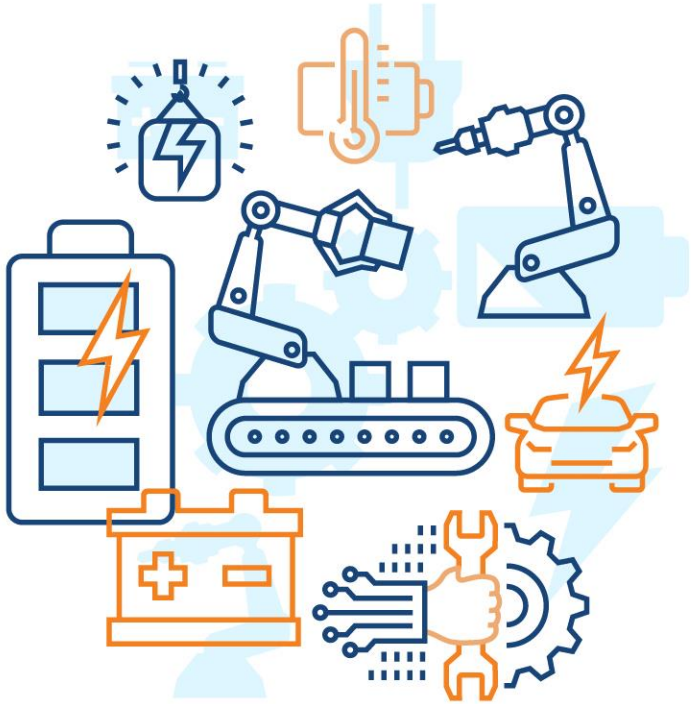
Battery Equipment (Overweight)

A supercycle is coming

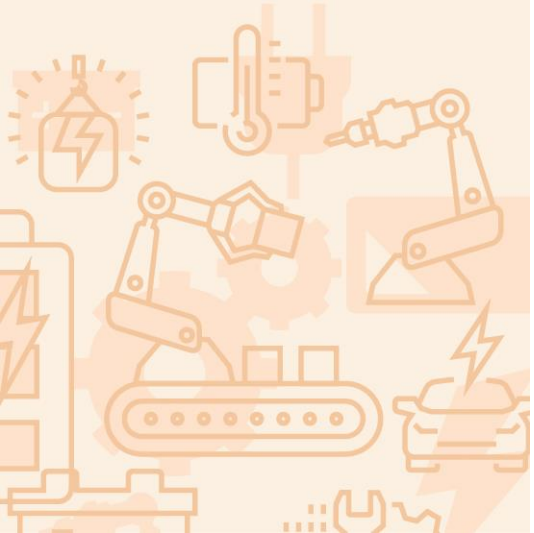


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MIRAE ASSET Securities

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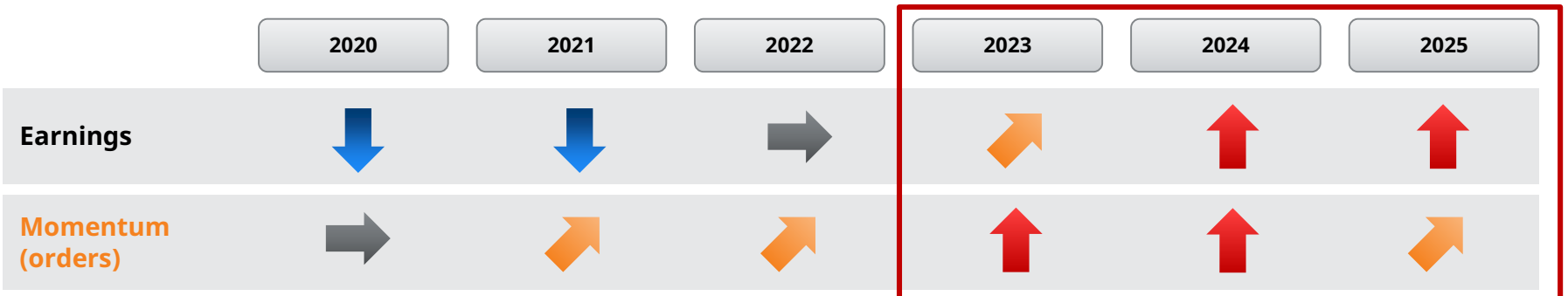
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[Summary] Battery equipment supercycle amid US ramp-ups



Earnings	**External risks** ① Delays to China revenue recognition; unpaid receivables recognized as losses ② SK On-LG Energy Solution (LGES) litigation **Delays to revenue recognition** ① Customer request for delay to delivery ② Customer request for parts replacement (Mitsubishi PLC → Siemens PLC)	**US market to take off** US capex to expand markedly compared with other regions **Revenue to grow sharply in 2024 and 2025** Order backlog to translate into revenue: Revenue recognition likely to accelerate, as most battery equipment suppliers recognize revenue upon delivery
Momentum (orders)	**Limited order intake due to the pandemic** Conservative capex stance in 2020-21 **Continued Europe/China-oriented capacity expansion** Equipment orders have expanded since 2021	**US-led battery equipment cycle** US capacity additions through end-2025: 400GWh (245GWh for LGES; 129GWh for SK On; 24GWh or more for Samsung SDI) **JVs in the US** GM4 (Samsung SDI/LGES), Ford Europe JV (LGES), Hyundai Motor US JVs (LGES/SK On), Toyota US JV (LGES), BMW North America and Europe JVs (Samsung SDI; 4680 battery orders to be placed full swing)

