

LiB Recycle Solution Proposal

2023. 9.

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1 | COMPANY INFO

SOLARLIGHTKOREA

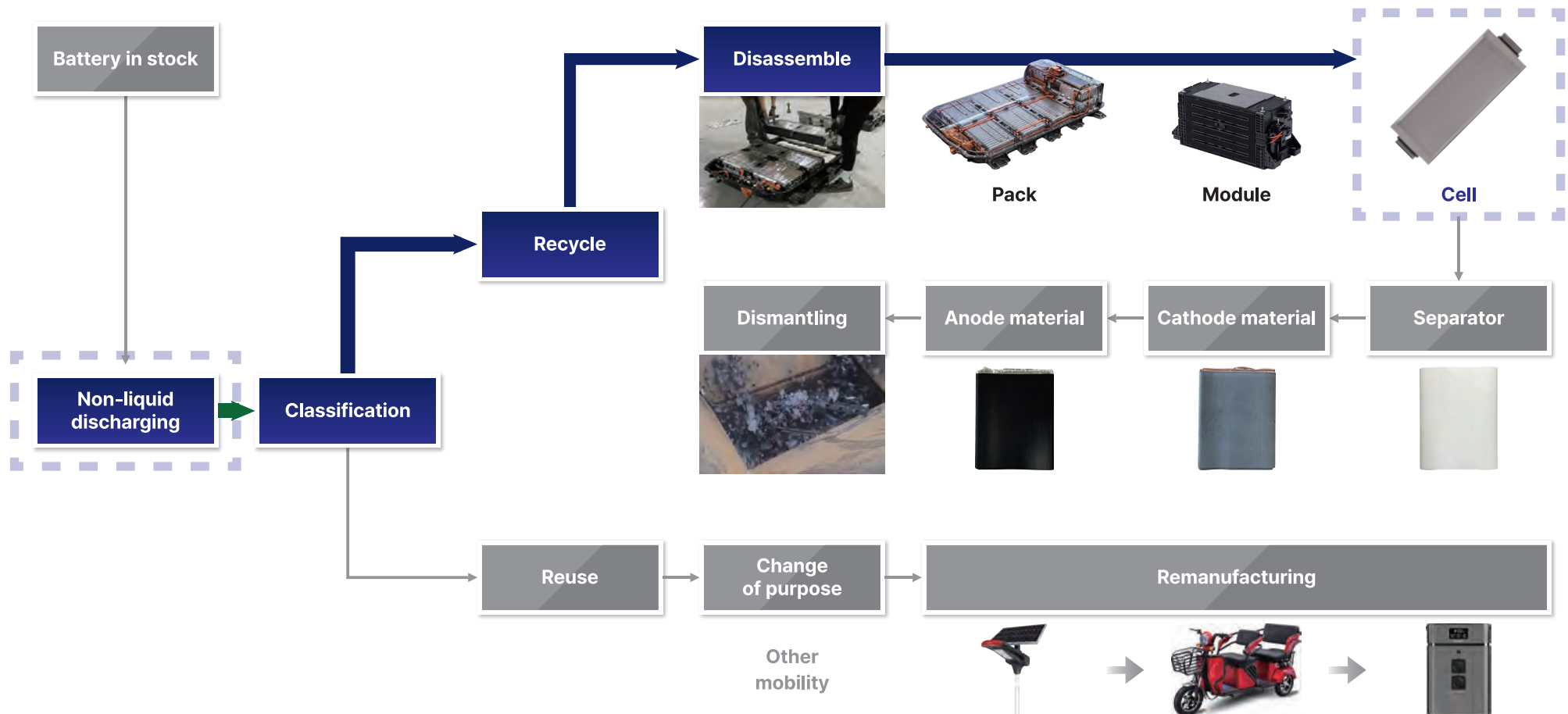


SOLARLIHGTKOREA Co., Ltd. is an energy solution company that strives to provide reliable electrical energy wherever and whenever its customers are.

COMPANY	SOLARLIGHTKOREA
CEO	Kim Wolyeong
FOUNDING YEAR	2011. 8.
HEAD OFFICE	Dongnaero 76, Dong-gu, Daegu Metropolitan City, Korea

2-1 BUSINESS AREA

SOLARLIGHTKOREA LIB Solution structure chart



2-2 | BUSINESS AREA

LiB Recycle/Reuse Solution

Remove residual energy from the battery after use is prerequisite steps for safe re using and recycling.

LiB Recycle

Crushing non-reusable batteries to black powder and extract resources.



LiB Reuse

Categorize and select batteries that energy remained and reuse them for other mobility services.

2-3 | BUSINESS AREA

Pre-treatment of Recycling

It is a pretreatment stage for recycling and reuse of used batteries. Energy is stabilized by non-liquid discharge. It is an efficient eco-friendly solution that can not only transport or store but also crush.

Non-liquid discharge facilities that overcome the limitations of wet discharge to enable safe and economical high-capacity discharge.

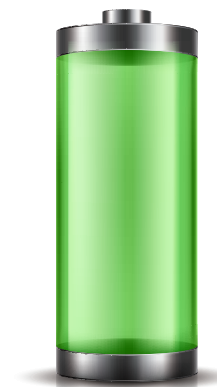
Problem and Necessity in Recycling



Battery
after use



Battery
for recycle



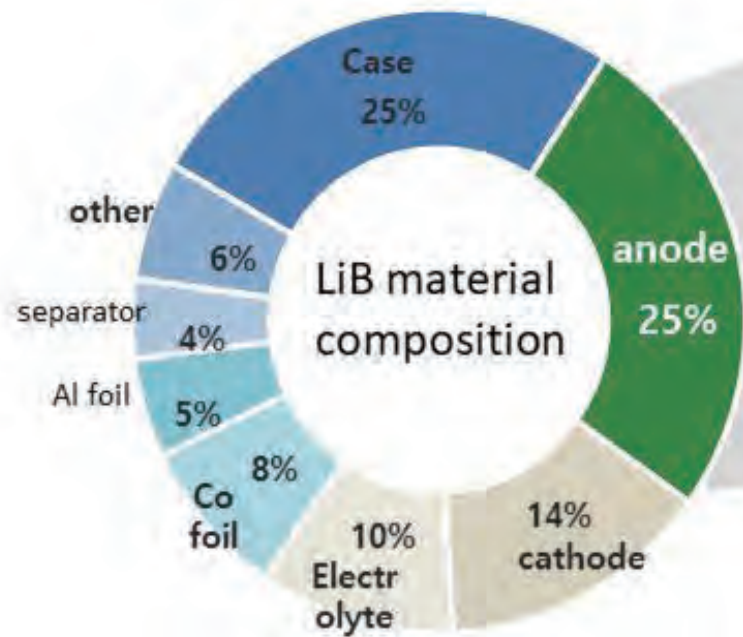
Battery
for reuse

Problem	Necessity
✓ Expanding the used battery industry due to increased demand for EV and the amount of waste batteries generated.	✓ Needs of efficient pre-treatment for reuse and recycling of used batteries.
✓ Problems of Wet discharge system such as unsafety, uneconomical, and non-eco-friendly.	✓ Needs of efficient follow-up to prevent accident caused used battery.

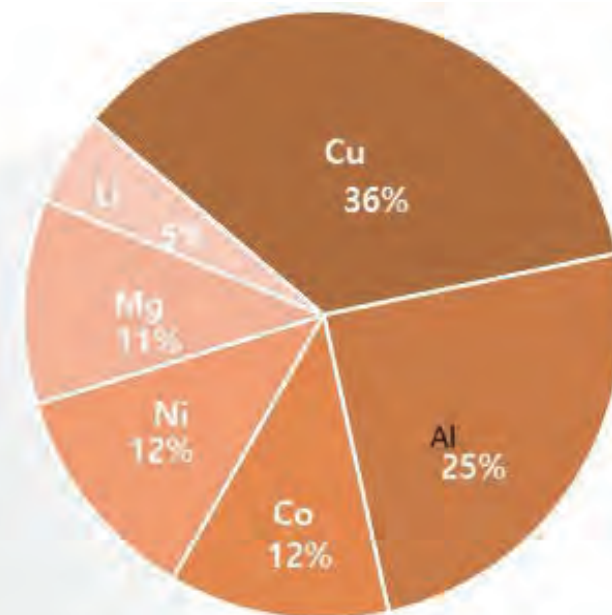
2-4 | BUSINESS AREA

LiB Recycle | overview

Anode materials are the main of the LiB industry



Anode material



Realize a circular economy by extracting and recycling high-purity resources

2-5 | BUSINESS AREA

Factory Hyeonpung

Facility size 3,306m²

Facility location

40, Gukgasandan-daero 33-gil,
Guji-myeon, Dalseong-gun, Daegu



Factory Gyeongju

Facility size 4,385m²

Facility location

279-92 Naeseo-ro Seo-myeon, Gyeongju-si,
Gyeongsangbuk-do(Ahwa-ri 734-1)

Processing field

Intermediate waste recycling business

Storage facility

Discharge facility

Disassemble facility

Collection · transport vehicle



2-6 | BUSINESS AREA

Facility | LiB Recycle/Reuse

Establish a pre-processing roadmap without environmental constraints with our licenses

Capacity-limited discharge and deassemble facilities

Size 4,385 m²

Location 279-92, Naeseo-ro, Seo-myeon, Gyeongju-si,
Gyeongsangbuk-do

Filed Intermediate waste recycling business

License | Intermediate waste recycling business

허가번호 제 2022-6 호

■ 중 간 재 활용 업
폐 기 물 ☐ 최 종 재 활용 업 허 가 중
☐ 종 합 재 활용 업

① 상호(명칭)	솔라라이트	② 사업자등록번호 (법인등록번호)	502-66-12059 (170111-0436081)
③ 성명(대표자)	김 팔 영		
④ 주소(사무실)	경북 경주시 서면 내서로 279-92 (아화리 734-1번지) (전화번호: 070-4069-3177)		
⑤ 전문처리분야	폐기물중간재활용업		
⑥ 영업대상 폐기물	전기자동차 폐배터리(51-41-05)		
⑦ 처분시설 또는 재활용 시설 소재지	경북 경주시 서면 내서로 279-92 (아화리 734-1번지) (전화번호: 070-4069-3177)		
⑧ 시설·장비	" 별 정 "		
⑨ 기술 능력	" 별 정 "		
⑩ 전문 보관량	" 별 정 "		
⑪ 허가 조건	" 별 정 "		

"폐기물관리법" 제25조제3항 및 같은 법 시행규칙 제28조제7항에 따라
■ 중 간 재 활용 업
폐기물처리업 중 폐기물 ☐ 최 종 재 활용 업 을 허가합니다.
☐ 종 합 재 활용 업

[최초허가 : 2022. 06. 30.]

