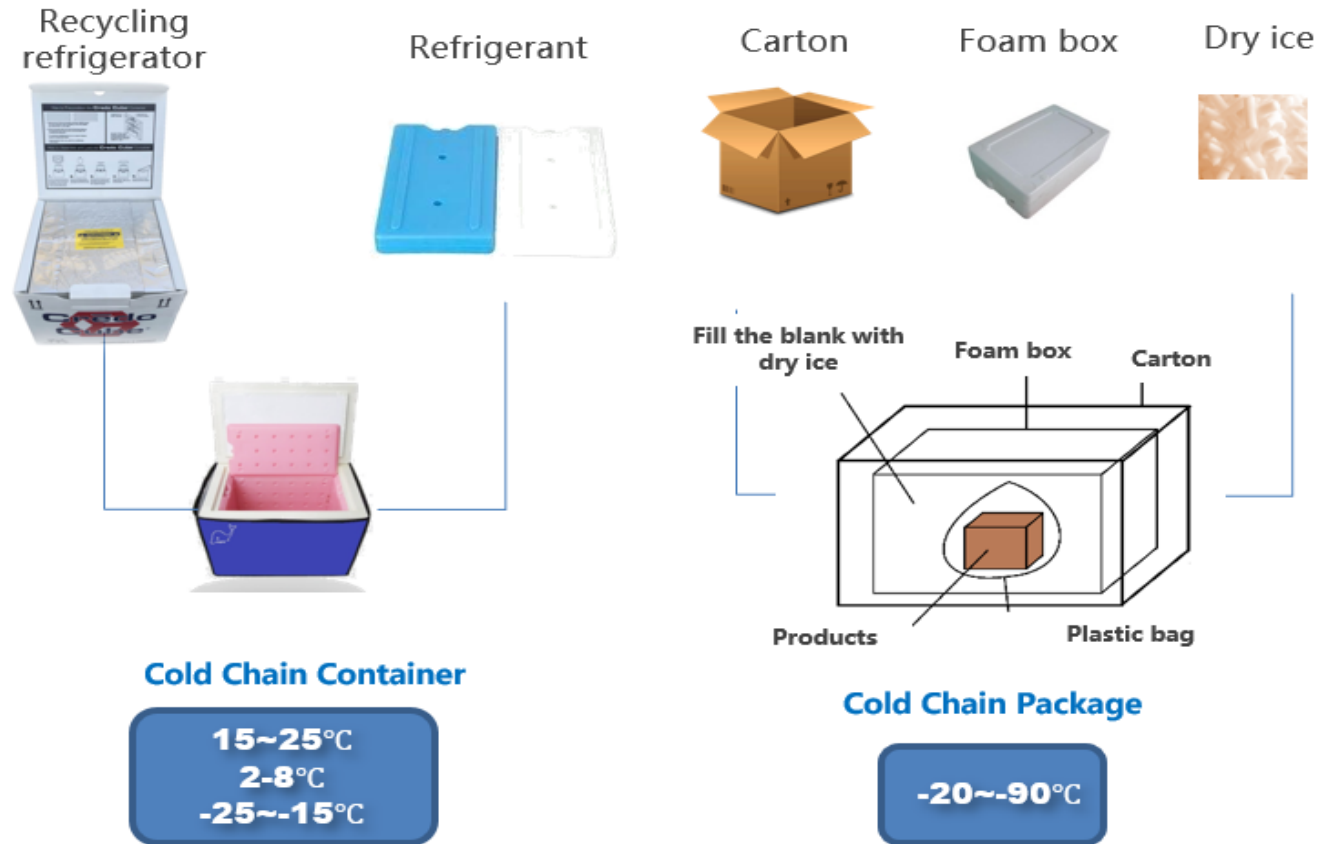
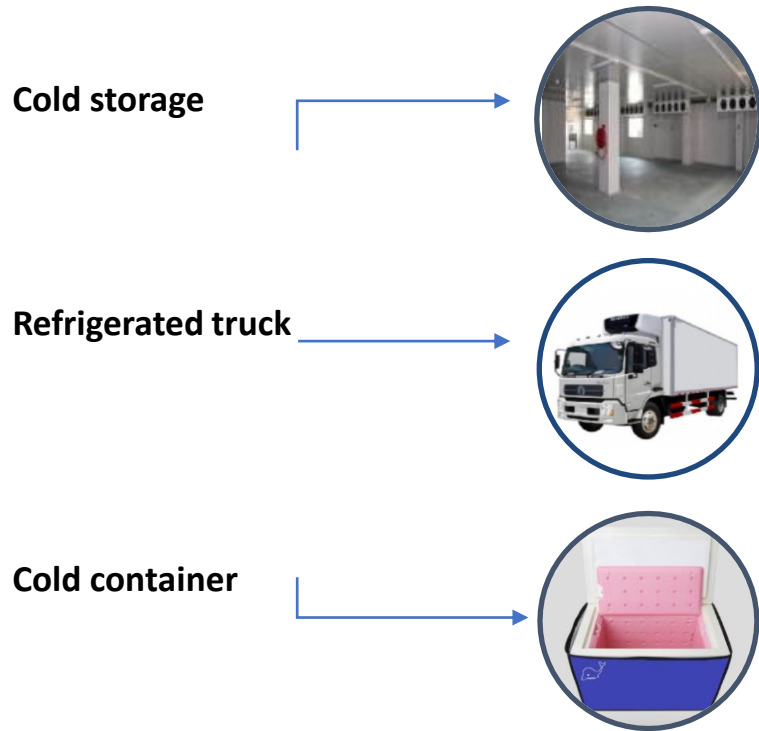
| Category                    | Advantages   | Enterprises        | R&D progress             |
|-----------------------------|--|--------------------|--------------------------|
| Inactivated vaccines        | Lower cost<br>Rapid clinical trial progress                        | Sinopharm          | Phase III clinical trial |
|                             |  | Sinovac Biotech    | Phase III clinical trial |
| Adenovirus vector vaccine   | Can present a variety of antigens                                  | CanSino            | Phase III clinical trial |
|                             |  | AstraZeneca        | Phase III clinical trial |
| Recombinant protein vaccine | Security<br>Effectiveness<br>Cost advantage                        | Clover             | Phase I clinical trial   |
|                             |  | Zhifei             | Phase II clinical trial  |
|                             |  | Novavax            | Phase II clinical trial  |
| mRNA vaccine                | Strong ability to cope with mutation of COVID-19                   | BioNTech           | Phase II clinical trial  |
|                             |  | CureVac            | Phase I clinical trial   |
|                             |  | Translate Bio      | Preclinical              |
|                             |  | Sanofi             | Preclinical              |
|                             |  | Moderna            | Phase III clinical trial |
| DNA vaccine                 | Reduce time for formulation development<br>The immune time is long | Inovio & Adivishin | Phase I clinical trial   |