Source: Mirae Asset Securities Research

I

2023 outlook

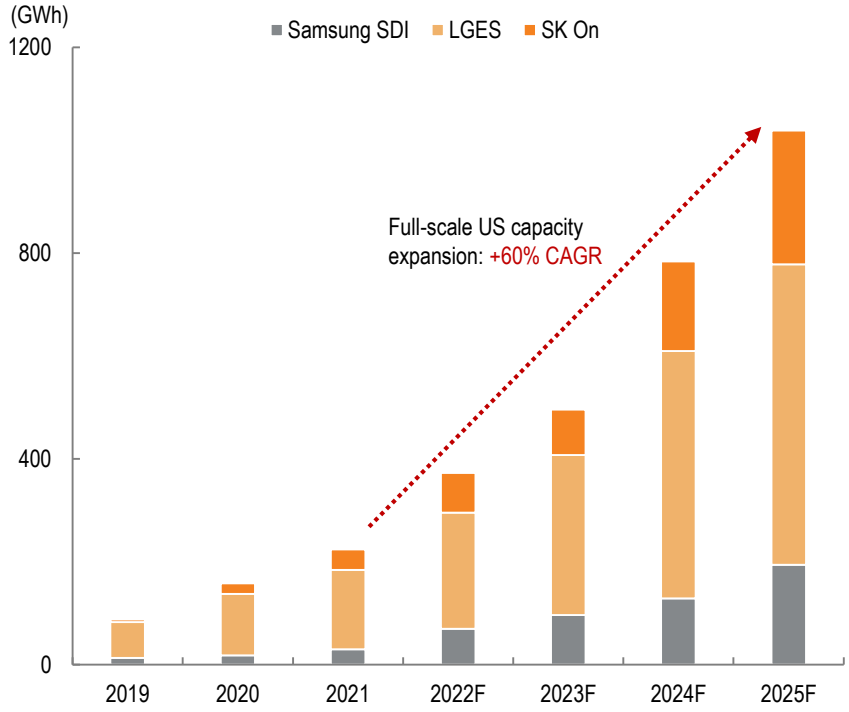


I. Battery equipment market outlook

2023: US capacity expansion to benefit equipment suppliers; equipment orders to expand full swing

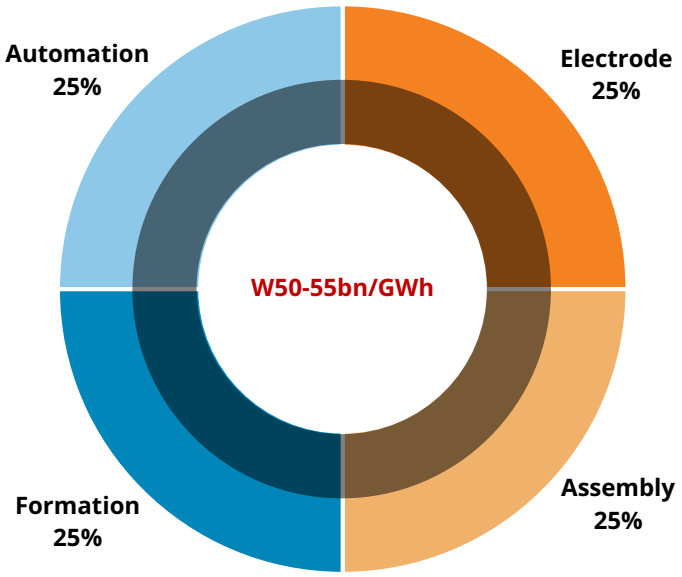
- We expect the three domestic battery suppliers to add combined capacity of more than 400GWh in the US by 2025.
- The average capex per 1GWh stands at around W130bn, of which equipment accounts for more than 40%.
- In 2023, we expect the three domestic battery suppliers to place combined equipment orders of W13.5tr (equivalent to W50-55bn per GWh).
- We estimate the share of equipment in total capex (which typically rises in line with a project's scale) will rise to over 50% (vs. 30-40% currently).
- US sites will likely have a higher share of equipment, given their larger scale compared to existing sites in China, Hungary, and Poland.

Capacity outlook by domestic battery supplier



Source: Mirae Asset Securities Research

2023F combined battery equipment orders



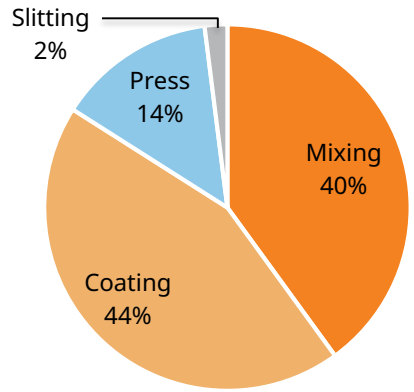
Source: Mirae Asset Securities Research

I. Battery equipment market outlook

Market breakdown by pouch battery process

Electrode process equipment breakdown

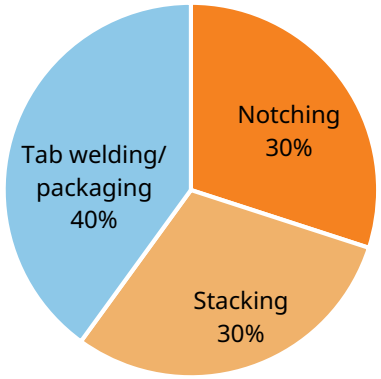
Est. at W10-12.5bn/GWh



Source: Mirae Asset Securities Research estimates

Assembly process equipment breakdown

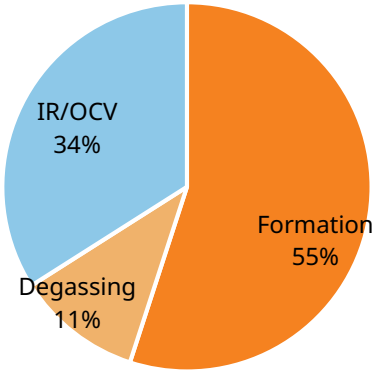
Est. at W10-12.5bn/GWh



Source: Mirae Asset Securities Research estimates

Formation process equipment breakdown

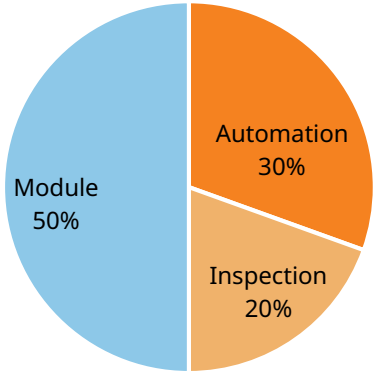
Est. at W10-12.5bn/GWh



Source: Mirae Asset Securities Research estimates

Automation process equipment breakdown

Est. at W10-12.5bn/GWh



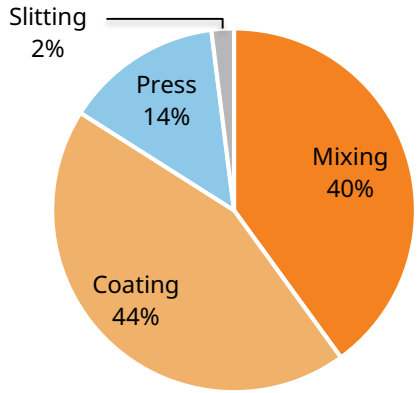
Source: Mirae Asset Securities Research estimates