2022 년 06 월 30 일

경 주 시

내	용	확 인
가	폐기물중간재활용업 허가	경주시

사 항 >

일 자	위 반 내 용	일 자	처 분 내 용

2-7 | BUSINESS AREA

LiB Reuse/Recycling system | Background

현대글로비스, 전기차 사용후 배터리 ESS로 재사용

에너지경제신문 | 입력 2022.11.07 10:53



▲4일 서울 전신서그 1층 서울에서 진행된 업무협약식에서 김호석 (왼쪽부터) 대표, 김정은 현대글로비스사장, 박우영 신원군수, 황주호 한국수력원자력 사장, 김중우 LS일렉트릭 사장, 이준용 목포MBC 사장이 기념촬영을 하고 있다.

[에너지경제신문 여현우 기자] 현대글로비스가 전기차 사용후 배터리를 에너지저장장치(ESS) 등으로 활용하는 방안을 모색한다.

현대글로비스는 한국수력원자력, 신원군청, LS일렉트릭 등과 '탄소중립 이행, 전력망 이용효율 제고를 위한 신재생에너지 전력망 모델 단지개발'을 위한 업무협약(MOU)을 체결했다고 4일

EV are replaced with new batteries even if their performance drops by about 20%

폐배터리의 '인생 2막'...캠핑장비·전기스쿠터로 재탄생

분류 2021.09.21 21:39 / 수정 2021.09.21 22:26

오현주 기자



21:37 국제 러시아 대학에서 학생 총기 난사로 최소 6명 사망·28명 부상

캐나다 추천1위 배터리 건강검진 소평을
캐나다 추천1위 배터리 건강검진 소평을

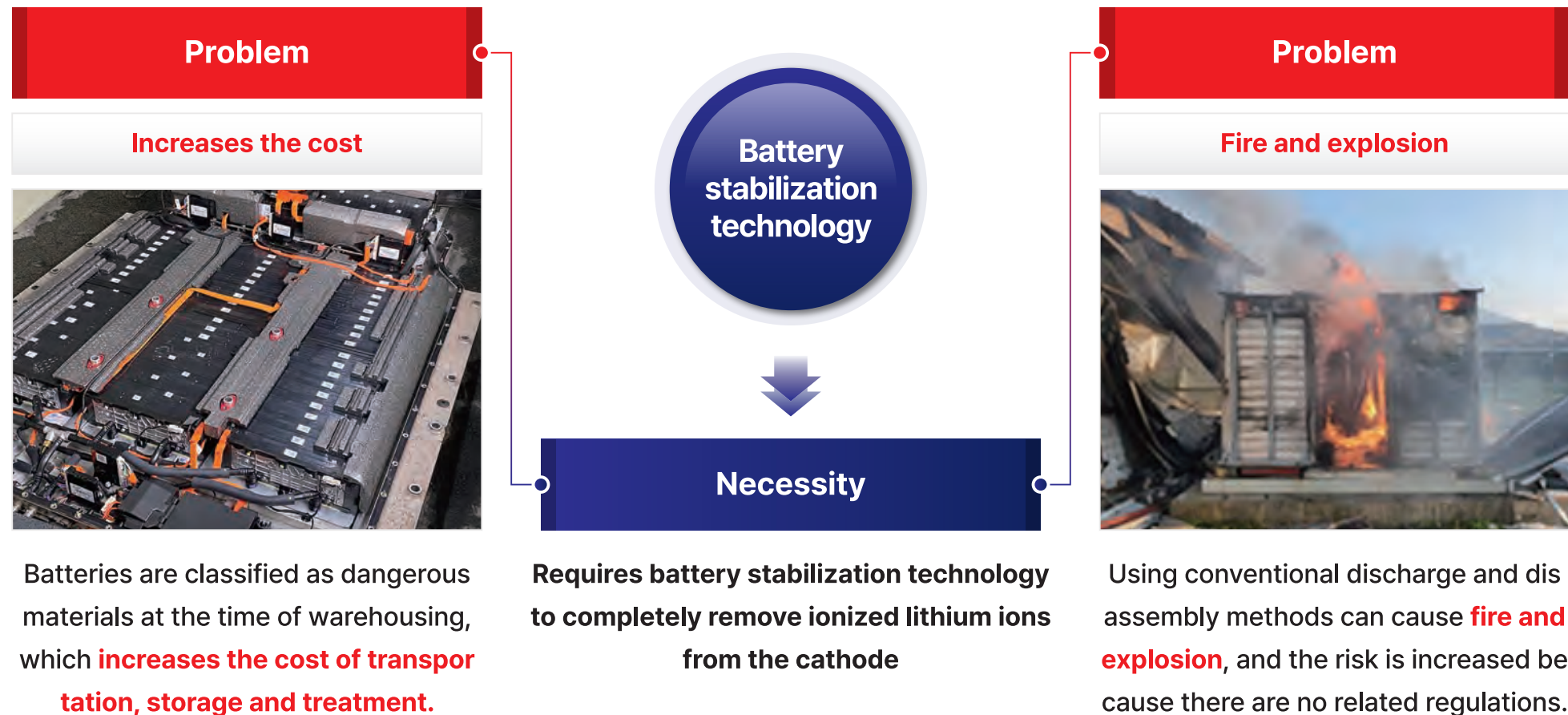
[앵커]
전기차 배터리는 성능이 70% 아래로 떨어지면 바꿔야합니다. 이렇게 버려진 배터리는 방치하면 환경 오염을 초래하기 때문에 폐배터리 처리 문제가 또 다른 고민거리인데요. 하지만 조금만 손 보면, 환경도 보존하고 유용하게 쓸 수 있습니다.

오현주 기자가 보도합니다.

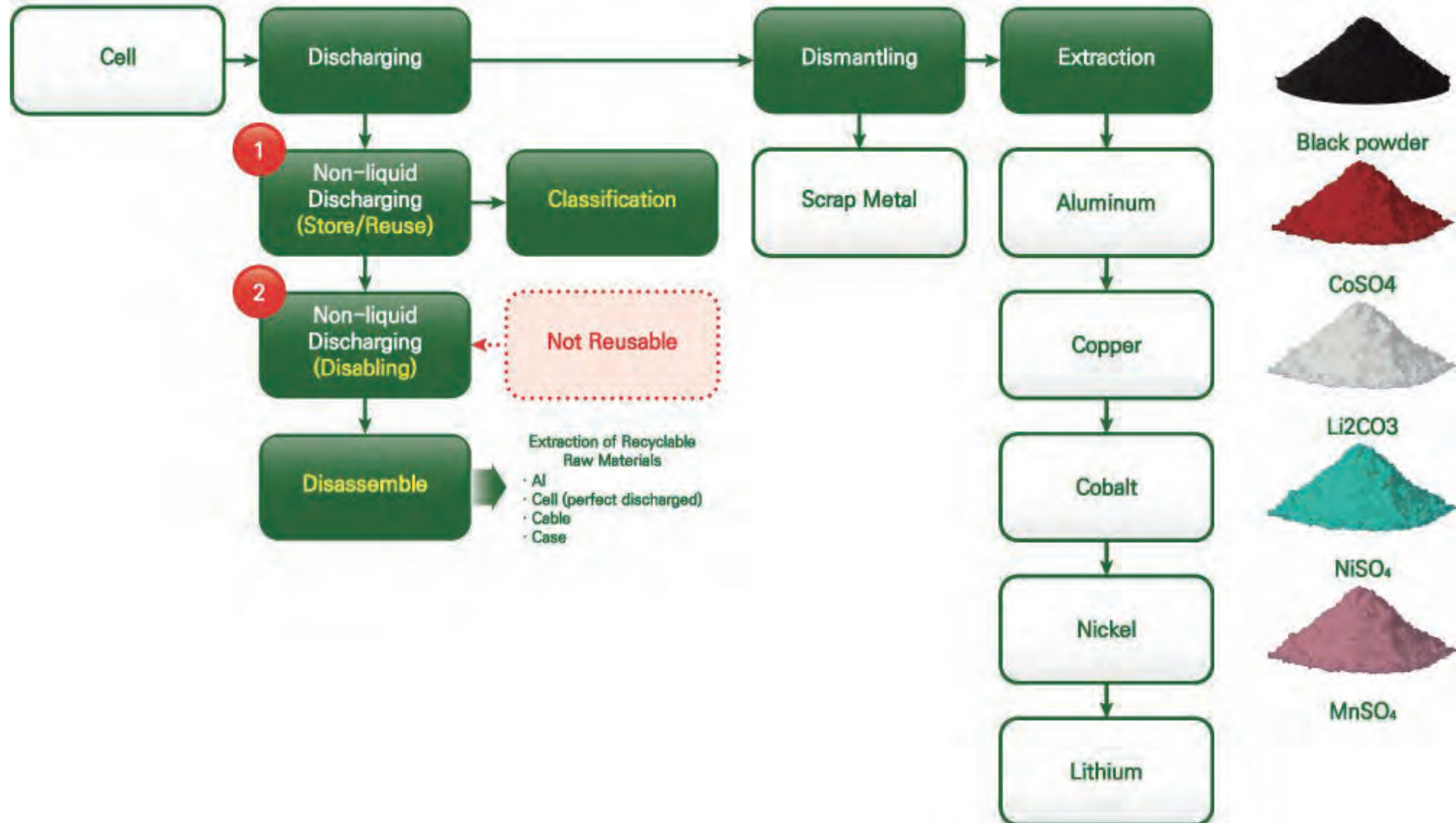
Increasing volume of batteries with remained energy
→ Expanded reuse industry