# Current situation of cold chain logistics

Basic requirements of traditional cold chain logistics:

Traditional cold chain packaging:





## Current situation of cold chain logistics

### Common problems:

- ❑ The temperature might out of control and the cold chain might been broken
- ❑ Temperature control is not accurate enough
- ❑ Falsification of temperature data
- ❑ The resources of cold storage and vehicles are insufficient, and the operation cost is high
- ❑ It is difficult to keep the long-term high efficiency in remote areas

### Services

- National cold chain network is expanding
- The market competition is intensifying, and the service system is improving day by day

### Costs

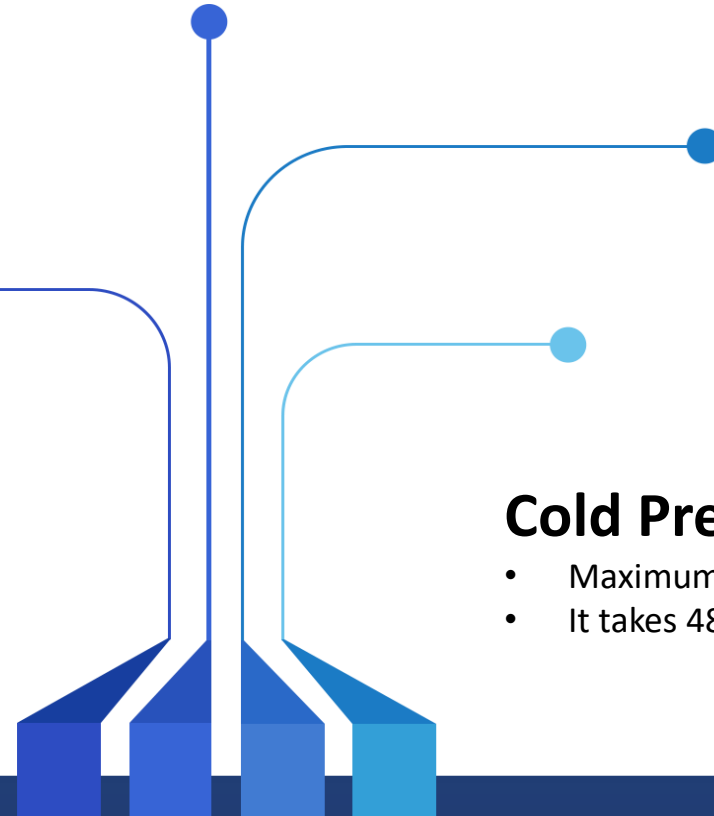
- Investment in cold storage (manpower, site, time)
- Investment in refrigerated truck
- Investment in cold container
- Validation costs

### Quality

- Manual test verification (cold storage, refrigerated truck, and cold container generally twice a year, thermometer calibration once a year)
- Regular companies monitor temperature through the IOT and hand over data to customers
- Unable to achieve accurate temperature control

### Cold Preservation Duration

- Maximum cold preservation duration: 72 hours
- It takes 48 hours to pre-cool the ice.





## **PART 02**

# Introduction of Cold Chain Container





# Portable Stirling Cryocooler Medical Container (PSCMC)



Emergency Alarm



Web Terminal



APP Terminal



Date Collection



Date Output



Date Statistics



24hrs Service



## The differences between PSCMC and other coolers

| Num | Comparison categories           | Traditional Ice Cooler   | Semiconductor Cooler                                | PSCMC  |
|-----|---------------------------------|--|---|--|
| 1   | Cold Preservation Duration      | 72 hours   | No limitation with electricity                      | No limitation with electricity   |
| 2   | Temperature Control Performance | Only can preserve temperature, cannot control temperature        | Control temperature between $\pm 4^{\circ}\text{C}$ | Control temperature between $\pm 0.1^{\circ}\text{C}$                          |
| 3   | Delivery Influence              | Affected by traffic and weather and it is easy to be overheated. | Cannot bear a big bump                              | No influence   |
| 4   | Packing Operation               | Complicated packing and need precooling for about 45 minutes     | Easy packing and do not need precooling             | Easy packing and do not need precooling  |
| 5   | Environment Protection          | Special recycling is required for the ice material               | Containing Freon or similar refrigerants            | It is filled with helium and carbon dioxide which is environmentally friendly. |
| 6   | Cost                            | High rental and labor cost                                       | High maintenance cost                               | One-time investment, low maintenance cost                                      |
| 7   | Service Life                    | 2 years  | 2 to 3 years  | 5 to 6 years   |
| 8   | Battery Duration                | Without lithium battery  | Without lithium battery                             | With lithium battery, the duration is up to 96 hours                           |



## The Advantages of PSCMC

### **Saving costs of cold storage:**

- The construction and management cost of cold storage is high. The usage of active refrigeration systems can reduce the space cost and labor management cost of cold storage.
- PSCMC can reduce time cost. The traditional ice needs 48 hours of precooling, while PSCMC only needs less than 1 hour of precooling.
- PSCMC can reduce venue cost. It can reduce the storage of freezers and multiple sets of ice. Active refrigeration systems only need the space for stacking cold chain containers and charging cabinets
- PSCMC can reduce labor cost. It can reduce the laborcost of ice management, and only need to charge and maintain the equipment.



