SEVENKING ENERGY Co., Ltd.

HIGHTLIGHTS

SEVENKING
ENERGY'S BATTERIES

SHOW LIB LEVEL PERFORMANCE
(Superior energy density when applying Li metal Anode)

RESOLVE THE RISK OF EXPLOSION THAT CAN BE FOUND IN LIBS

CAN BE MASS PRODUCED USING EXISTING LIB MANUFACTURING FACILITIES

HISTORY

2016
09 Established in Pangyo Techno Valley

2018
04 Built a R&D laboratory and the manufacturing facility for the battery

2019
08 Participated in IP Road Day and awarded the 2nd prize

11 Awarded POSCO IMP best startup prize

2020
10 Acquired by Duksan Techopia

2021
01 Relocated in Sejong R&D laboratory

05 Building a commercial manufacturing facility for 2MWh

AUTOMOBILE POLICY BY COUNTRY

DECREASE INTERNAL COMBUSTION ENGINE VEHICLES, INCREASE ELECTRIC VEHICLES

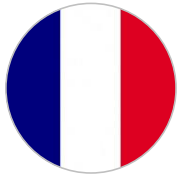
- Prohibition of internal combustion engine vehicle sales: 2035
- EV subsidy: reduce total amount, expand eligibility
  *Govt. ₩8 million, Local govt. ₩4 ~ 11 million
- Ratio of compulsory purchases of 'eco-friendly vehicles' by public institutions 100%

- Prohibition of internal combustion engine vehicle sales: 2035
- EV subsidy: tax credit
  *Federal Govt. Max $7,500, Local govt. $3,000

- Prohibition of internal combustion engine vehicle sales: 2035
- EV subsidy : Provide mainly for companies with technological abilities, extend deadline
  *13,000 ~ 18,000 Yuan depending on mileage

- Prohibition of internal combustion engine vehicle sales: 2030
- EV subsidy: Increase subsidy and extend deadline ('20 → '25)
  *€7,500 ~ 9,000 (subject to automobile cost)

- Prohibition of internal combustion engine vehicle sales: 2035
- EV subsidy: Provided according to mileage, Additional payments when utilizing renewable energy
  *Govt. Max ¥800k, Local govt. ¥400k



- Prohibition of internal combustion engine vehicle sales: 2040
- EV subsidy: Increase subsidies
  *Subsidies €7,000

* **Source :** Trend and Implications of EV Subsidies in Major Countries, Korea Automotive Technology Institute Apr 2021
Chosun Biz (China, Oct 2020), Motorgraph (France, June 2020)

AUTOMOBILE BUSINESS TREND

All major combustion engine companies have established aggressive goals/strategies
Established battries as the main component of EV

- Stop production of internal combustion engines : 2035, Sell over 1m EV by ’25
- Launch 30 different types of EV by ’25, Target to make 40% of all US automobile sales to be EV
- Collaboration with LGES, SK, and SES

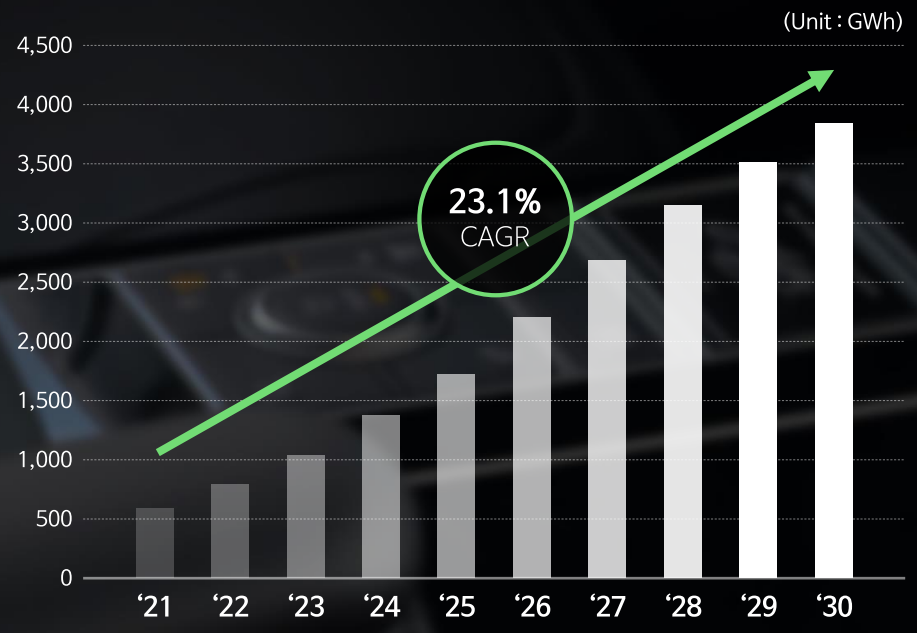
- Stop launching new cars with internal combustion engine : 2030, by ’25 for Kia
- Launch at least 12 types of EV by ‘25
- Be ready to mass produce all-solid-state batteries by ’27
- Collaboration with SES