2-8 | BUSINESS AREA

LiB Reuse/Recycling system | Problem/Necessity



2-9 | BUSINESS AREA



2-10 BUSINESS AREA

Normal Dry discharging

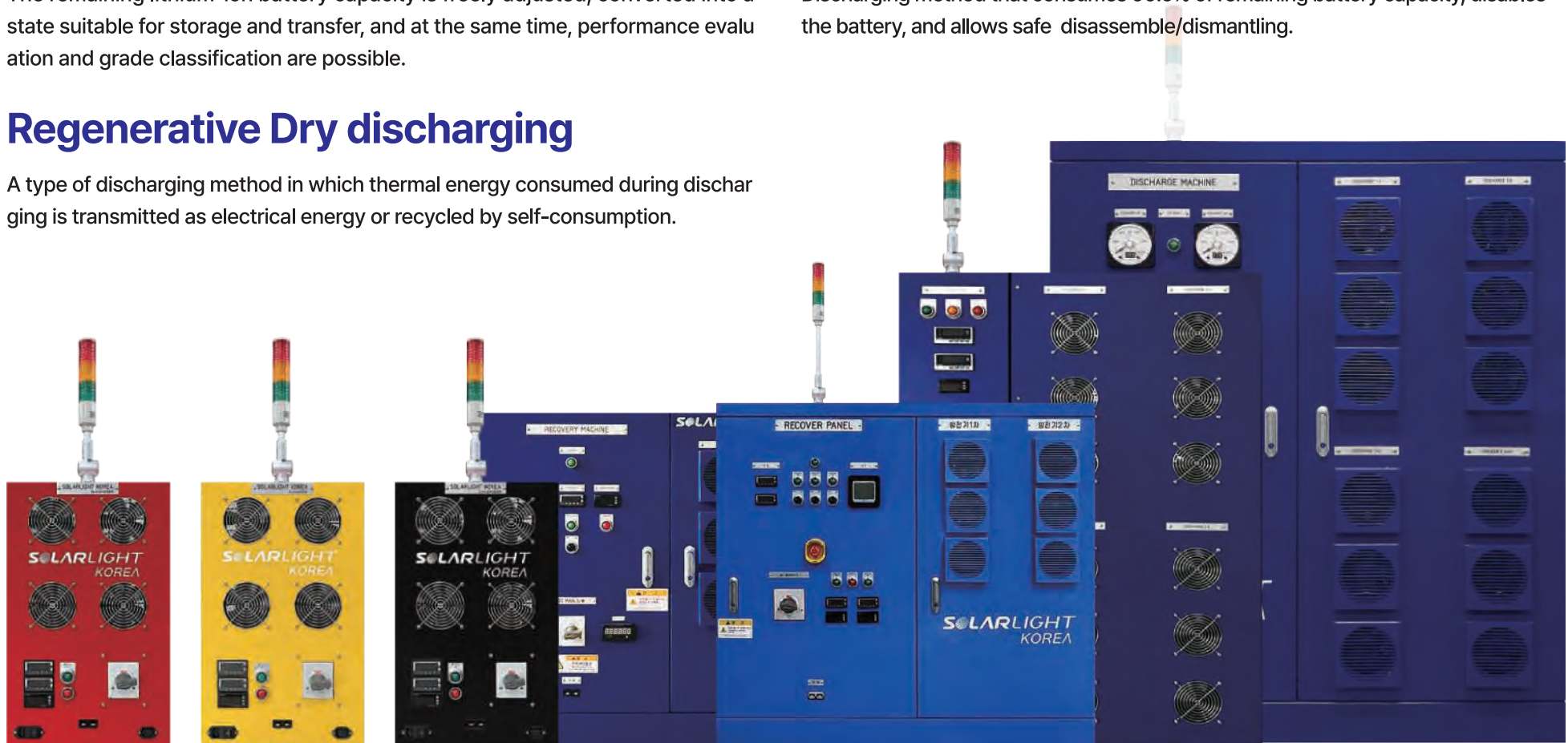
The remaining lithium-ion battery capacity is freely adjusted, converted into a state suitable for storage and transfer, and at the same time, performance evaluation and grade classification are possible.

Regenerative Dry discharging

A type of discharging method in which thermal energy consumed during discharging is transmitted as electrical energy or recycled by self-consumption.

Earth Dry discharging

Discharging method that consumes 99.9% of remaining battery capacity, disables the battery, and allows safe disassemble/dismantling.



2-11 | BUSINESS AREA | From SOLARLIGHTKOREA

Needs an efficient discharge process due to a surge in demand
for reusing and recycling of batteries after use

"Ensure safe handling and management environment" by consuming after use battery internal residues