I. Battery equipment market outlook

Market breakdown by prismatic battery process

Electrode process equipment breakdown

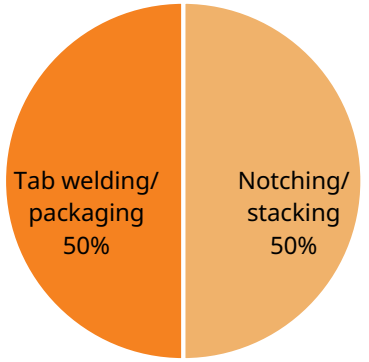
Est. at W10-12.5bn/GWh



Source: Mirae Asset Securities Research estimates

Assembly process equipment breakdown

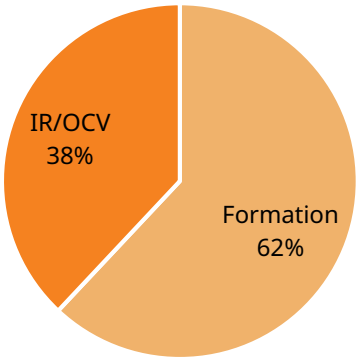
Est. at W10-12.5bn/GWh



Source: Mirae Asset Securities Research estimates

Formation process equipment breakdown

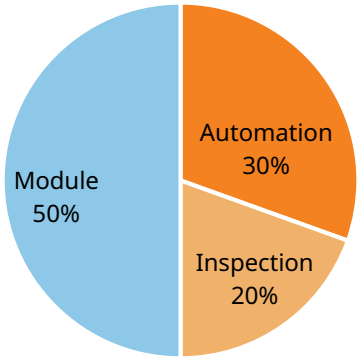
Est. at W10-12.5bn/GWh



Note: Unlike polymer batteries, prismatic batteries do not need a degassing process
Source: Mirae Asset Securities Research estimates

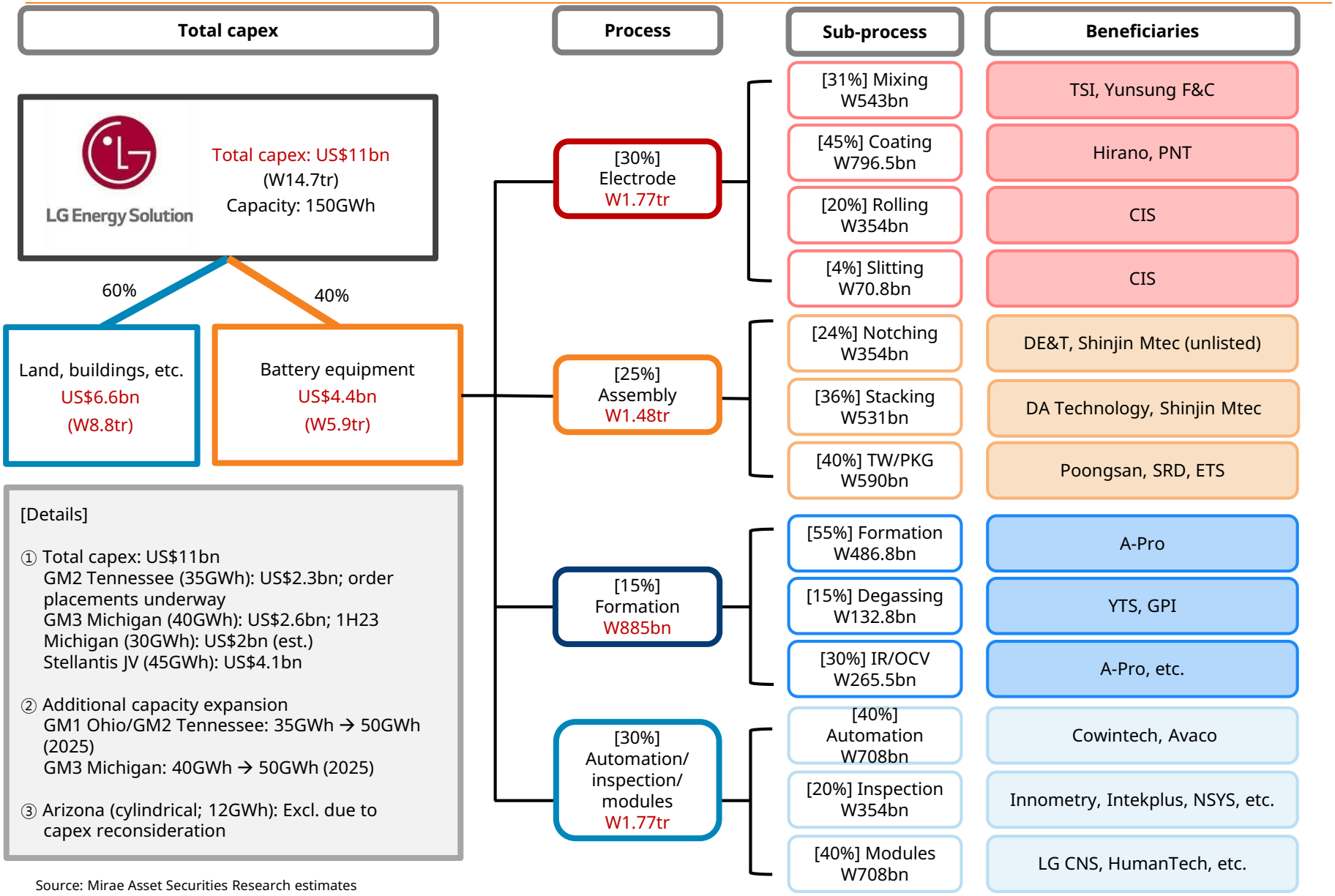
Automation process equipment breakdown

Est. at W10-12.5bn/GWh



Source: Mirae Asset Securities Research estimates

I. 2023F US equipment orders from LGES



[Details]