- Stop production of internal combustion engines : 2034, Target to be top of EV market by ’25
- Launch 27 types of new cars based on electric vehicle platform by ’22
- Collaboration with Northvolt and QuantumScape

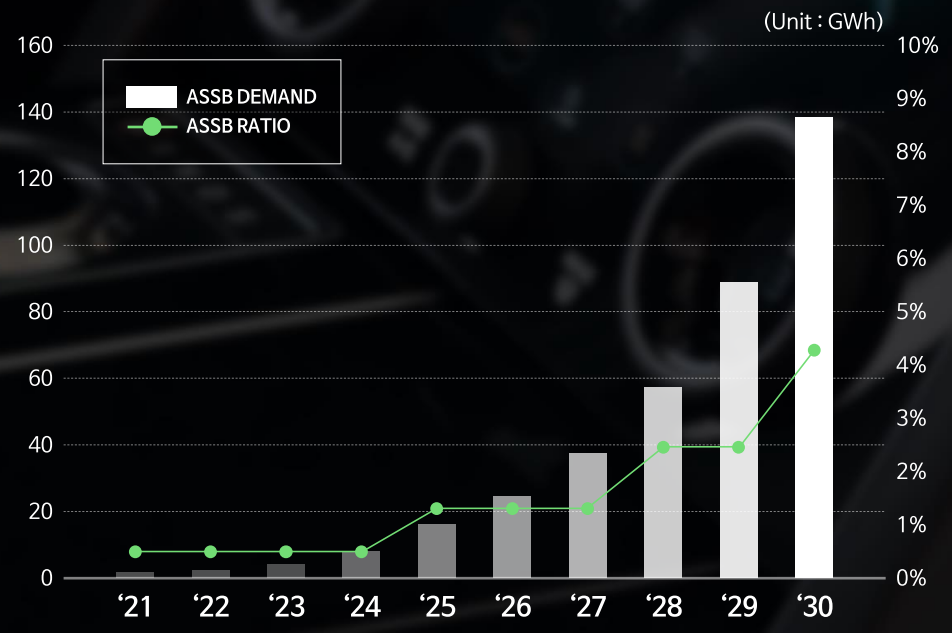
* **Source :** News articles and trading firm report (Mar 17 2021, Implications of Volkswagen battery strategy, Hana financial investment)

MARKET PROJECTION

BATTERY SUPPLY PROJECTION



SOLID-STATE BATTERY MARKET PROJECTION



	'21	'22	'25	'26	'27	'30	CAGR
SUPPLY	594	785	1,716	2,200	2,677	3,843	23.1%

	'21	'23	'24	'25	'28	'30	CAGR
ASSB Demand	1.6	4.0	8.0	16.0	57.0	138.0	144.3%
ASSB Ratio	0.5%	0.5%	0.5%	1.2%	2.5%	4.2%	53.1%

*Source : SNE Research, Korea Advanced Battery Conference (Oct 13, 2021)

SOLID STATE BATTERY MANUFACTURERS

	QUANTUMSCAPE	SES	SOLID POWER	SEVENKING ENERGY
VALUATION	$9.3 billion (Sep 2021)	$3.6 billion (estimate)	$1.2 billion (estimate)	Opportunities for Investment and collaboration
PARTNERSHIP	Volkswagen	GM, Hyundai, SK	BMW, Ford, Samsung	
TYPE	Oxide (sheet type)	Polymer	Sulfide	Oxide (coated form)

[1] Quantum Scape homepage, [2] SES homepage, [3] Solid Power homepage, [4] The Korea Economic Daily Oct 2021