## The Advantages of PSCMC



### **Precise temperature control and no limitation of cold preservation duration:**

- The temperature range of PSCMC is from - 160 °C to 25 °C, which is under stable temperature control;
- PSCMC can solve the problem that traditional cold chain boxes cannot be supplied in remote areas with the replacement of battery.

### **Transportation cost reduction:**

- PSCMC can be applied in small trucks, vans, SUVs and cars, which can improve the utilization rate of vehicles and save the distribution cost of decentralized delivery in remote areas;
- PSCMC can reduce logistics cost for high value-added and small volume drug distribution, which can increase profits;
- The power supplies of PSCMC are 12 VDC, 24 VDC and 100-220 VAC.



## Core technology of PSCMC

Stirling cryocooler compressor adopts the reverse principle of Stirling engine, and the electric energy is transformed into heat energy through the operation of internal compressor. It is an efficient linear motor.

**Compared with other compressors used in refrigerators, Stirling cryocooler's features are as follows:**

1. Precise temperature control (strong instantaneous freezing capacity; sustainable refrigeration; controllable cooling capacity)
2. Strong anti-knock property (Can be turned at any degrees)
3. Long service life (operating in vacuum, oil-free, friction free environment)
4. Low noise and vibration
5. Environmental protection and energy saving
6. The engine is small in size and simple in structure





## PSCMC Product Series

Temperature control range:

-160°C~25°C

Internal volume (under 43°C ambient temperature):

2~8°C: Maximum internal volume is 160L

-20°C: Maximum internal volume is 80L

-40°C: Maximum internal volume is 35L


-80°C: Maximum internal volume is 5L

-160°C: Maximum internal volume is 1L

Battery Duration:

12~96 hours, increasing cold preservation duration by replacing batteries



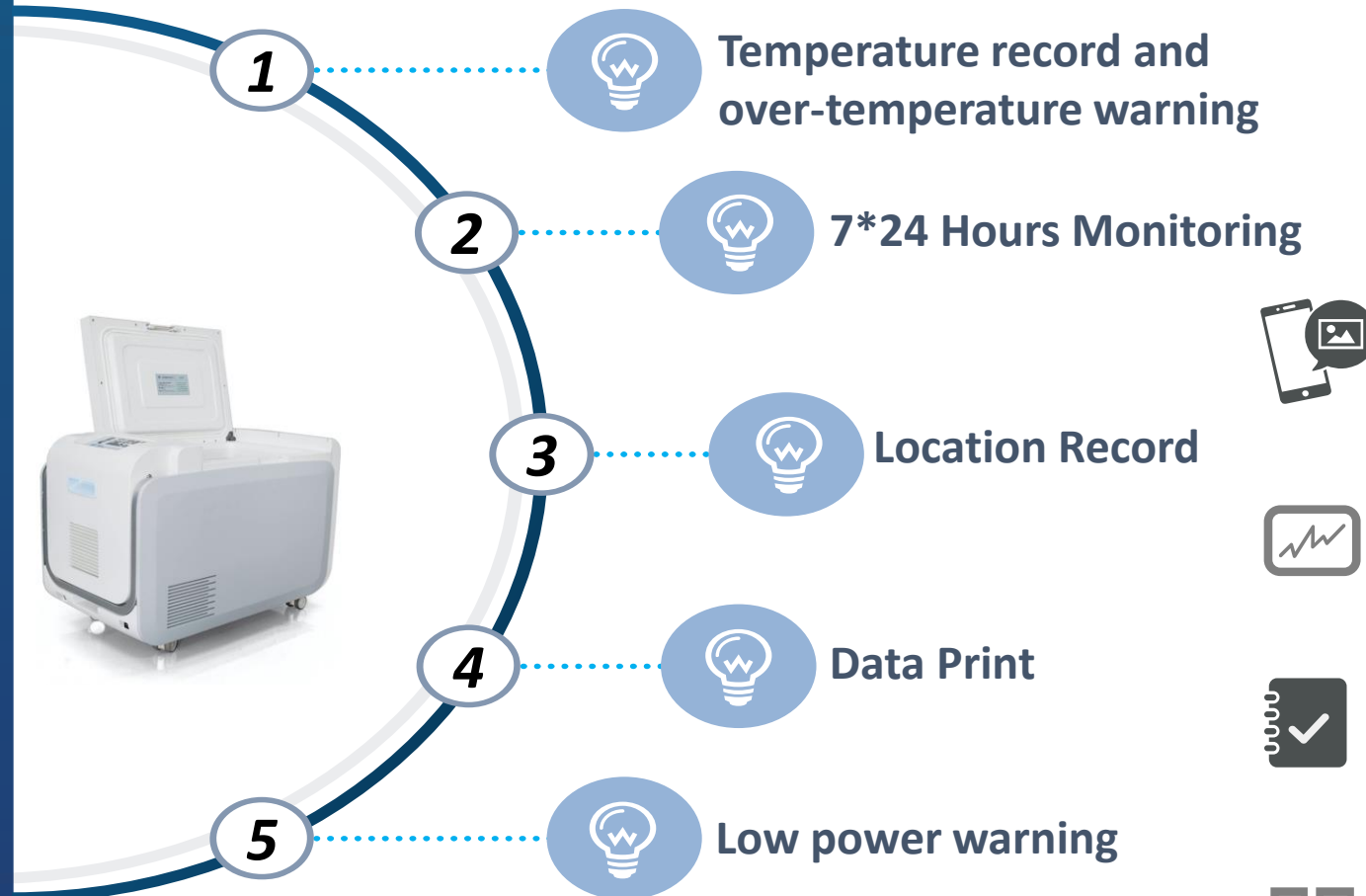
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- 12~96 hours battery duration
  - Full charged in 6 - 11 hours
  - Convenient to replace the battery





# Information System

## Real-time monitoring with data visualization in whole process



### Real-time monitoring

The temperature, location, battery capacity and unpacking times of PSCMC can be checked in real time from the mobile phone and computer.



### Historical data query

The historical data of PSCMC can be stored on private cloud for 10 years



### Save data in local and upload data in real time

When the network transmission of PSCMC is blocked, the data will be temporarily stored in the IOT module, which can support the storage of 60000 messages within 200 days. There is no need to worry about the "broken chain" caused by network problems.