For safe transport of after use batteries recovered from the site

**Immediate discharge and efficient after-use battery handling environment
through Earth Dry discharging**

**Safe transfer
and storage**

**Create an efficient
and affordable processing
environment**

**Ensuring stability
and eco-friendliness**

2-12 | BUSINESS AREA

Discharging and disassemble process | EV Pack



Warehousing



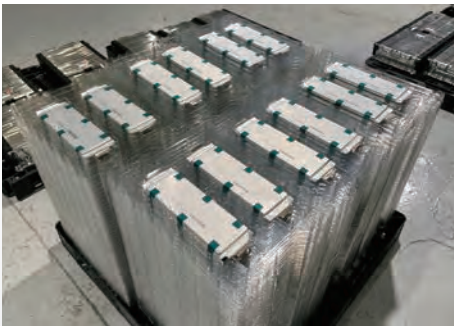
Discharging



Unpacking



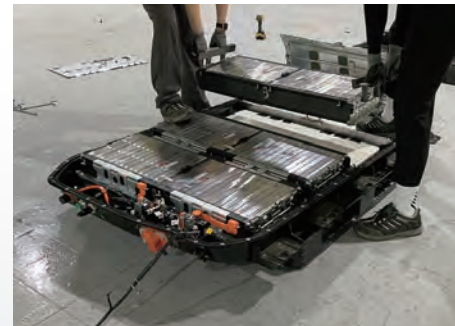
Remove Cable



Extract Cell



Extract Module



Extract Module

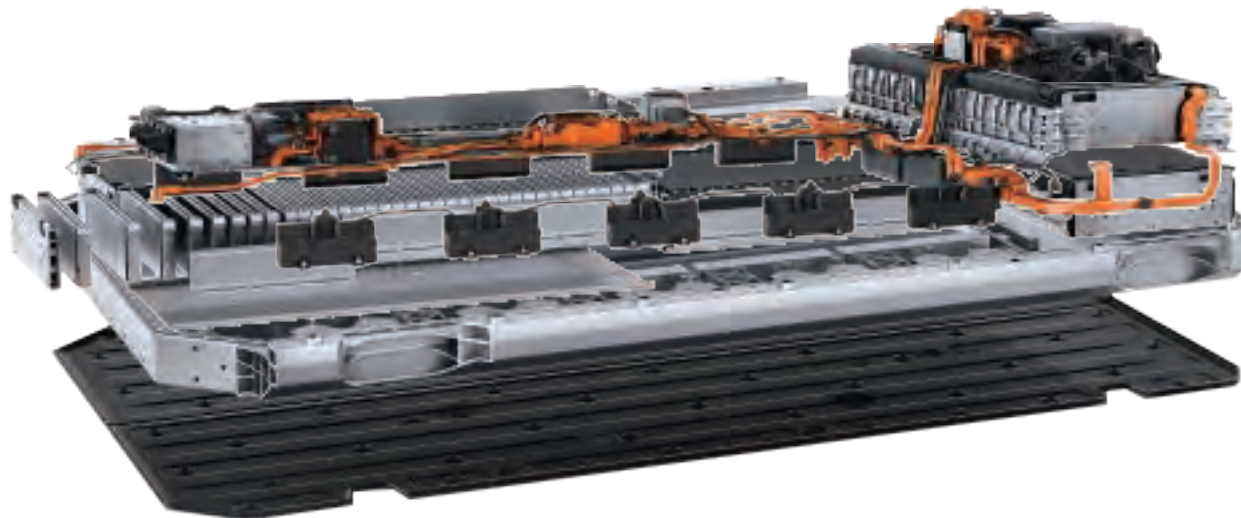


Remove BMS

2-13 | BUSINESS AREA

Work Flow | Unpacking

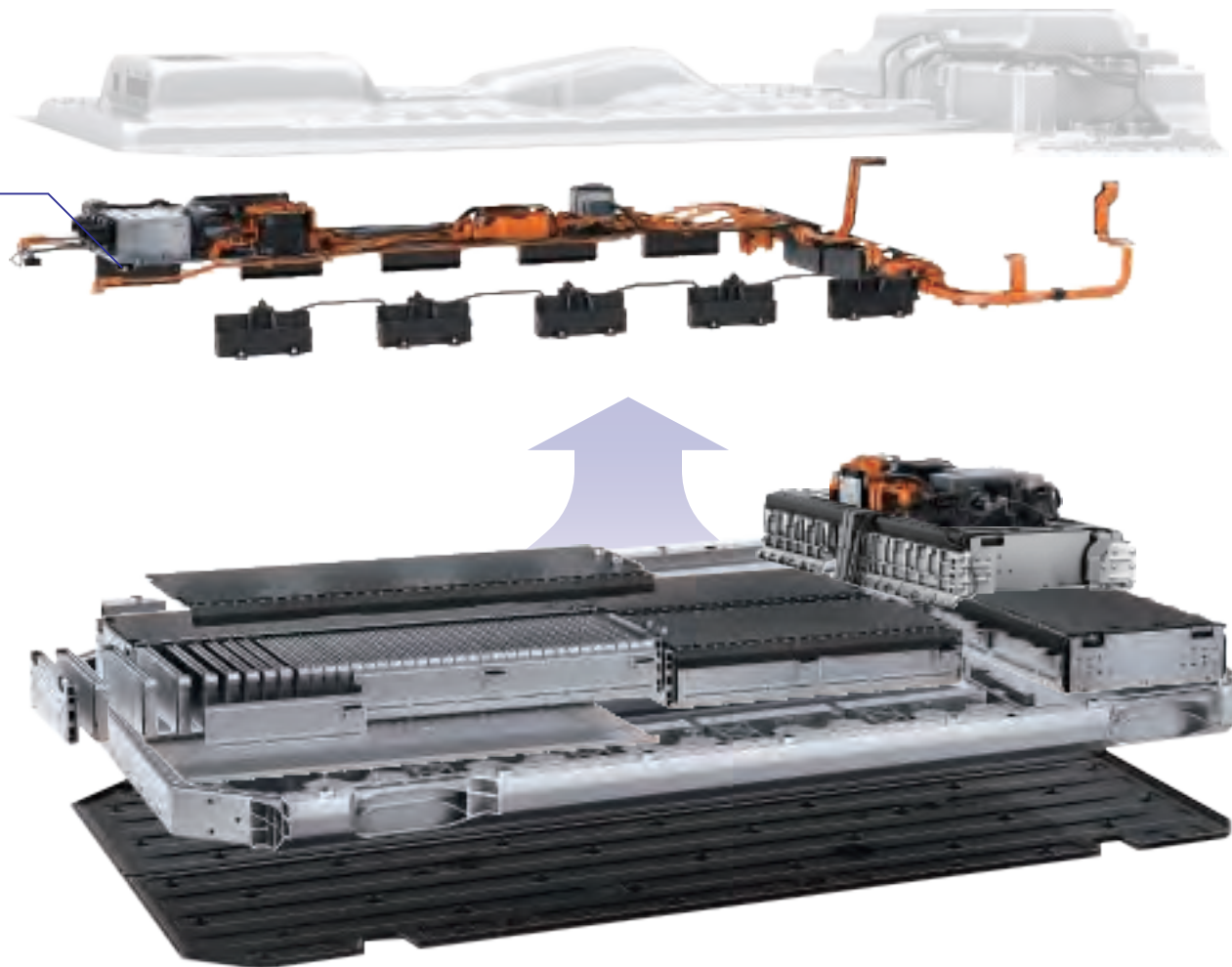
Pack case



2-14 | BUSINESS AREA

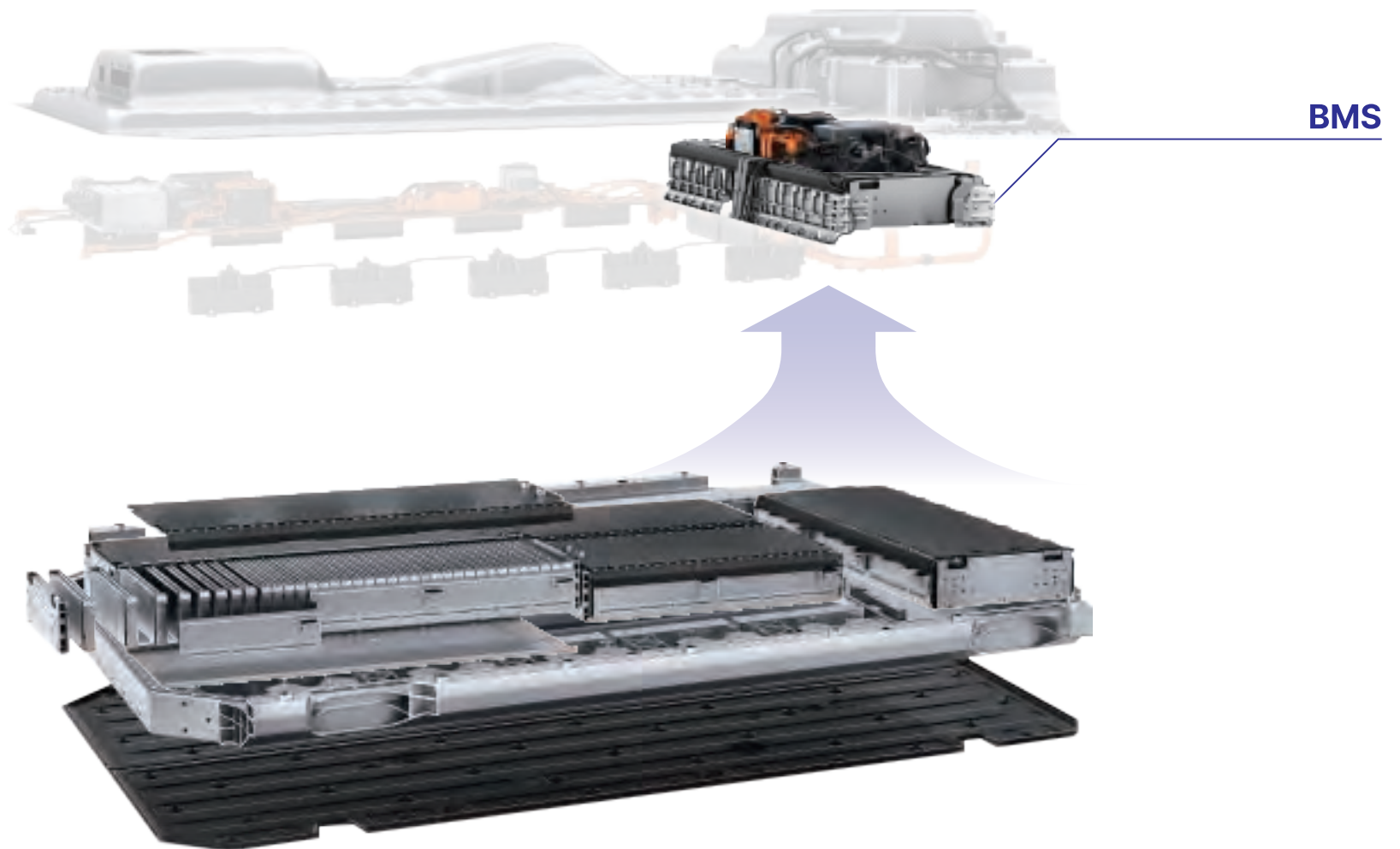
Work Flow | Remove Cable

Cable