SOLID ELECTROLYTE

Low cost / Can be mass produced

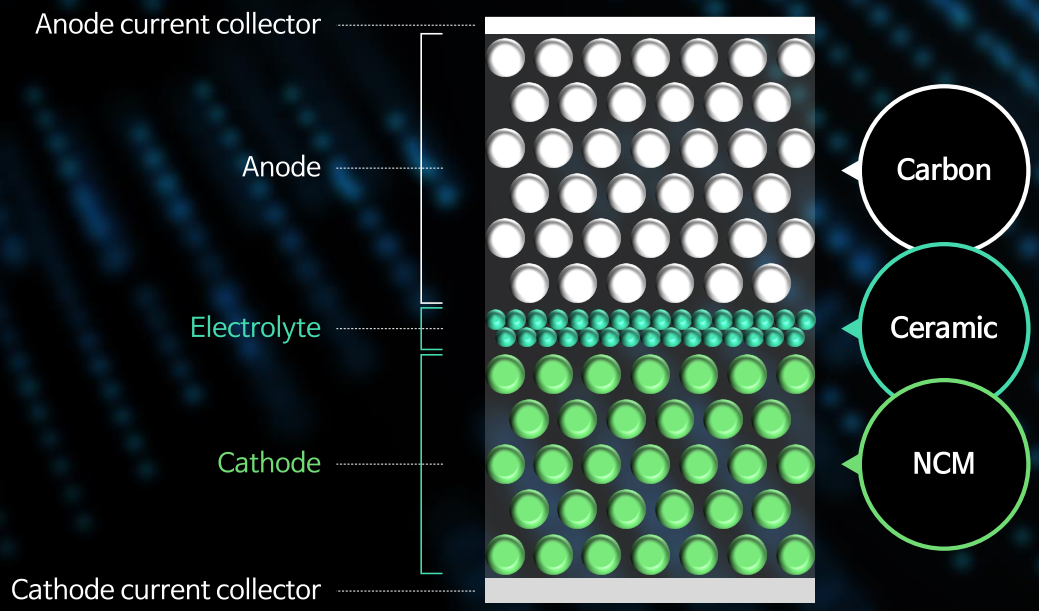
High ion conductance of 10^{-3} S/cm^2

Nano size powder realization
/ Uniform particle size distribution

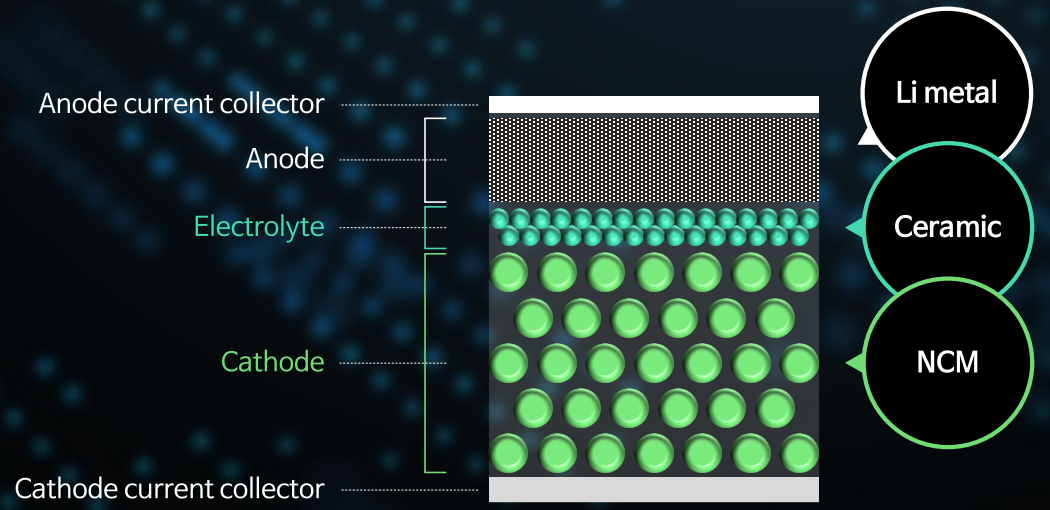
Easy particle machinability

CELLS

Gen 1 Graphite anode



Gen 2 Li metal anode



PERFORMANCE

	RECENTLY LI-ION BATTERY	SEVENKING ENERGY CELL (Gen 1)
Energy density	200Wh/kg	**200Wh/kg**
Power density	2,500W/kg	**2,500W/kg**
Life (1C/1C)	3,000N ↑	**3,000N ↑**
Thermal stability	45℃	**80℃**
Safety	EUCAR 4	**EUCAR 2**

PATENTS

IP PORTFOLIO AND PATENT VISION (Patent and Family Patent, 35)

Sevenking Energy holds original patents for solid-state batteries

MATERIALS

- Hybrid Solid Electrolyte
- New Li ion conductor
- Powder processing method

CELLS

- Solid state battery structure
- Multi-layer electrolyte
- Integrated solid state battery

SYSTEM

- Cooling System
- BMS for solid state battery

SAFETY

SEVEN KING ENERGY BATTERIES DO NOT EXPLODE

COMMERCIAL LI-ION BATTERY

- Cathode Layer
- Polymer Separator
- Anode Layer

Polymer Separator shrinks at high temperatures
→ Anode/Cathode Short circuit → Thermal runaway

SEVENKING ENERGY BATTERY

- Cathode Layer
- Ceramic layer
- Anode Layer

Ceramic separator does not shrink at high temperatures
→ Short circuit prevention → Thermal runaway prevention