### More functionality will be developed...



Market Background

Product Introduction

Business Model

Application Scenarios

# Information System



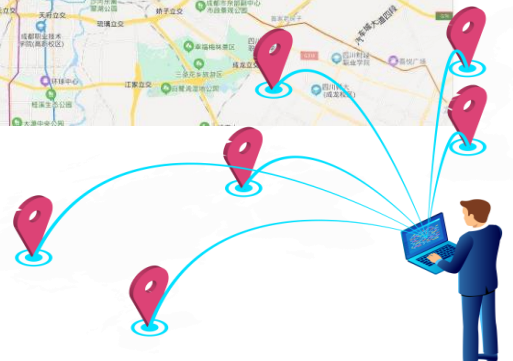
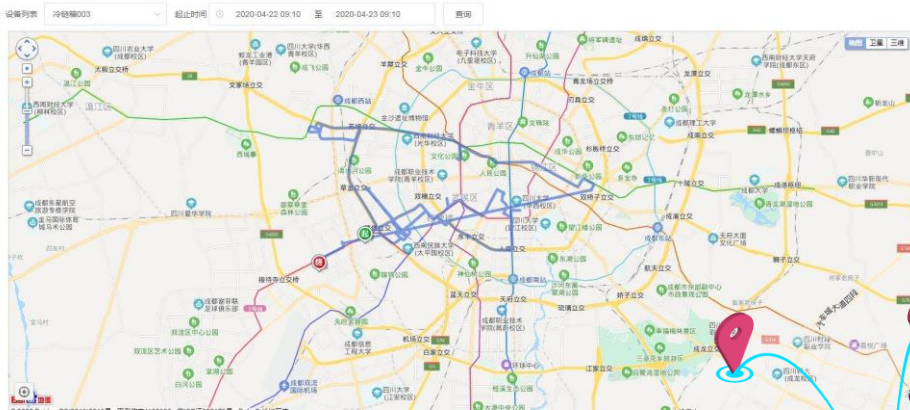
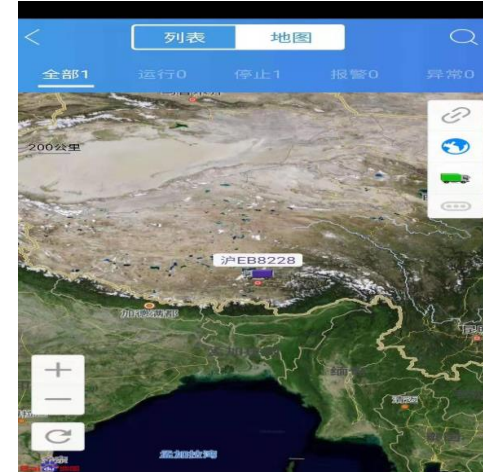
## Battery Information