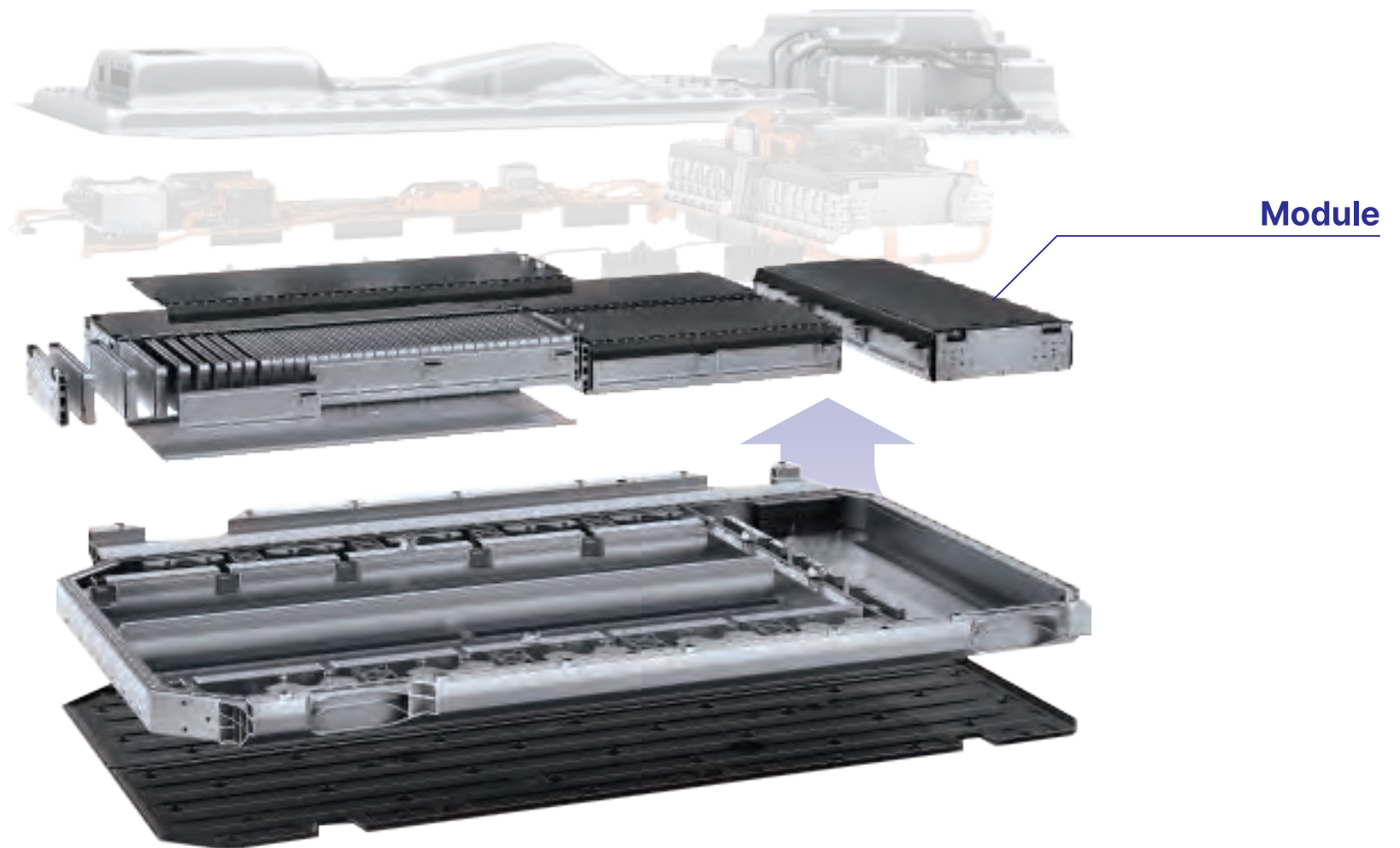
2-15 | BUSINESS AREA

Work Flow | Remove BMS



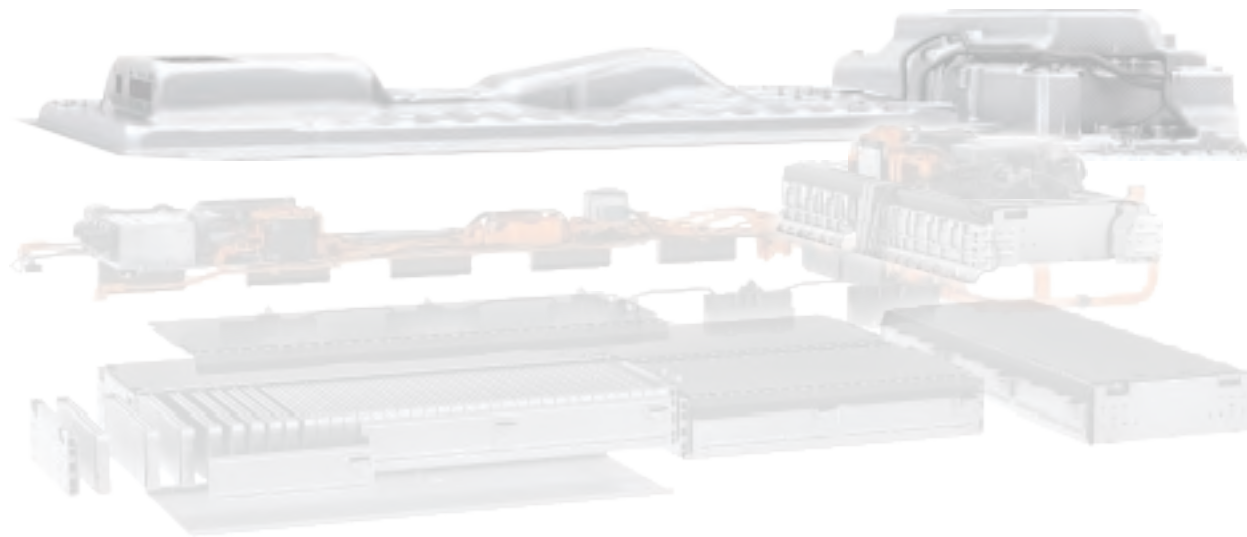
2-16 | BUSINESS AREA

Work Flow | Extract Module



2-17 | BUSINESS AREA

Work Flow | Unpacking



Pack case



2-18 | BUSINESS AREA

Work Flow | Extract Module / Cell

Extract Module



Extract Cell



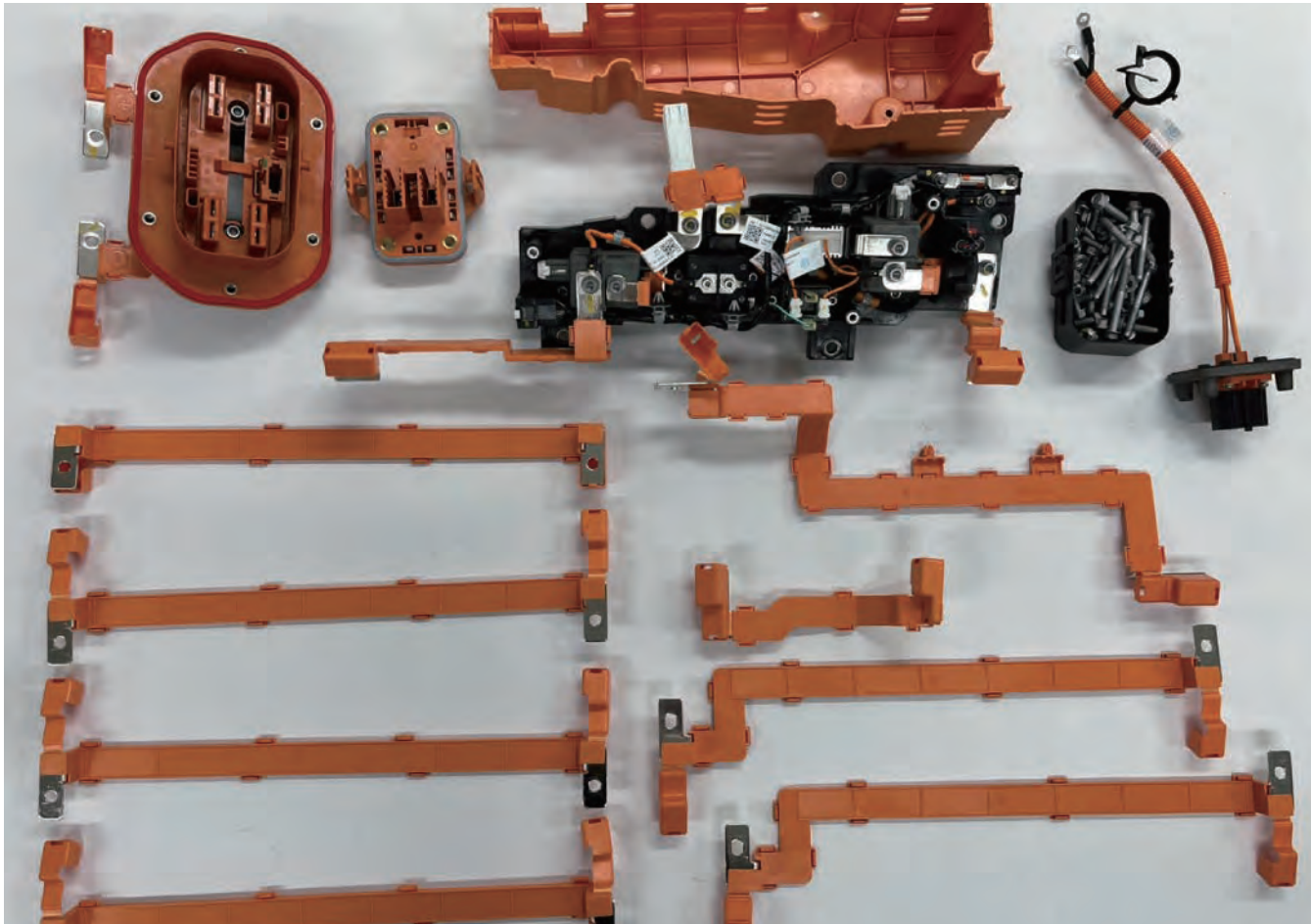
2-19 | BUSINESS AREA

OnSite | Pack



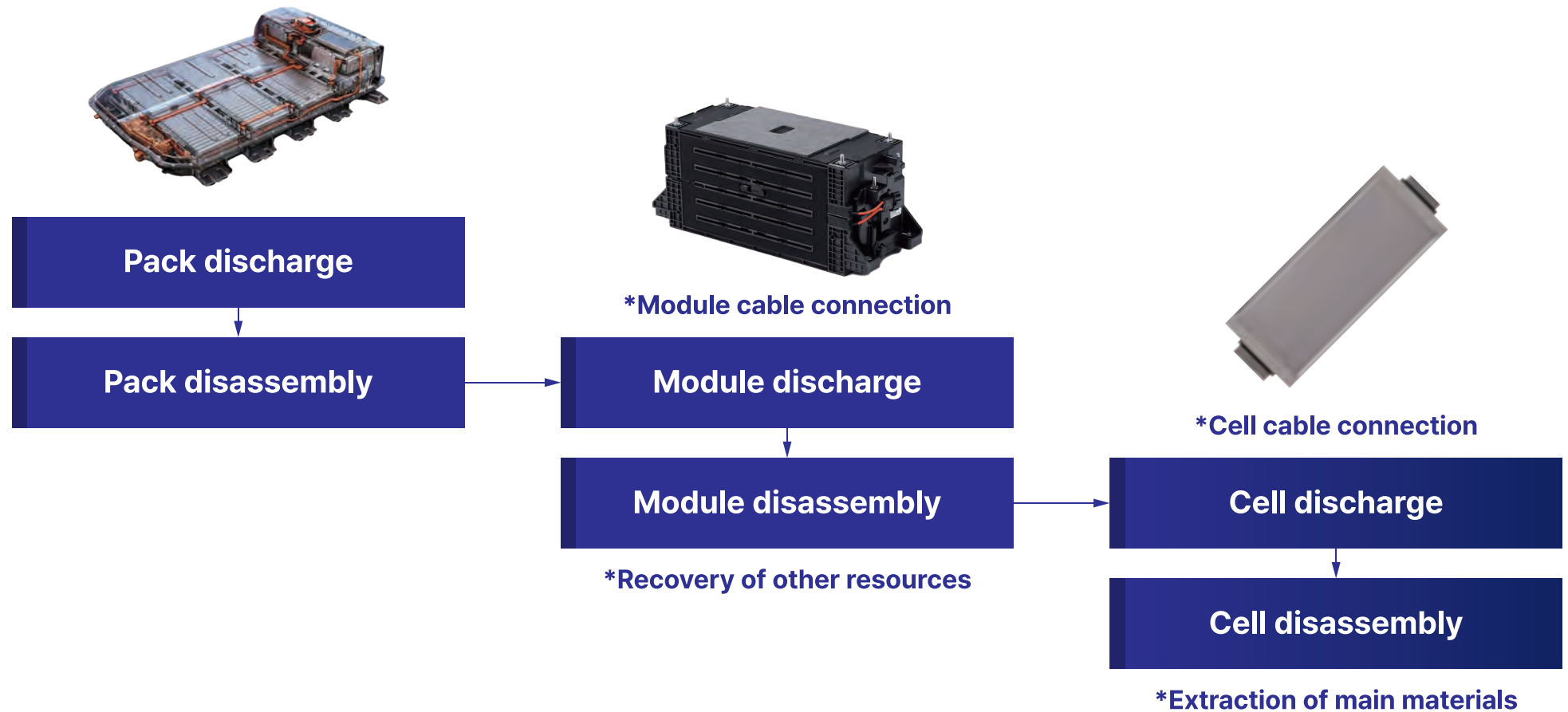
2-20 BUSINESS AREA

Discharging and Disassemble Output | EV Pack



2-21 | BUSINESS AREA

Discharge process



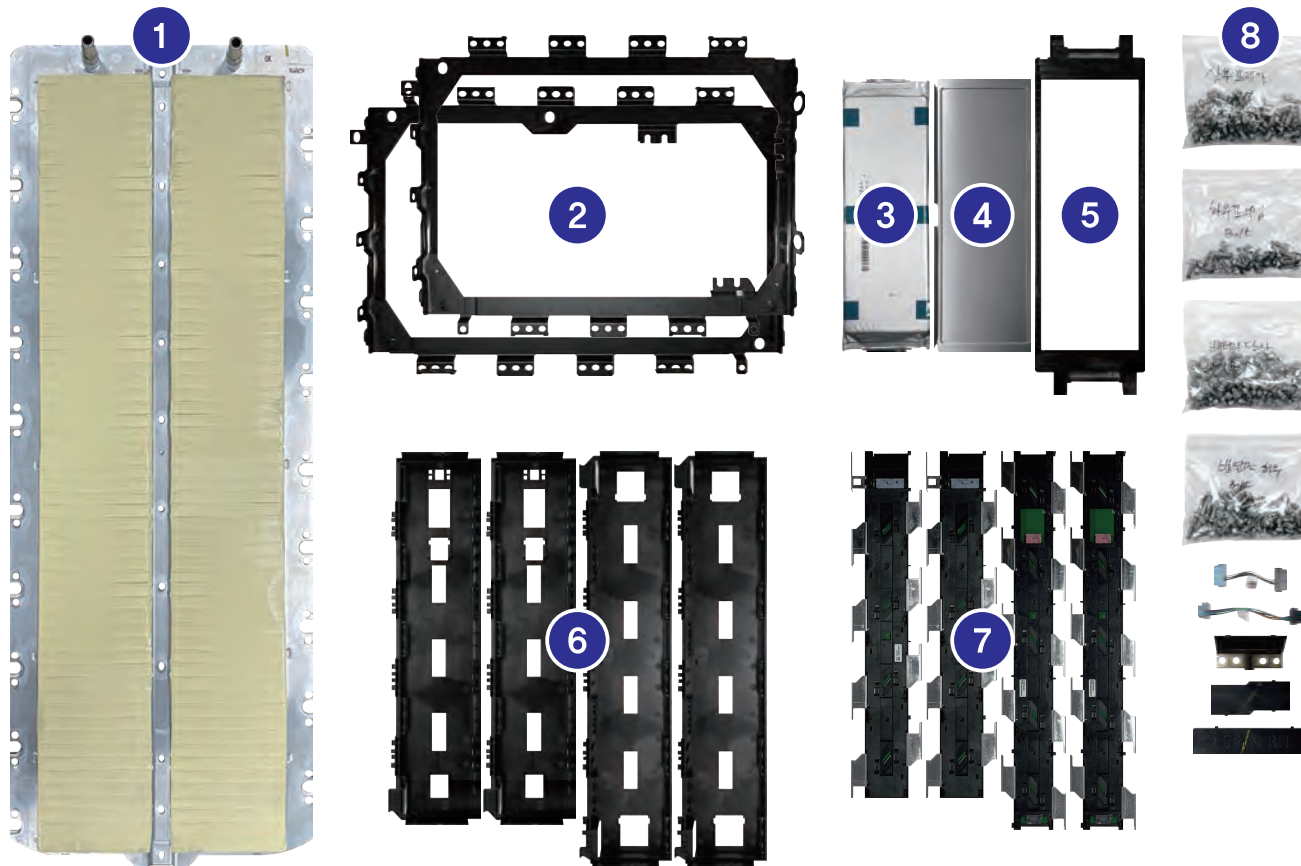
2-22 BUSINESS AREA

OnSite | Module



2-23 BUSINESS AREA

Discharging and Disassemble Output | EV Module



- 1 Heat sink
- 2 Frame(iron)
- 3 Cell
- 4 Catridge(aluminum)
- 5 Cell case(plastic)
- 6 BMS cover(plastic)
- 7 BMS
- 8 Cables and terminals