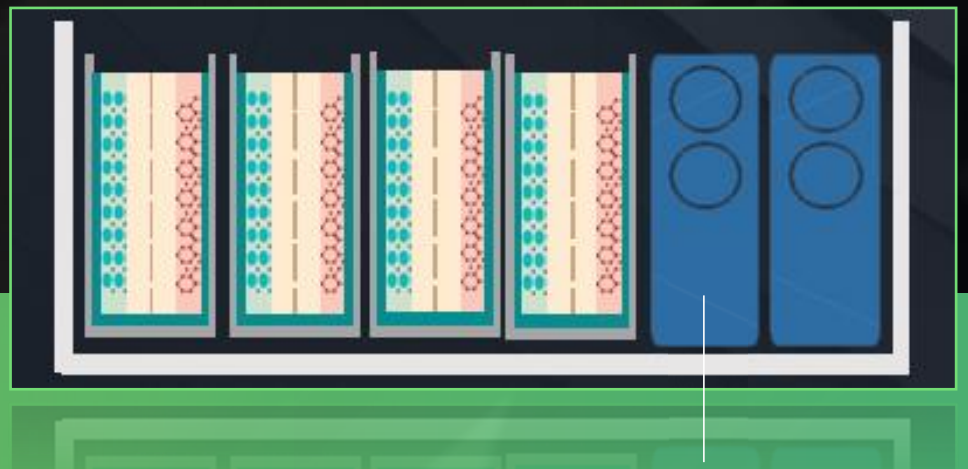
NO thermal runaway

NO Explosion

SAFETY (SPACE EFFICIENCY)

DECREASED BMS FEE INCREASED ABILITY TO STORE MORE ENERGY

LIB



SEVENKING ENERGY BATTERY

Air-Conditioning System

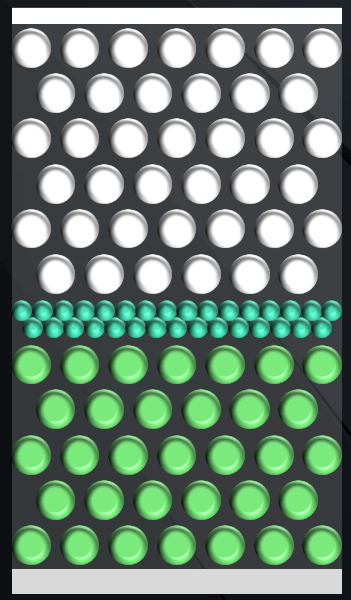
Establish large capacity ventilation system to maintain 25℃

Less Cost, More Energy

Max 80℃ temperature environment through high temperature safety trait

ENERGY DENSITY & POWER

Gen1

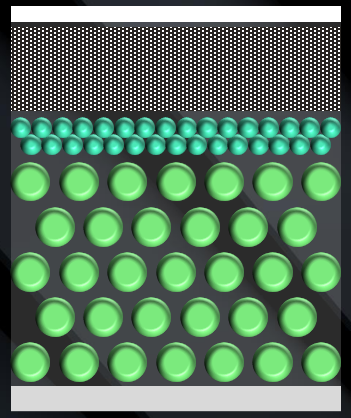


[ENERGY DENSITY]
- Less liquid electrolyte
- No commercial separator

[POWER]
- Thin solid electrolyte layer

: Lower resistance than self-supporting solid electrolyte layer

Gen2



[ENERGY DENSITY]

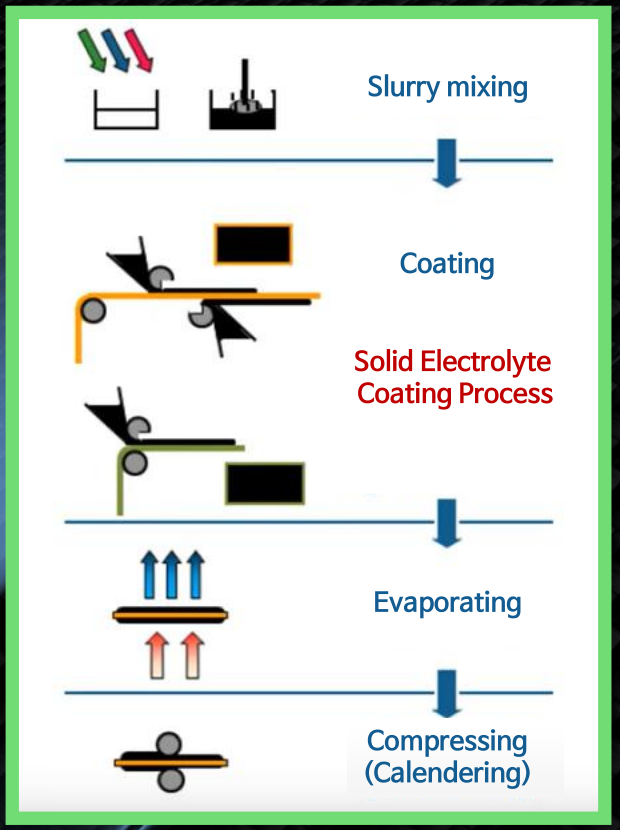
Advantages of Gen1 +
- Light anode material
- Anode Free

[POWER]