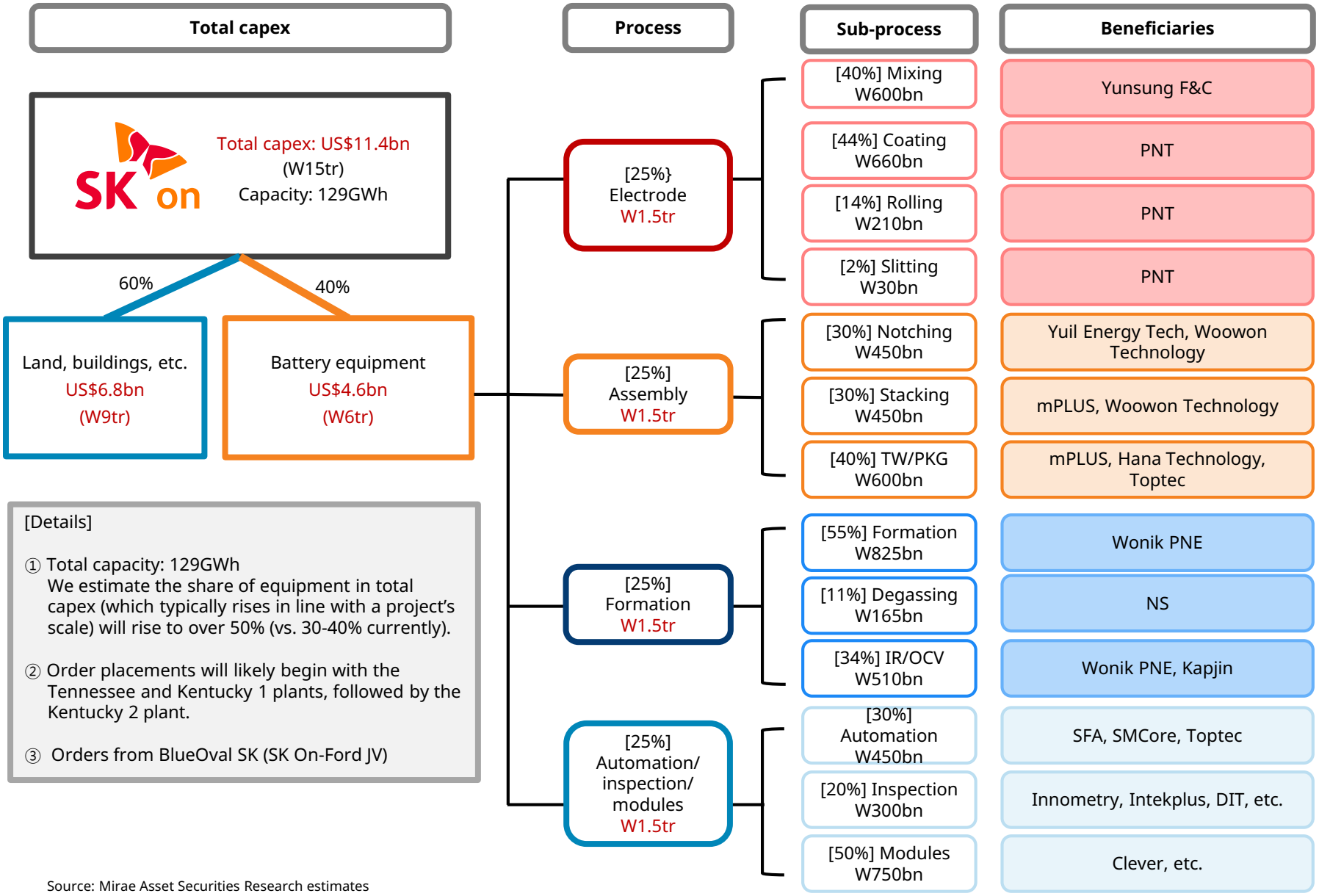
① Total capex: US$11bn
GM2 Tennessee (35GWh): US$2.3bn; order placements underway
GM3 Michigan (40GWh): US$2.6bn; 1H23
Michigan (30GWh): US$2bn (est.)
Stellantis JV (45GWh): US$4.1bn

② Additional capacity expansion
GM1 Ohio/GM2 Tennessee: 35GWh → 50GWh (2025)
GM3 Michigan: 40GWh → 50GWh (2025)

③ Arizona (cylindrical; 12GWh): Excl. due to capex reconsideration

Source: Mirae Asset Securities Research estimates

I. 2023F US equipment orders from SK On



[Details]