2-24 BUSINESS AREA

Methode of discharging | Pack / Module / Cell discharging

Remove residual energy
from the battery after use

Discharge and disassemble
without shape deformation

No environmental hazard
physical discharge



Pack



Module

0%



**Cylinder-type
Cell**

0%



**Pouch-type
Cell**

0%



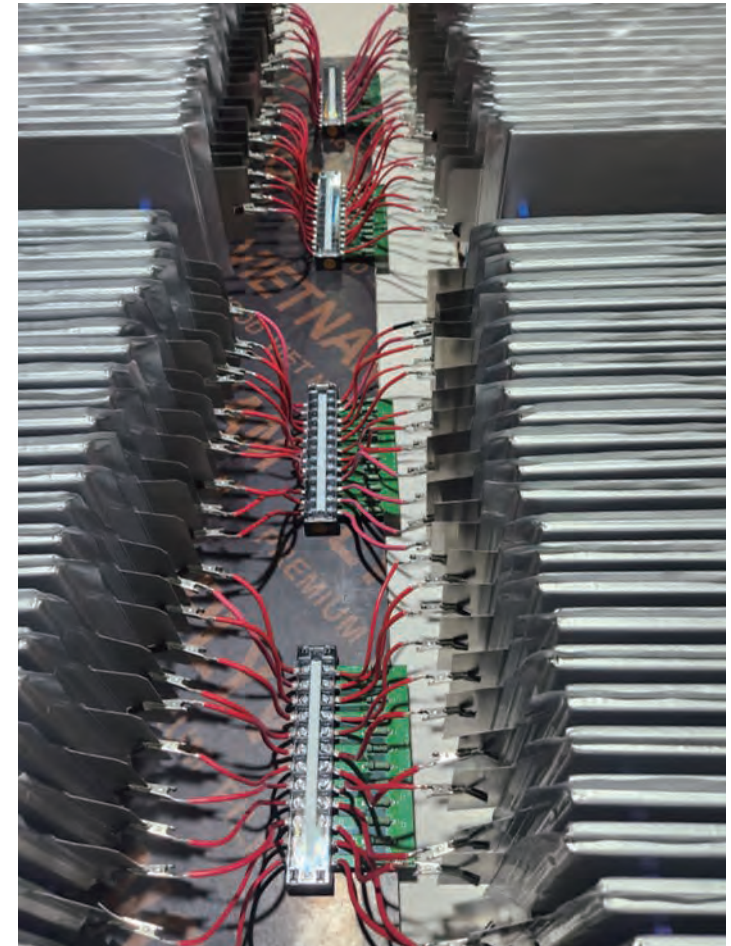
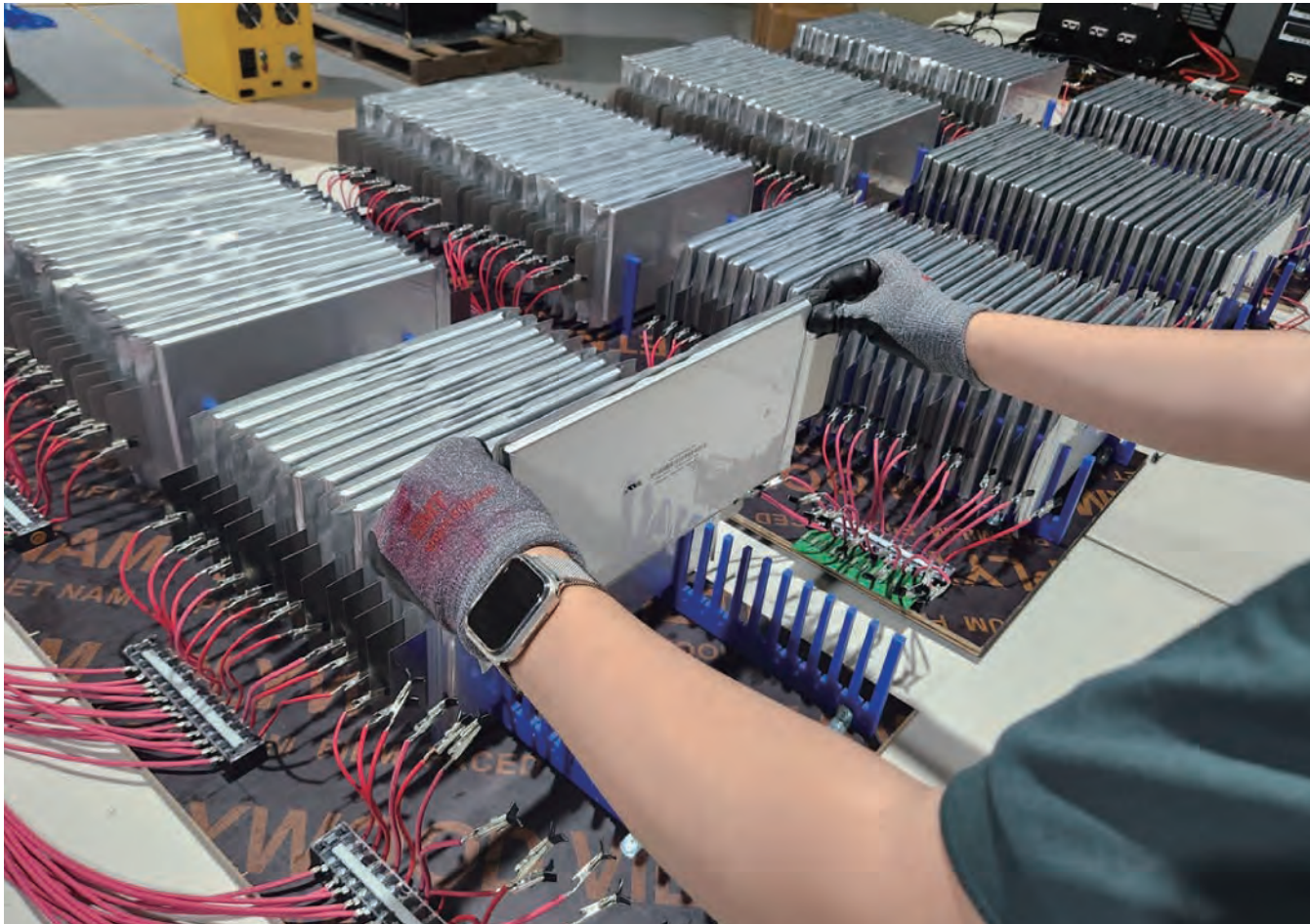
**Square-type
Cell**

" All types of cells can be Earth Dry discharging "

LiB Recycle Solution Proposal

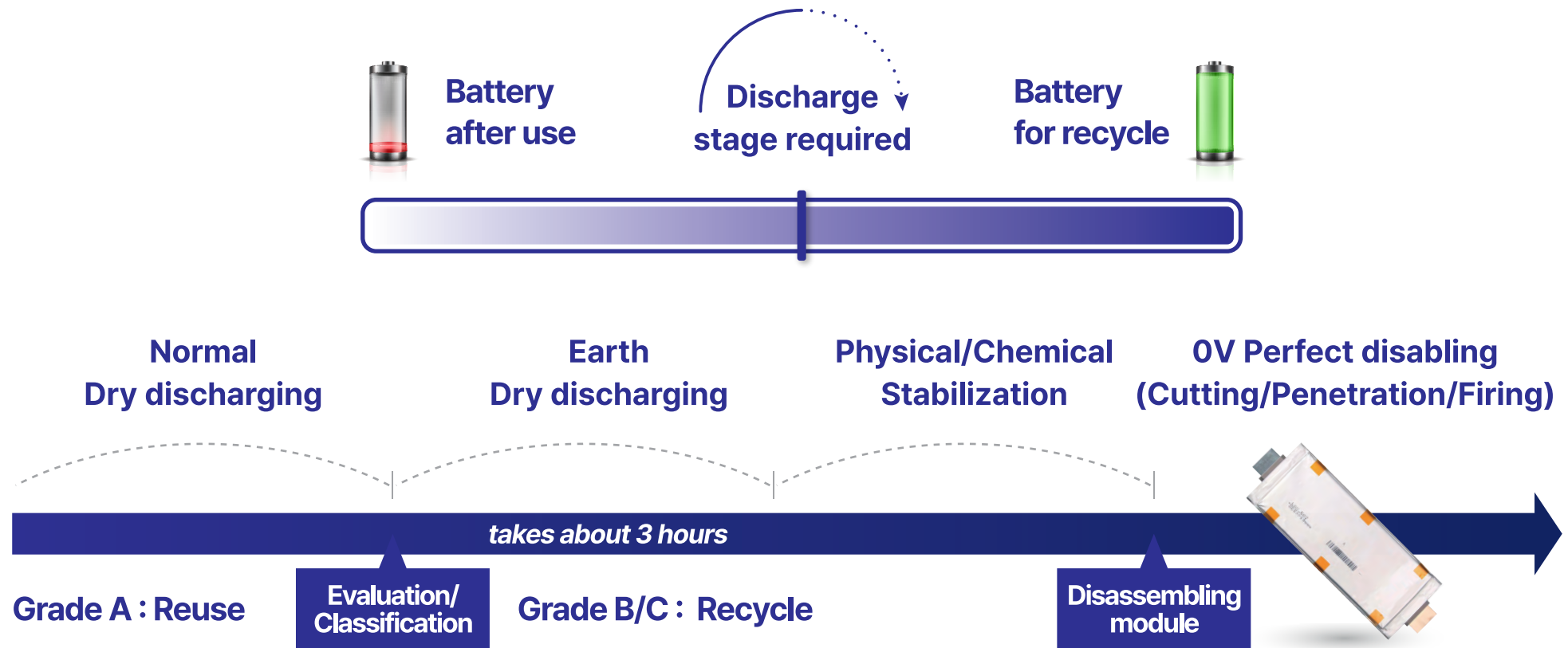
2-25 BUSINESS AREA

OnSite | Cell



2-26 BUSINESS AREA

Methode of discharging | Extract Cell



2-27 BUSINESS AREA | Safety Certification

Cell unit discharge



ktl 한국산업기술시험원 (Korea Testing Laboratory) | 상주식 번호: 22-064241-01-1 | 페이지 (3 / 총 4)

□ 첨부 1: 시험결과 내용

1) 관측 시험

시험 방법

1) 공차정전 적어진 배터리를 준비

2) 관측기를 이용하여 배터리의 충전부 관측 (관측 두 지점: 2.94 mm)

3) 결과 값을 기록

시험 전 전압 (DC V)	0.53 V
시험 후 전압 (DC V)	0.53 V
시험 결과	무정전류 측정 결과

시험 전 사진

시험 후 사진

FP104-05-00

FP104-06-00

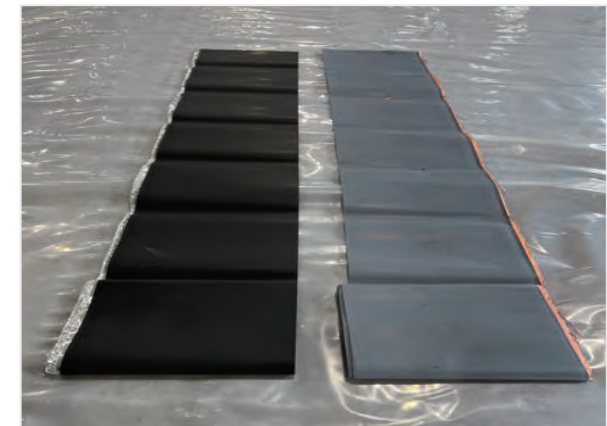
End of the report

Obtain stability test results

Discharged battery cell penetration test

Discharged battery cell heat exposure test

Extraction of core materials



2-28 BUSINESS AREA | Safety Certification

“ Securing safety test results ”

ktl 한국산업기술시험원 Korea Testing Laboratory
 등록지 번호: 22-064241-01-1
 페이지 (2) (중 4)

1. 제품 사양

시험품 정보	
제품명	리튬이온전지
생산자 또는 제조사	LG Energy Solution Co., Ltd.
모델명	ES30
정격전압	DC 3.63 V
공용 용량	880 mAh

비고
 본 시험은 고객이 제공한 시험품에 대해서, 제품의 사양에 기록된 제조업체 명칭으로 제품인정번호 KOLAS33을 부여함.