- Battery Capacity
- Warning Message



## Driver & Vehicle Information

- Driver Name
- Contact Information
- Plate Number
- Truck Number



## Temperature Information

- Temp. Information
- Doors Open/Shut Status
- Warning Message



## Location Information

- GPS
- Route Information
- Vehicle Trajectory Information





## PART 03

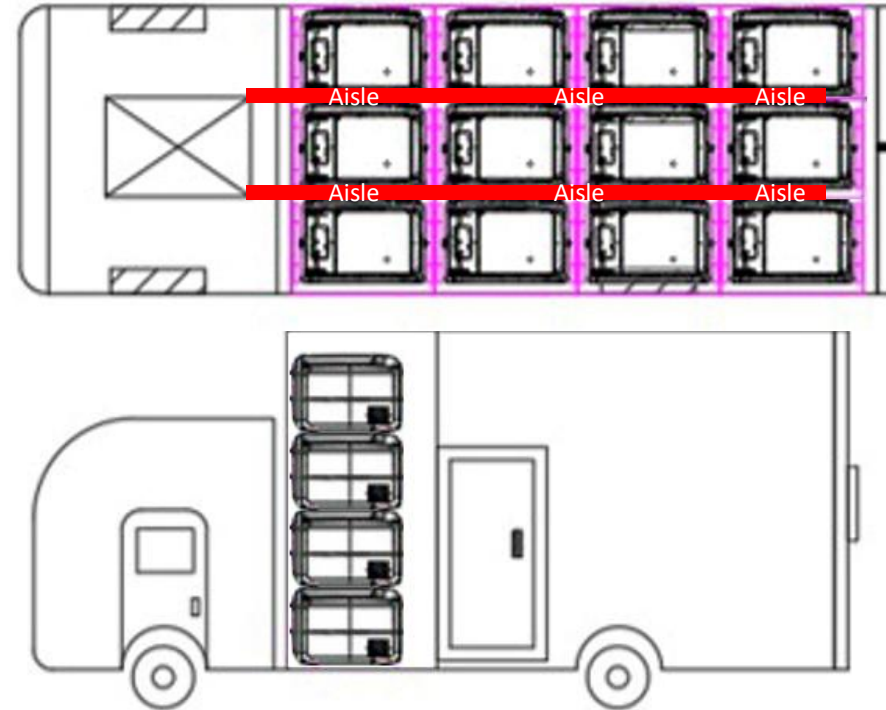
# Business Model



## Land Transportation Mode



Stackable PSCMC

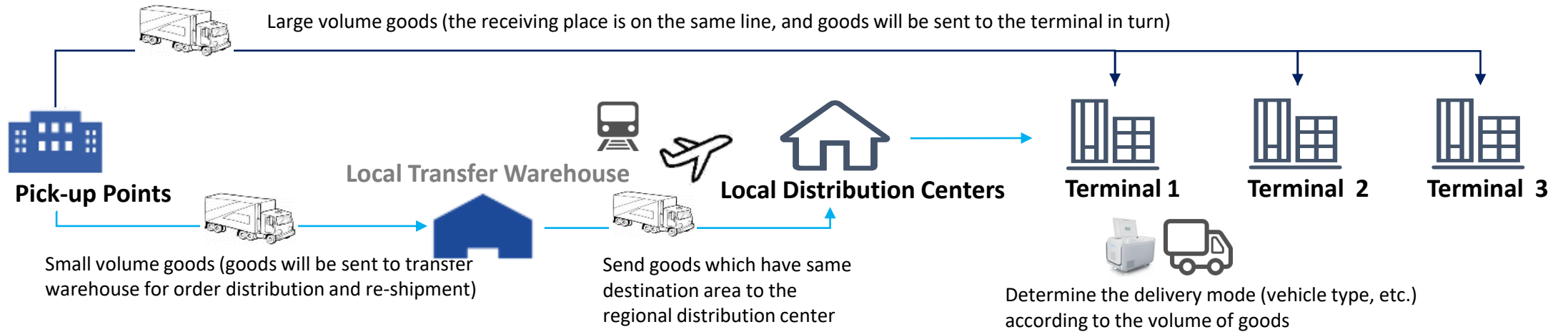


- ★ The working efficiency of cold chain logistics are increased by no longer being subject to the restriction of ice;
- ★ Different temperature control range in one vehicle;
- ★ With the lithium battery, the cold preservation duration can reach 96 hours or even longer;
- ★ Saving costs of cold storage and labor.



# Business Scenario (Long Distance Distribution)

24-96Hrs



- Power on and pre-cool PSCMC40 minutes in advance;
- Handover goods on site according to the SOP;
- Inspect goods in cold storage at the pick-up point, then pack goods and turn on temperature tracking;
- According to the volume of goods, distribute goods to the distribution centers or directly to the terminals;
- Remote monitoring PSCMC's situation (battery duration, etc.);
- Professional maintenance.



- Contact consignees in advance to communicate the receiving matters;
- If consignees have no abnormality, direct delivery will be arranged;
- If consignees have any abnormality, goods will be sent to the nearest distribution center (including cold storage) waiting for further instructions;
- According to the destination and cold preservation duration, battery charging can be arranged at the distribution center;
- Refitting some trucks with customized accumulator and cigarette lighter wires.