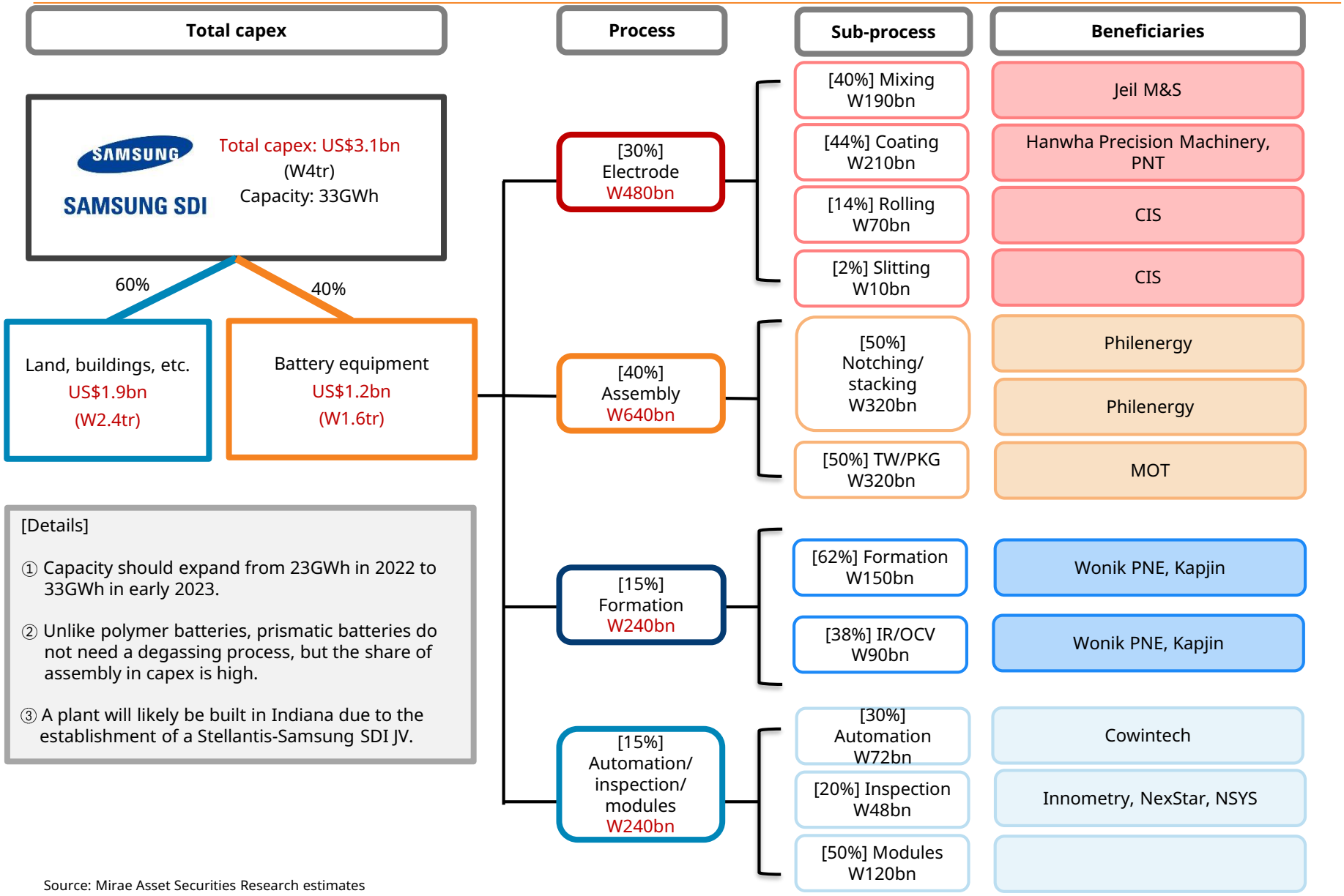
① Total capacity: 129GWh
We estimate the share of equipment in total capex (which typically rises in line with a project's scale) will rise to over 50% (vs. 30-40% currently).

② Order placements will likely begin with the Tennessee and Kentucky 1 plants, followed by the Kentucky 2 plant.

③ Orders from BlueOval SK (SK On-Ford JV)

Source: Mirae Asset Securities Research estimates

I. 2023F US equipment orders from Samsung SDI



[Details]

① Capacity should expand from 23GWh in 2022 to 33GWh in early 2023.

② Unlike polymer batteries, prismatic batteries do not need a degassing process, but the share of assembly in capex is high.

③ A plant will likely be built in Indiana due to the establishment of a Stellantis-Samsung SDI JV.

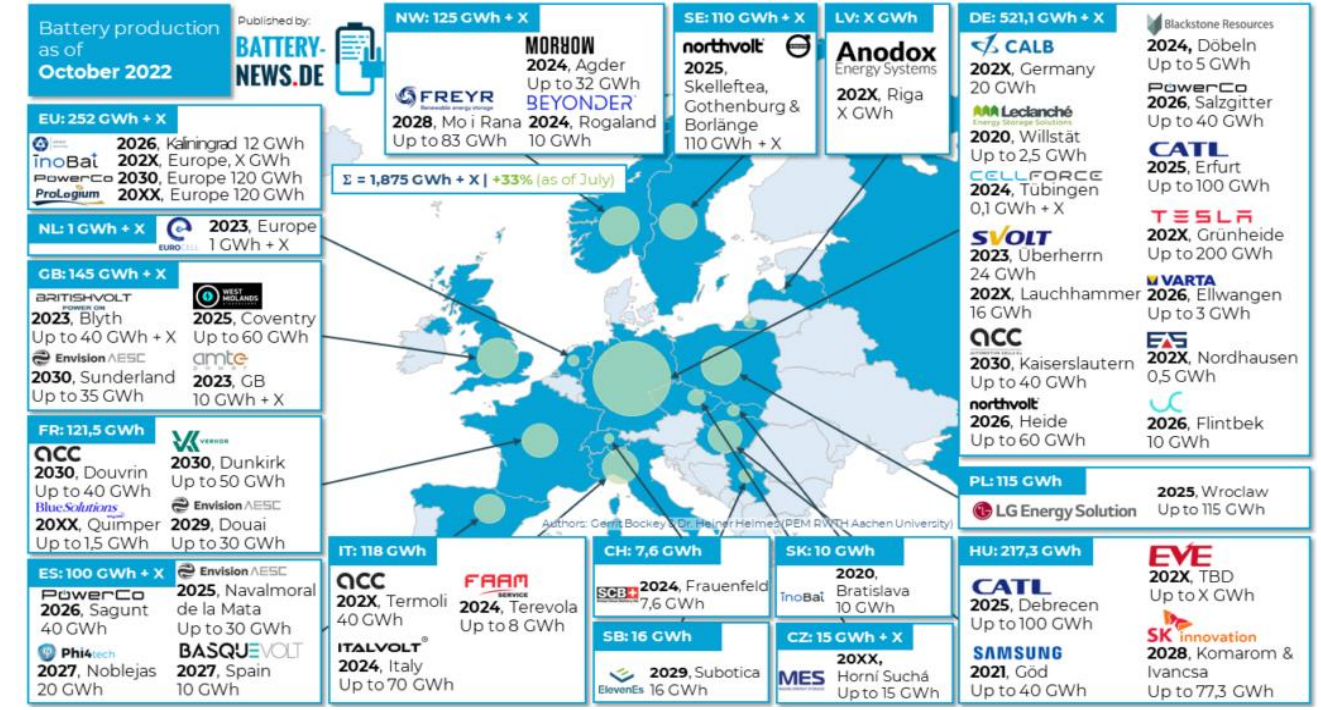
Source: Mirae Asset Securities Research estimates

I. 2023 order placement outlook

European battery start-ups to meet their production capacity targets, albeit slowly

- In Oct. 2022, Europe's battery production capacity expanded 33% (vs. Jul.) to 1,875GWh.
- Thanks to their solid track record, Korean battery equipment makers are well-positioned to keep winning orders from new battery cell makers.
- European battery start-ups seem to prefer Korean battery equipment suppliers over Chinese players (with price advantages). For example, starting with its second plant, Northvolt expanded orders for Korean-made equipment due to yield issues with Chinese-made equipment introduced in the first plant.
- We forecast new battery production facilities in Europe to come online from 2024. While investments have been delayed due to funding difficulties (stemming from higher interest rates and the equity market slump), we think Europe remains committed to internally sourcing batteries.