2. 시험 정보 및 결과

시험 정보 및 결과		
시험항목	시험 수	시험 결과
소통 시험		양극 및 음극 접촉
열 노출 시험	1	발열 및 폭발 시험

비고
 본 시험의 결과는 고객이 제공한 시험품에 대해서만 적용됨.
 (시험 방법, 시험 결과, 시험품 정보 등 참조)

FP104-05-03

ktl 한국산업기술시험원 Korea Testing Laboratory
 등록지 번호: 22-064241-01-1
 페이지 (3) (중 4)

3. 시험 결과

□ 첨부 1: 시험결과 내용

1) 관측 시험

시험 방법

1) 관측용 전 처리된 배터리를 준비

2) 관측기를 이용하여 배터리의 중심부 관측 (관측 두께: 2.94 mm)

3) 결과 발열 여부 확인

시험 전 전압 (DC V)	0.53 V
시험 후 전압 (DC V)	0.53 V
시험 결과	발열 및 폭발 없음

시험 전 사진



시험 후 사진

FP104-05-03

ktl 한국산업기술시험원 Korea Testing Laboratory
 등록지 번호: 22-064241-01-1
 페이지 (4) (중 4)

2) 열 노출 시험

시험 방법

1) 고체담금 처리된 배터리를 준비

2) 챔버 내 온도를 130 °C 설정한 후, 130 °C 도달한 뒤 30분 유지 후 종료

3) 결과 발열 여부 확인

시험 전 전압 (DC V)	0.55 V
시험 후 전압 (DC V)	0.55 V
시험 결과	발열 및 폭발 없음

시험 전 사진



시험 후 사진

FP104-05-03

[For penetration and heat exposure tests]



2-29 BUSINESS AREA

" All units of battery " can be discharged

Pack unit
discharge

Module unit
discharge

Cell unit
discharge



Efficiently distribute and utilize time and cost by performing selective processes for each battery unit.



A safe dry discharge process is possible depending on the battery condition and grade.



Convenience and commercial viability can be increased through systematic and optimal discharge treatment.

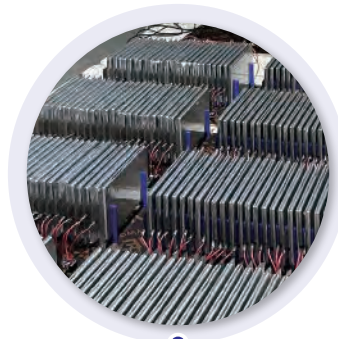
2-30 BUSINESS AREA

Cell unit discharge is possible at " high speed " and in " large quantities "



**Construction of discharge/
disassembly facilities**

Safety and data can be secured
through know-how
→ Rapid response is possible



**Securing
50t/day CAPA**

Capable of processing the maximum
daily volume through large-scale,
high-speed discharge facilities

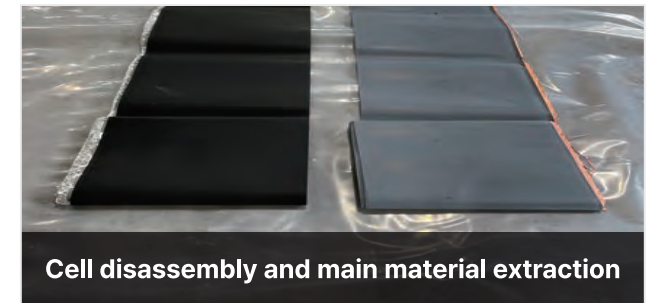


**Professional
workforce**

As a battery specialist,
we established our expertise by being
the first to introduce dry discharge.

2-31 | BUSINESS AREA

" All types of battery cells " can be discharged



Cylinder-type Cell



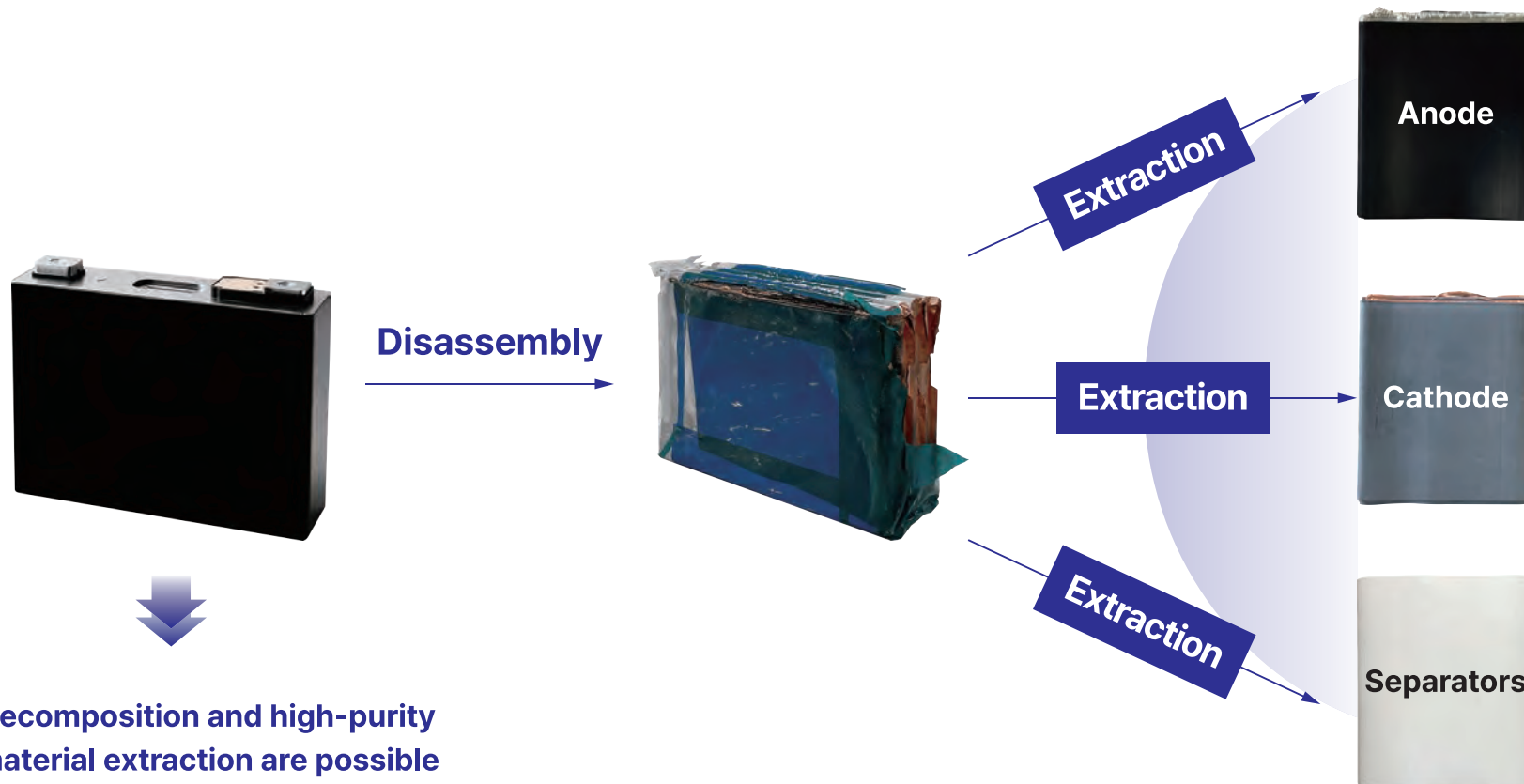
Pouch-type Cell



Square-type Cell

2-32 BUSINESS AREA

It is possible to extract core materials such as " Anode / Cathode and Separators "



Safe decomposition and high-purity
core material extraction are possible
with 99.99% energy consumption.

2-33 BUSINESS AREA

Wet discharging vs Dry discharging Comparison Table

Wet discharging	VS	Dry discharging
Minimum 48 hours (drying takes an additional 48 hours)	Discharging time	Within 3 hours
impossible	Disabling discharging	Possible (99.99% discharging)
impossible	Large discharging	Possible (Pack/Module/Cell)
impossible	Performance test	Possible (1st Classification)
After discharging, fire and explosion accidents occur	Safety	No case of fire or explosion accident
After discharging, treatment costs are incurred(wastewater treatment, etc.)	Economics	No separate processing cost
Generation of environmentally harmful substances such as wastewater	Eco-friendliness	No environmental harmful substances such as wastewater

2-34 | Fire and explosion

" Wet discharging "



**Residual energy remains
after wet discharging, causing fire and explosion
during transport and storage**

" Dry discharging "



**No fire or explosion during
transport and storage due to no residual energy
due to disable discharging**

2-35 | Pollution

" Wet discharging "



The battery is corroded due to erosion by saline water, and harmful substances such as large amounts of wastewater and harmful gases are generated

" Dry discharging "



The battery can be preserved in its original state and no environmental hazards are generated because it does not use brine

2-36 | Disabling

" Wet discharging "



Battery corrosion and residual energy are left,
making **safe disassembly impossible**

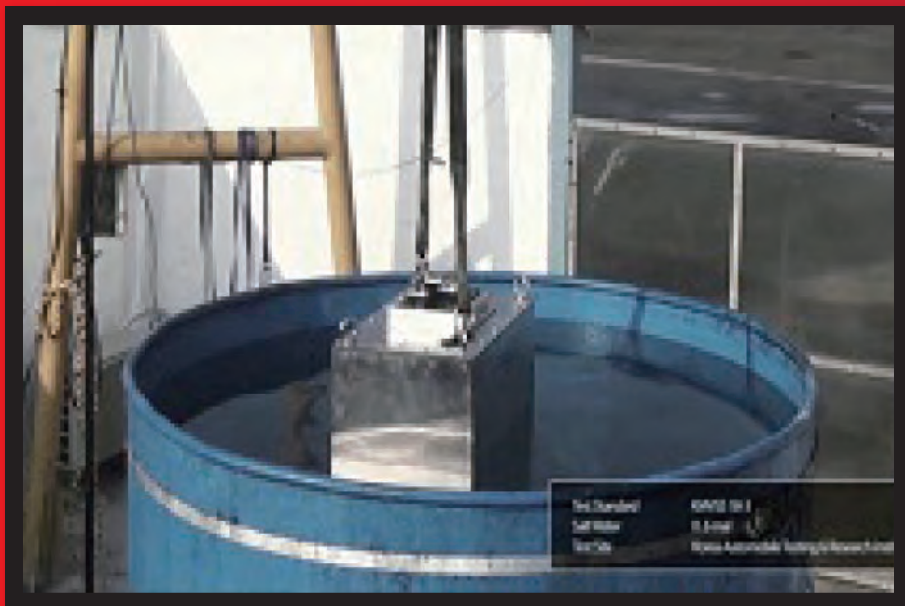
" Dry discharging "