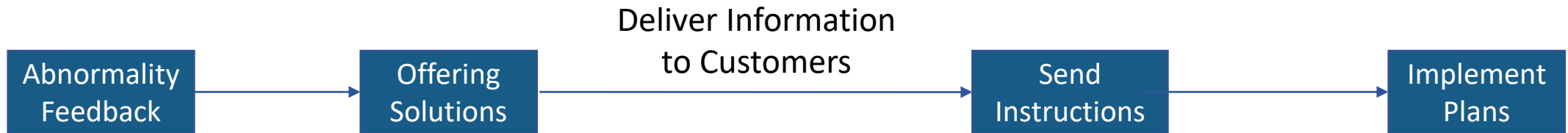
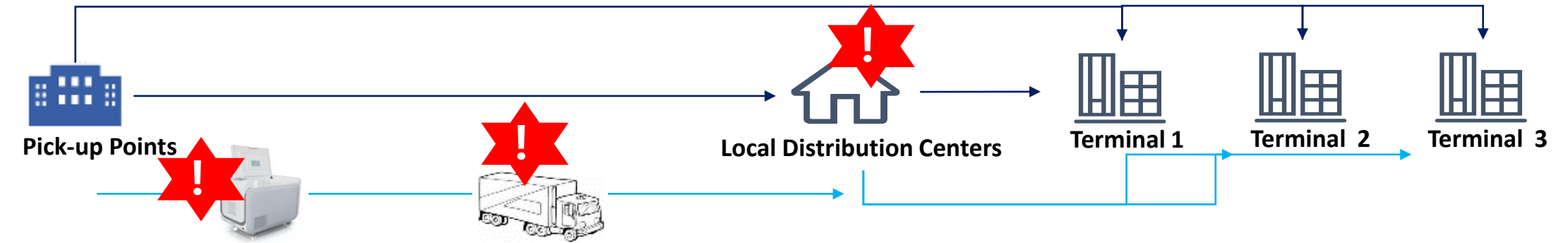


- Monitoring of temperature and battery duration in the whole process;
- Customers can print temperature record reports by portable Bluetooth printer when they inspect goods;
- Querying PSCMC's temperature in transportation can be supported on mobile phone and computer;
- Acceptance and handover of goods;
- Receipt management (e-receipts).





## Emergency plan



**Abnormality Feedback**

- Abnormal temperature
- Abnormal electric power

**Offering Solutions**

- The vehicle broke down
- Traffic accident
- Abnormal monitoring

**National cold chain information integration system and resource scheduling platform**

- Nearby self owned or contracted refrigerated trucks or cold storages
- National network resource sharing platform
- 7\*24hrs emergency response team

**Emergency solutions in warehouse**

- Emergency charging pile
- Spare PSCMC
- Rapid repair response

**Insurance plan**

- Road transportation insurance
- Product liability insurance
- Battery insurance

**Equipment maintenance**

- Remote monitoring
- Regular maintenance
- On site maintenance
- Battery replacement



## Service System -- Quality Management System



### Personnel Management

- ◆ Personnel Files Management
  - ✓ Personnel files
  - ✓ Healthcare files
  - ✓ Training files
- ◆ Staff Training Management
  - ✓ Professional knowledge and skills
  - ✓ Laws and regulations
  - ✓ Emergency handling



### Equipment Management

- ◆ Equipment Classification Management
  - ✓ Cold chain transportation equipment management
  - ✓ General transport equipment management
- ◆ Establish equipment supplier lists
- ◆ Define the maintenance cycle of different equipment
- ◆ Regular maintenance of equipment
- ◆ Establish emergency treatment plan for main equipment damage
- ◆ Annual review of suppliers



### Vendor Management

- ◆ Supplier Capability Assessment
- ◆ Supplier Screening
  - ✓ Supplier capability screening
  - ✓ Quality assurance agreements
- ◆ Supplier Training
- ◆ Supplier Management
  - ✓ Risk Management
  - ✓ Emergency plan
  - ✓ Process monitoring and periodic reviews
  - ✓ Analysis of daily operation problems
  - ✓ Customer satisfaction survey



## Service Advantages

### Safety

- Meeting the precise temperature control range without any broken cold chain
- Real time monitoring and printing
- Anti-impact property of PSCMC
- Various professional people and vehicles can be arranged for transportation according to the situation

### Cold Preservation Duration

- Meets the medical cold chain logistics needs of most customers;
- Emergency orders can be arranged in 0.5-1 days in advance.



### Services

- Customized products
- Information monitoring
- Dense transportation networks
- Perfect service system (including emergency plan)

### Costs

- The operation costs of PSCMC is lower than traditional cold containers

**Precise temperature control, strong timeliness, transportation safety, whole process traceability and perfect service system can be achieved in vaccine transportation scenario.**



**PART 04**

# Application Scenarios

# THANKS

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