Advantages of Gen1 +
- No intercalation resistance at anode

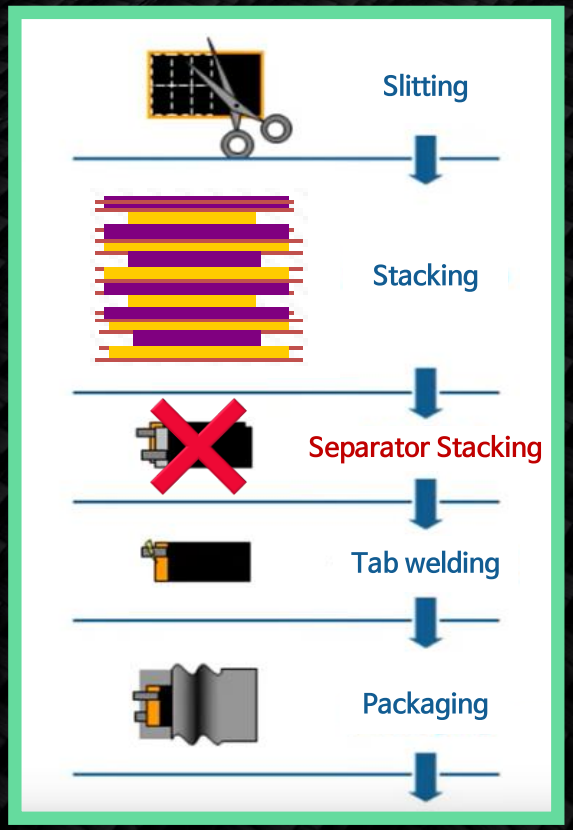
EASY MANUFACTURING
(MANUFACTURING PROCESS)

COATING PROCESS



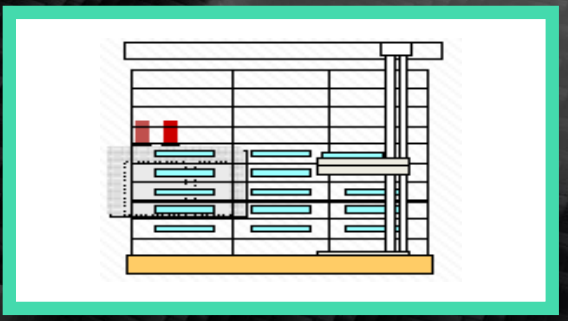
01

ASSEMBLY PROCESS



02

FORMATION



Sevenking energy makes solid state separator

03

- Sevenking Energy cells can be produced using existing LIB process and facilities
- The solid electrolyte is added in the coating process, and the separator lamination process is ruled out in the assembly process