Preserve the original state of the battery
and **safely disintegrate to a disassemble state**
with no residual energy

2-37 | Mobility

" Wet discharging "



Low mobility and low space utilization
as it requires space for installation and drying
of large saline tanks

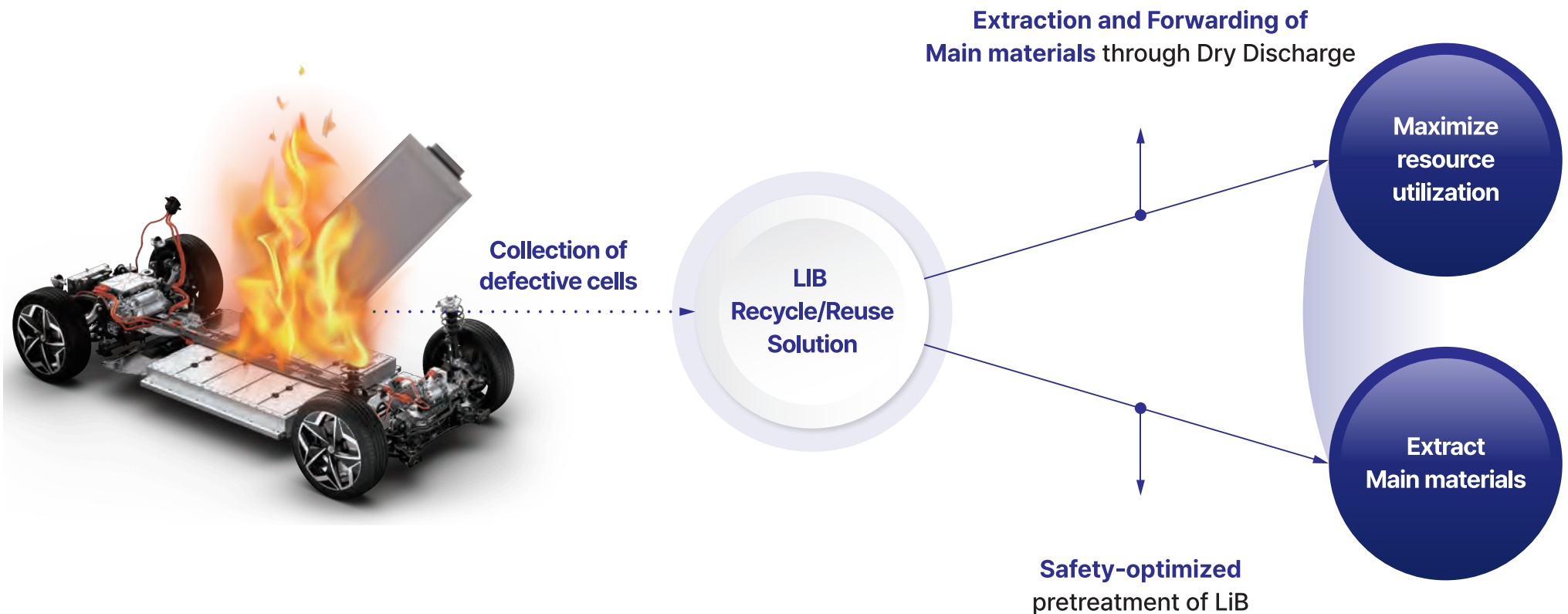
" Dry discharging "



High space utilization with mobility
with Non-liquid discharging that does not require
separate installation

3-1 | WHY SOLARLIGHTKOREA

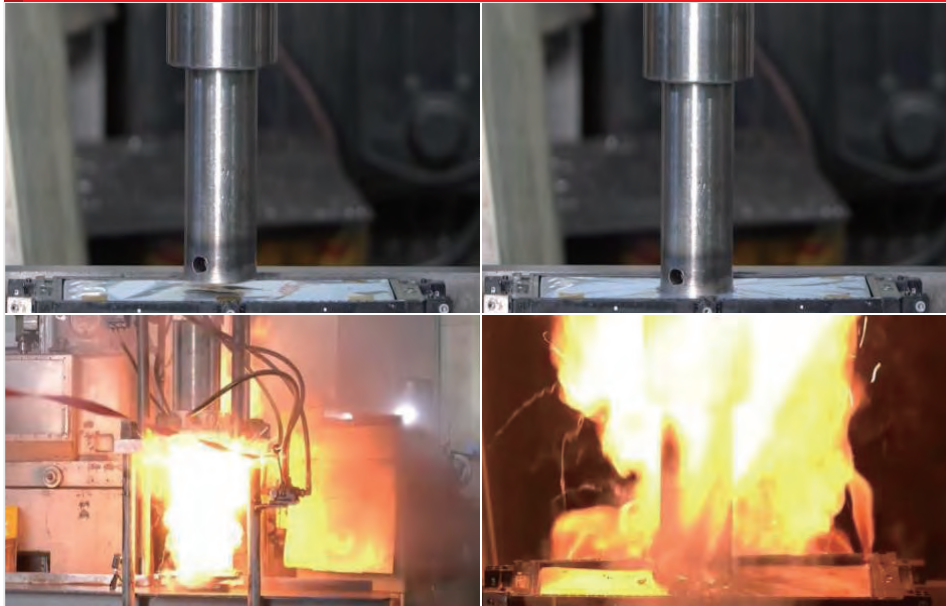
The goal of LiB recycle/reuse solution



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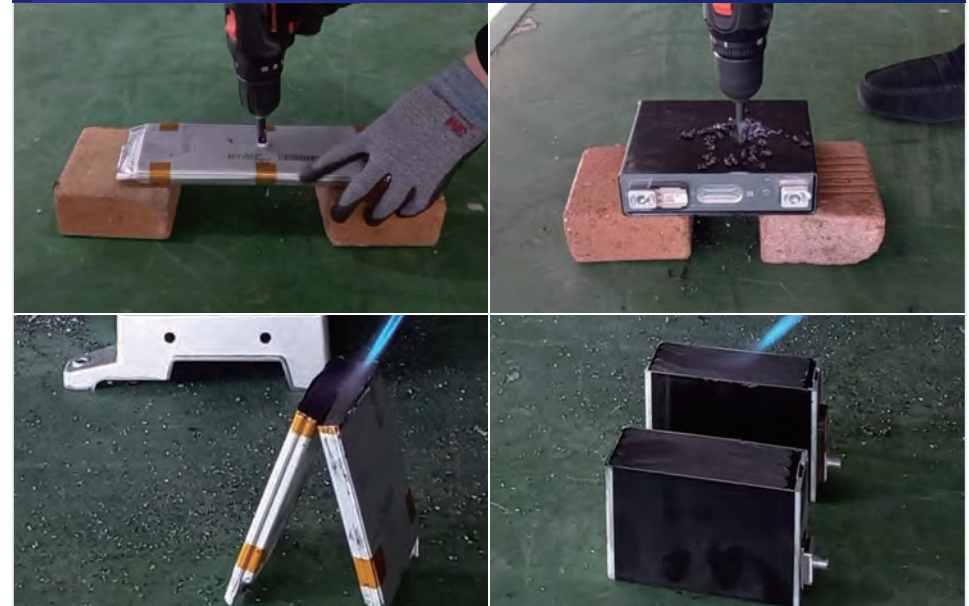
Comparison of test results

Wet discharge test results



After wet discharge, the battery has residual energy, **which poses a risk of fire or explosion, and cannot be disassembled.**

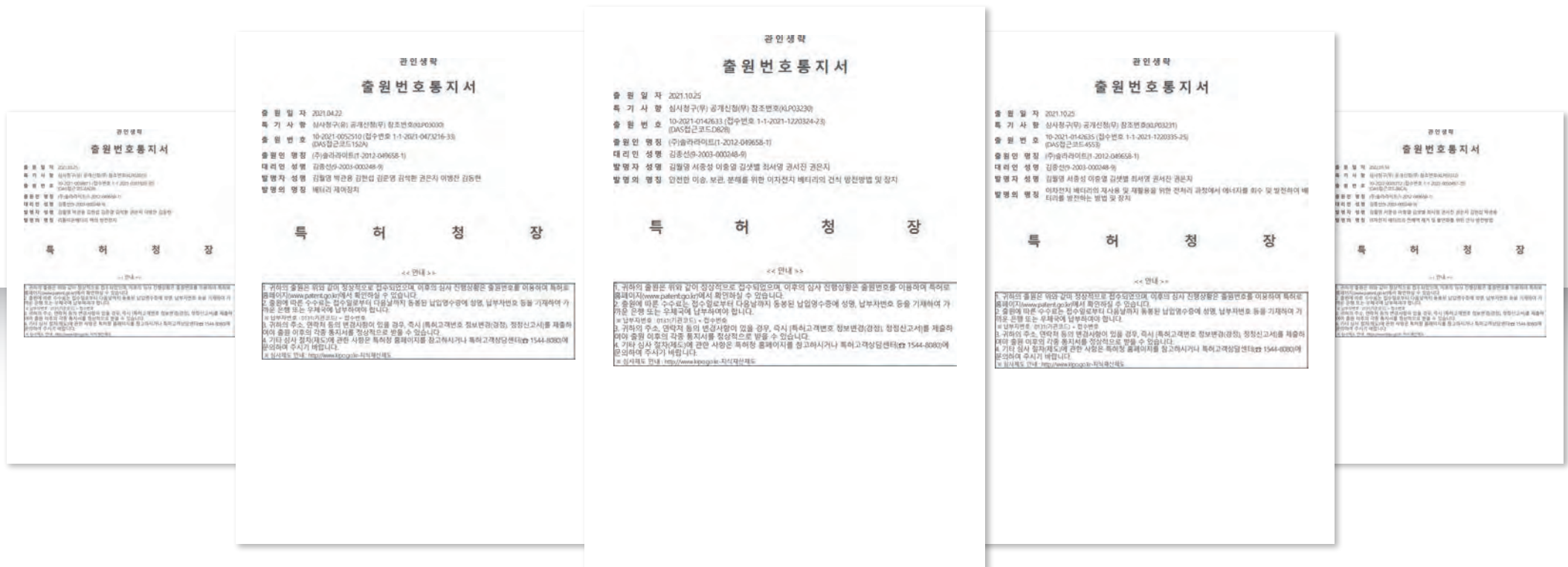
Dry discharge test results



After dry discharge, the battery has no residual energy and can be safely disassembled.

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“ Through original technology development ”



[Holds multiple patents]

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