European battery cell makers' capacity ramp-up road map



Source: Battery-News.de, Mirae Asset Securities Research

I. 2023 order placement outlook

European battery start-ups to meet their production capacity targets, albeit slowly

- Newer battery cell companies favor turnkey solutions for each process, due to their lack of equipment management know-how and limited knowledge of individual equipment offerings.
- Overseas cell makers seem to prefer the partnership approach of guaranteeing a certain level of margins for equipment suppliers. Supplies to overseas cell makers typically fetch over 5%p higher margins than those bound for domestic customers.
- Any order intake from pilot lines suggests a high possibility of winning orders from actual production facilities later on.

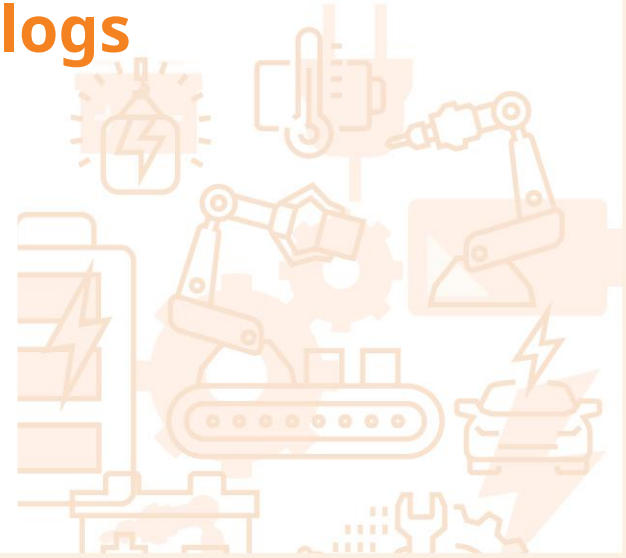
Domestic battery equipment suppliers' order intake from overseas customers

	Northvolt	ACC	Britishvolt	FREYR	Morrow	Verkor	AESC
Production capacity target	110GWh	120GWh	43GWh	200GWh	43GWh	50GWh ↑	300GWh
Target year	2026	2030	2028	2030	2028	2030	2026
Size	15GWh	13.3GWh	5GWh	Pilot	Pilot	Pilot	Mass production
Electrode	CIS	TSI, PNT (pilot lines)	CIS		TSI, PNT (pilot lines)		CIS
Assembly	Hana Technology		Manz	Hana Technology	Youil Energy Tech, Philenergy, MOT	mPLUS	mPLUS
Formation	SFA		Hana Technology	Hana Technology	Kapjin		
Automation	SFA			Hana Technology	Cowintech	SFA	

Source: Mirae Asset Securities Research estimates

II

Order backlogs

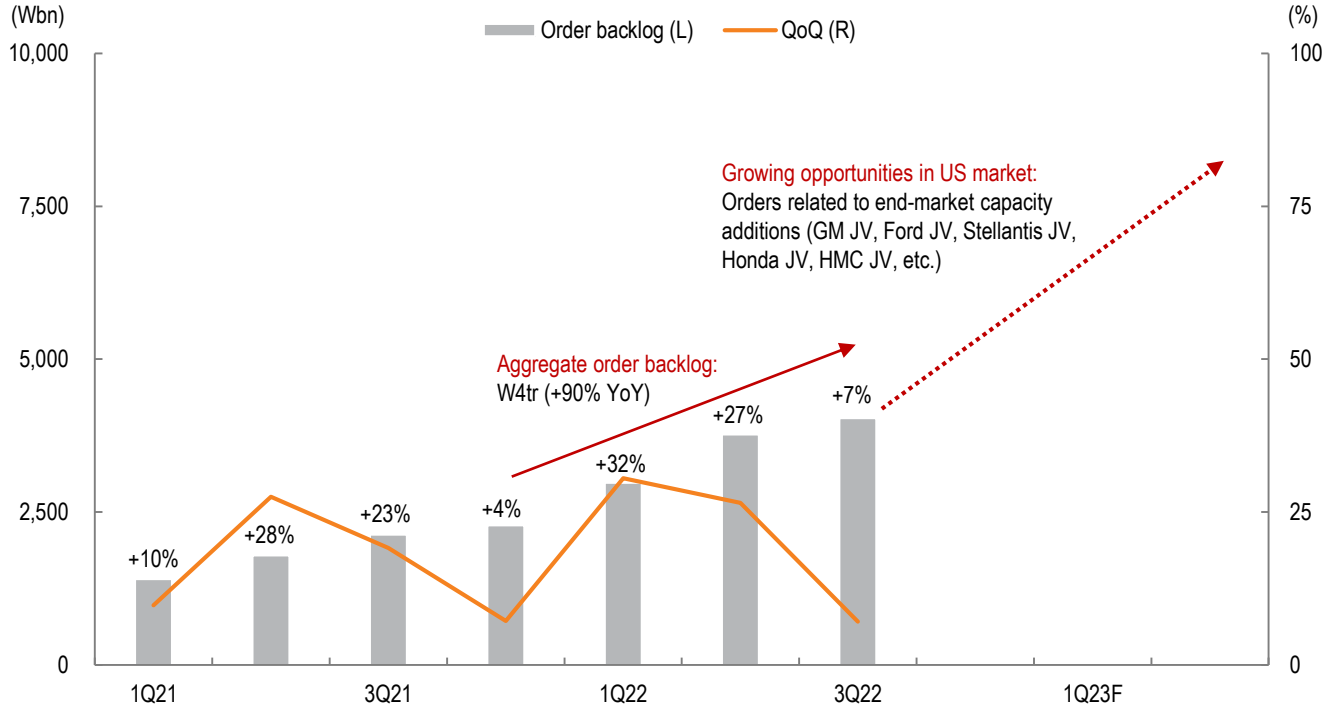


II. Order backlog expansion

Order backlogs to grow further in 2023

- As of end-3Q22, key battery equipment makers have a combined equipment order backlog of W3.7tr (+90% YoY).
- Order backlogs jumped 73% YoY for electrode fabrication equipment, 60% YoY for assembly equipment, 110% YoY for back-end formation equipment, and 55% YoY for inspection/electromagnetic filtering equipment.
- We expect order backlogs to continue growing QoQ through 2024.
- Taking into account the average lead time of one to two years, we expect battery equipment suppliers to post solid earnings going forward.