CELL PRODUCTION PLAN

ROADMAP

2016
Proto type Hybrid
– Cell

2019
260Wh/kg

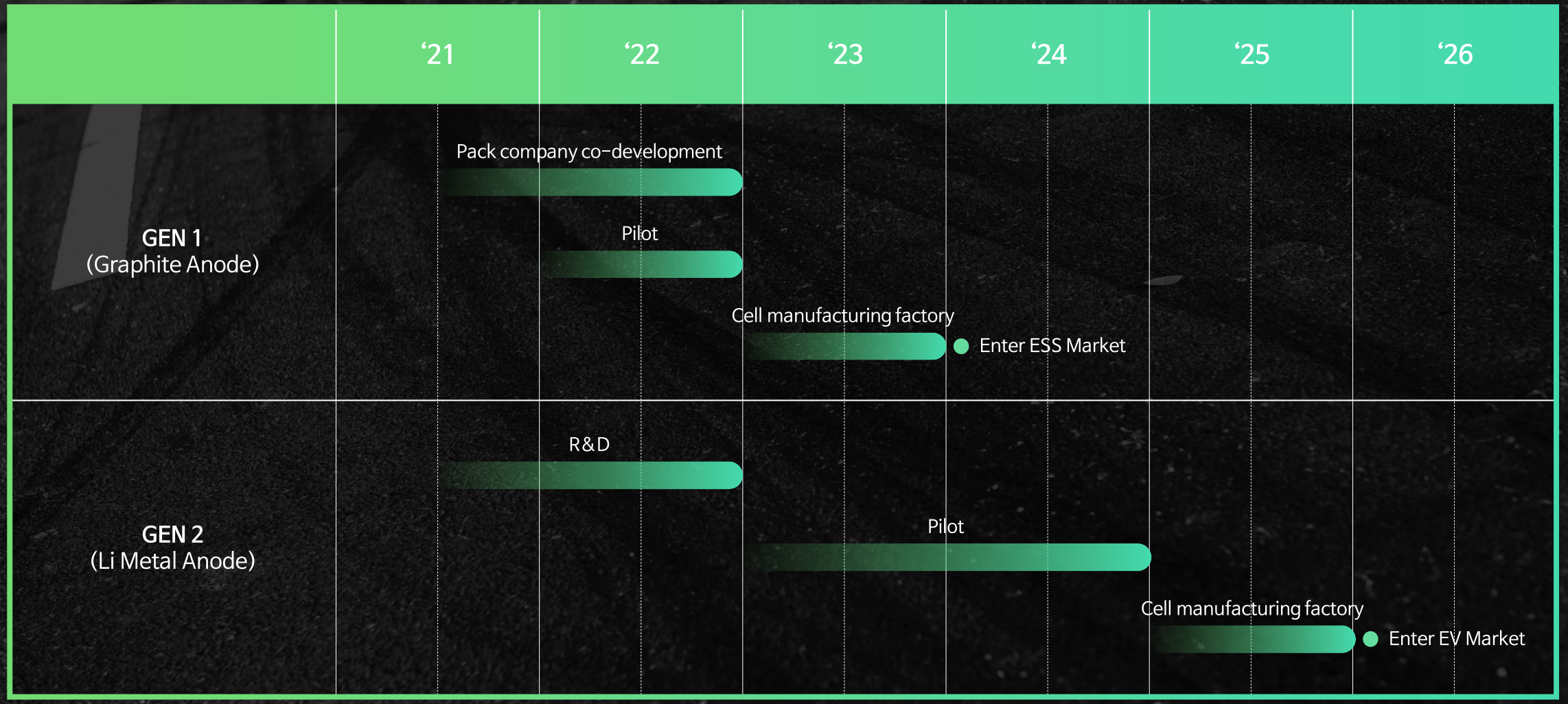
2020
280Wh/kg

2021
Long life 3,000N ↑

2023
350Wh/kg

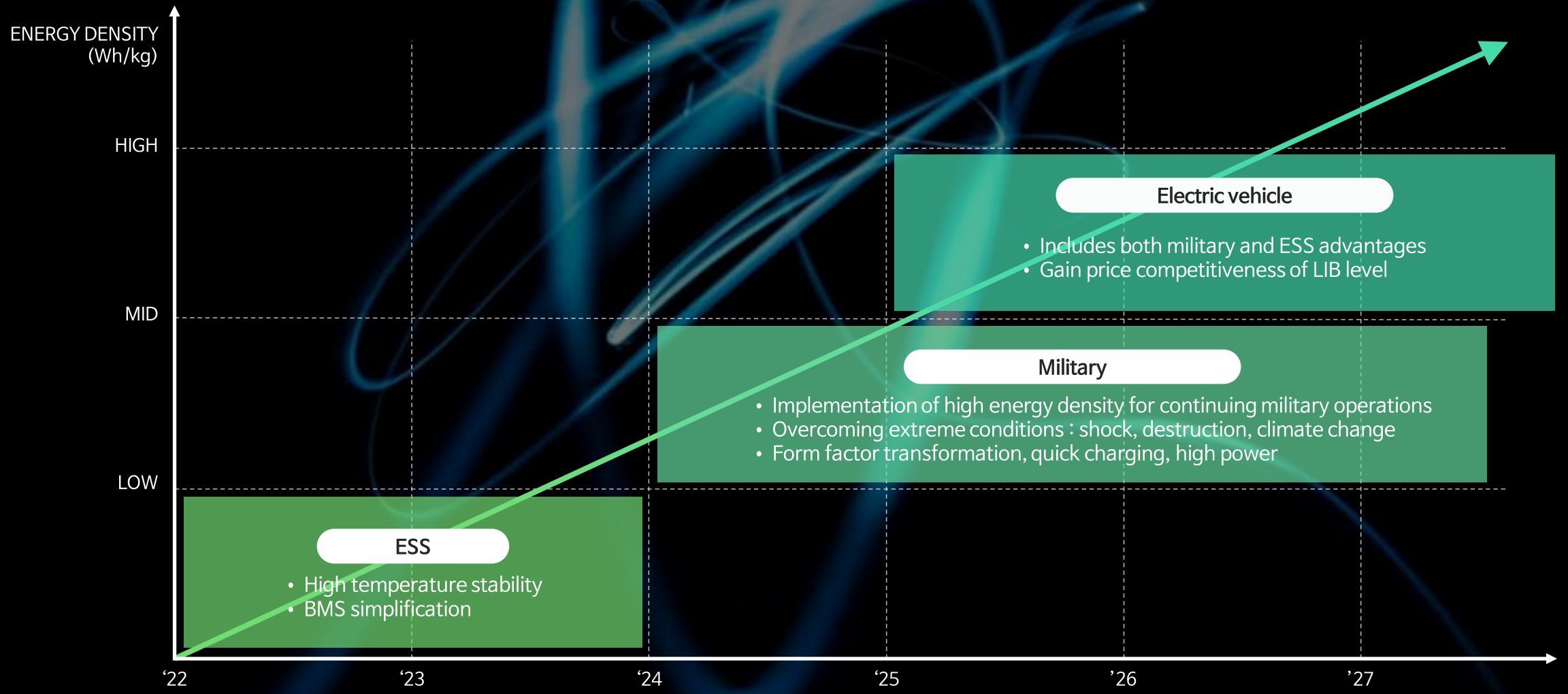
2025
For EV

ROADMAP

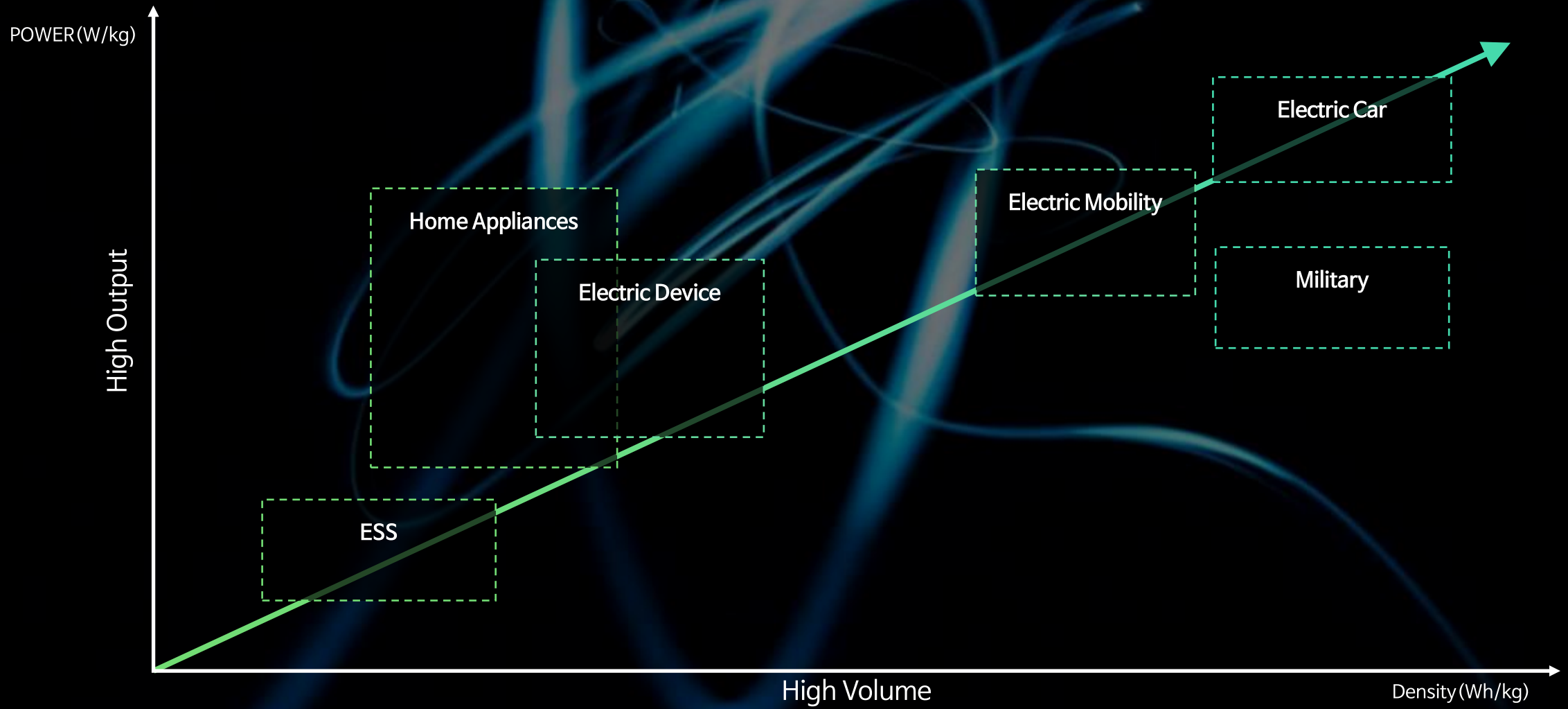

'21
'22
'23
'24
'25
'26
GEN 1
(Graphite Anode)
Pack company co-development
Pilot
Cell manufacturing factory
Enter ESS Market
GEN 2
(Li Metal Anode)
R&D
Pilot
Cell manufacturing factory
Enter EV Market

SEVENKING ENERGY MARKET

ROADMAP



EXPANSION PLAN



APPENDIX

COLLABORATION

MATERIAL

SOLID ELECTROLYTE MASS PRODUCTION UNDER DISCUSSIONS
: Japan T company and Korea S company
* NDA complete with 1 company, 1 under discussions

PACK SYSTEM

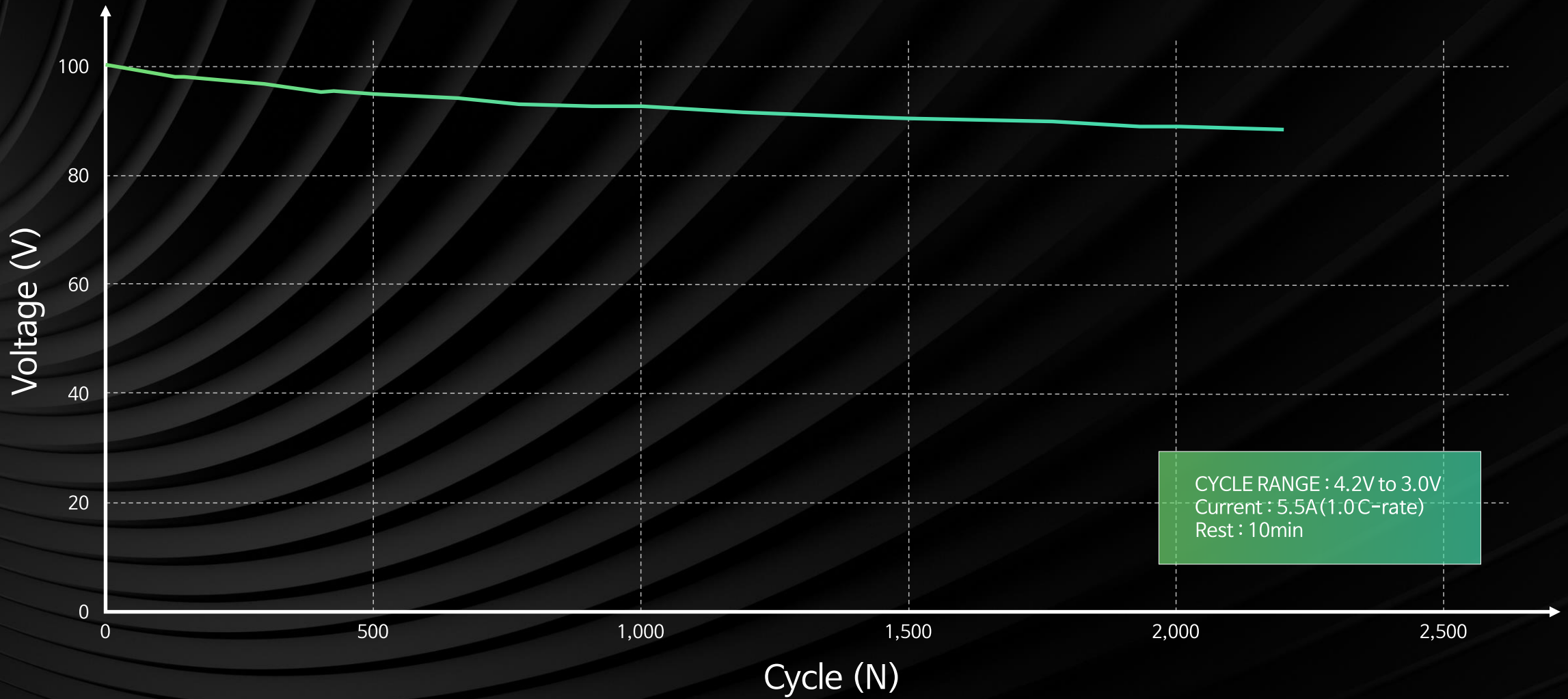
CO-DEVELOPMENT FOR MASS PRODUCTION OF SOLID BATTERIES
: Confirmation of product concept and evaluation of performance/quality on going to target the Japanese market
* Local Battery Pack manufacturer N

Battery performance evaluation
: Battery for semiconductor process, battery for military use, electric bicycle (motorcycle) etc.
* Local semiconductor equipment company S, local defense industry companies H, L, local electronics company E

EV

CO-DEVELOPMENT OF EV BATTERIES UNDER DISCUSSION
: GLOBAL AUTOMOBILE COMPANY B

CYCLE CHARACTERISTICS



SEVENKING CELLS

DISCLAIMER

GENERAL

The information provided in this document is intended to demonstrate technology, business content, management policies, plans, financial conditions, etc of Sevenking Energy Co., Ltd. (hereinafter referred to as Our company) and does not guarantee the accuracy of the information.

FUTURE PROSPECTS

Any information in this document other than historical-only facts is based on our judgment at the time on of publication. These future forecasts include various risks and uncertainties, such as changes in business, market, finance, politics, and legal conditions at home and abroad. Therefore, the actual performance published in the future may vary depending on these various factors, and we are not responsible for any damages caused by the use of information in this document. In addition, we are not obligated to amend or publish future forecasts posted in this document through new information or future events, and we do not promise to do so.

INVESTMENT JUDGMENT

The information in this document is not intended to encourage investment. Please make a final decision on investment, etc. under the user's own judgment and discretion.

RISK RELATED TO DEVELOPMENT AND COMMERCIALIZATION

- In the process of development, we may encounter unspecified variable delays; failures in accomplishing particular development objectives may delay or prevent successful commercialization of our products.
- Battery performance may not reach your goals.
- We are subject to risks relating to the construction and development activities of our manufacturing facilities.
- Certain components of our batteries contain safety risks that may cause accidents.
- The imbalance in the supply and demand of raw materials can have a practical and negative impact on our products.
- We can be adversely affected by COVID-19.

RISKS RELATING TO INTELLECTUAL PROPERTY

- If we are unable to protect our intellectual property rights, our business and position could be in jeopardy.
- Our patents may not be registered domestically or abroad, or patent rights may be restricted due to objection or invalidity even after registration.

OTHER RISKS

- Our operations expose us to litigation, environmental, and other legal compliance risks.
- Incorrect estimates or assumptions of financial statements can adversely affect reported assets, liabilities, and returns.

RISK FACTORS