Combined order backlog of major battery equipment suppliers

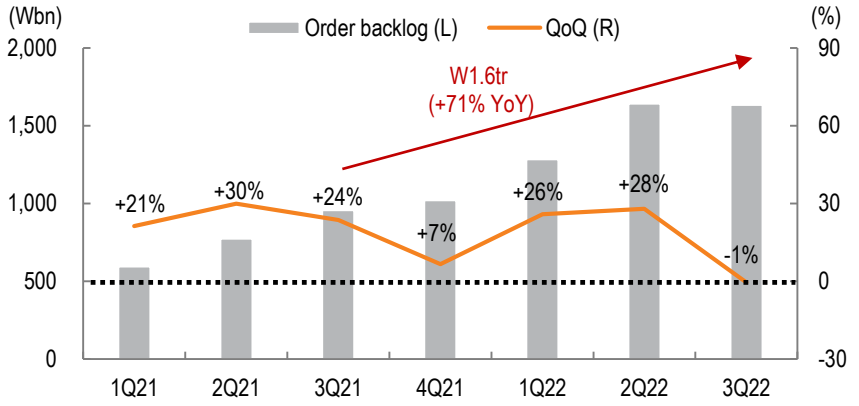


Source: Mirae Asset Securities Research

II. Order backlog expansion

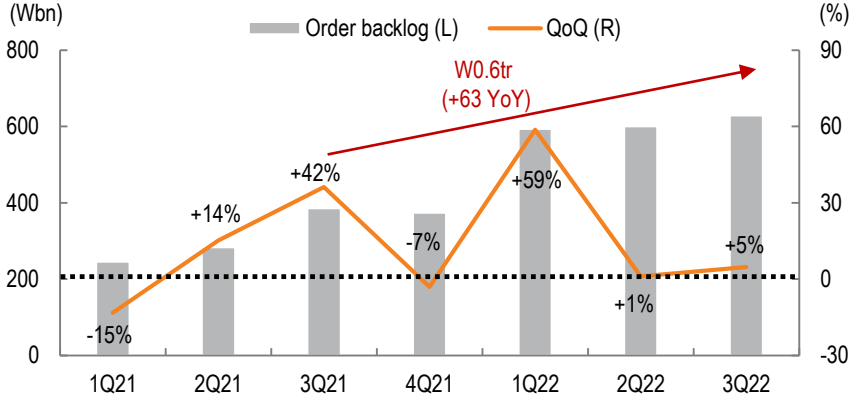
Order backlog by process

Electrode fabrication process



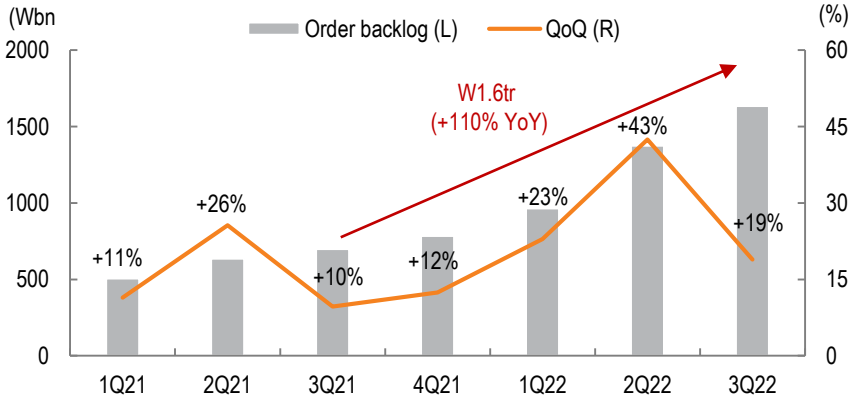
Note: Aggregate backlog of TSI, PNT, and CIS
Source: Mirae Asset Securities Research

Assembly process



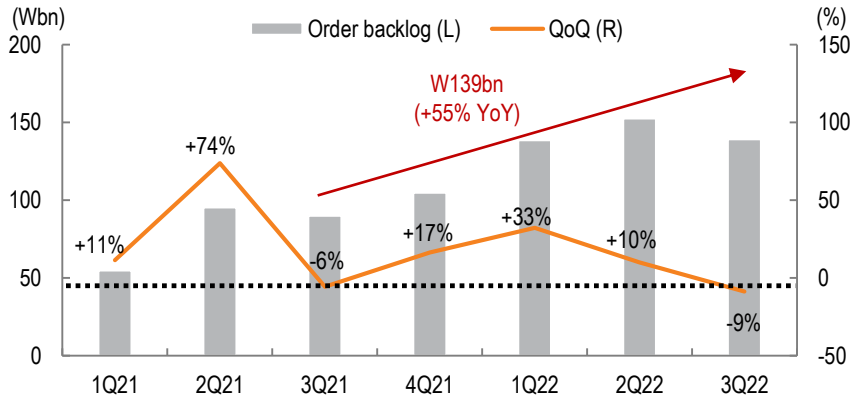
Note: Aggregate backlog of mPLUS, Youil Energy Tech, Philoptics, DA Technology, and DE&T
Source: Mirae Asset Securities Research

Formation and automation processes



Note: Aggregate backlog of Hana Technology, SFA, NS, Cowintech, Wonik PNE, and Apro
Source: Mirae Asset Securities Research

Inspection/electromagnetic filtering and other processes



Note: Aggregate backlog of NSYS, Daebo Magnetic, V-One Tech, and Innometry
Source: Mirae Asset Securities Research

III

Technological landscape



III. Investment points

Technological trends

- We note improving efficiency in the electrode fabrication process. While the number of units may decrease, high technological barriers and know-how should allow suppliers to maintain ASP growth and high margins. ① Mixers: 2,300L → 4,000L, ② Coaters: Short → long axis, ③ Rolling: Thickness deviation within 1.5μm → 1.3μm
- For the assembly process, we note growth in the number of notching and stacking units amid growing production efficiency. ① LGES adopted laser notching, but Samsung SDI and SK On still use press notching. ② In-line notching and stacking
- For the formation process, high-temperature/pressure formation is minimizing bulk. Development of power switches is needed.
- Automation process: 80% automation → 100% automated smart factory

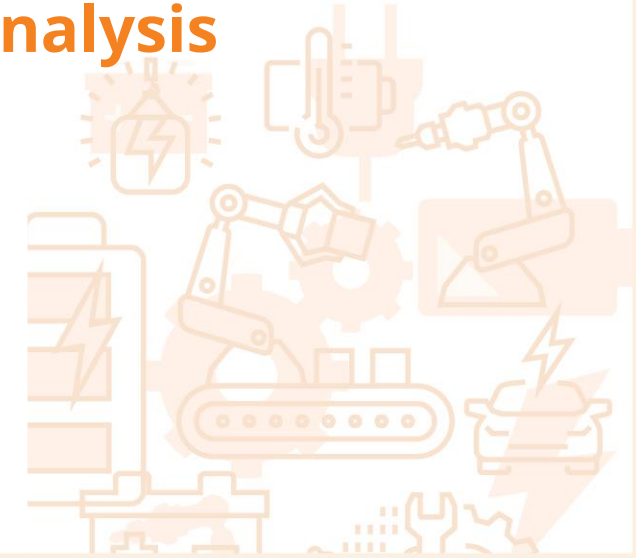
Battery processes: High technological barriers to entry support high margins

Process	Steps	Current status	Future direction	Entry barriers	Margins
Electrode fabrication	Mixing	4,000L and cathode materials mixer	Continuous mixer	High	High
	Coating	Wet process (thickness 6μm, width 1,400mm, production speed 100m/min)	Dry process	High	High
	Rolling	Thickness control: 1.3μm, 100m/min	Thickness control: 1.3μm or below, ppm improvement	High	High
	Slitting	Burrs: 7μm, 100m/min	Burr problems to be minimized; ppm improvement	Moderate	Low
Assembly	Notching	Laser notching, 1,000mm/s, non-coated surface	Laser notching, coated surface	High	High
	Stacking	0.5-0.6 sec/sheet In-line press notching & stacking	0.4-0.45 sec/sheet In-line laser notching & stacking	Moderate	Moderate
	Tab welding/ packaging	12-15ppm	ppm improvement, bulk minimization	Low	Moderate
Formation	Formation	High-temperature/pressure formation	Power switch/software development	Moderate	Low
	X-ray inspection	2D X-ray equipment	In-line 3D CT non-destructive equipment	Moderate	Moderate
Automation	Automated logistics system	80% automated	Smart factory: 100% automated	Moderate	Moderate

Source: Mirae Asset Securities Research

IV

Company analysis



People & Technology (137400 KQ)

Top pick

A supercycle is coming

(Maintain)	Buy
Target price (12M, W)	**76,500**
Current price (11/18/22, W)	48,450
Expected return	58%

Investment points

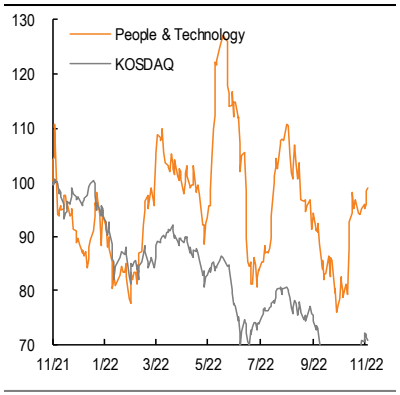
- We raised our 2023 revenue forecast by 14% to W695.8bn (+149% YoY). We also upped our 2023 operating profit forecast by 13% to W112bn (+53% YoY; OP margin of 16.1%) and our 2023 EPS forecast by 15% to W3,932.
- BlueOval SK is expected to begin large-scale battery equipment order placements starting in late November. If PNT were to take orders for coaters, slitters, and roll presses (electrode process), we estimate its maximum order intake at W900bn.
- PNT also stands to benefit from its domestic customers' anticipated entries into the US.
- With SK On's third European plant (Hungary; 30GWh) and Yancheng factory (30GWh) set to come online in 2024, we think PNT will begin recognizing related revenue in 2023.

Risk factors

- A potential decline in EV demand could drive down battery demand from EV makers, thus limiting the scale of battery capacity ramp-ups.
- Aggressive capex by Japanese rivals

OP (22F, Wbn)	73
Consensus OP (22F, Wbn)	72
EPS growth (22F, %)	47.1
P/E (22F, x)	14.0
Market P/E (22F, x)	11.3
KOSDAQ	731.92
Market cap (Wbn)	1,102
Shares outstanding (mn)	23
Free float (%)	79.8
Foreign ownership (%)	8.8
Beta (12M)	1.26
52-week low (W)	37,200
52-week high (W)	62,300

(%)	1M	6M	12M
Absolute	19.9	3.3	-5.6
Relative	14.2	23.0	33.3



(Dec.)	2019	2020	2021	2022F	2023F
Revenue (Wbn)	321	390	378	465	696
OP (Wbn)	1	55	54	73	112
OP margin (%)	0.3	14.1	14.3	15.7	16.1
NP (Wbn)	-2	36	53	79	89
EPS (W)	-113	1,679	2,355	3,465	3,932
ROE (%)	-2.6	33.6	33.5	35.0	29.2
P/E (x)	-	14.6	18.6	14.0	12.3
P/B (x)	1.6	4.0	5.2	4.1	3.1
Div. yield (%)	0.0	0.4	0.3	0.3	0.3

Notes: Under consolidated K-IFRS; NP is attributable to owners of the parent

Source: Company data, Mirae Asset Securities Research estimates

People & Technology (137400 KQ)

Top pick

Income statement (summarized)

(Wbn)	2021	2022F	2023F
Revenue	378	465	696
Cost of revenue	294	358	532
GP	84	107	164
SG&A expenses	29	34	52
OP (adj.)	54	73	112
OP	54	73	112
Non-operating profit	17	22	1
Net financial income	-1	0	1
Net income from associates	0	-1	0
Pretax profit	71	95	113
Income tax	18	17	25
Profit from continuing operations	53	78	89
Profit from discontinued operations	0	0	0
NP	53	78	89
Attributable to owners	53	79	89
Attributable to minority interests	-1	-1	-1
Total comprehensive income	54	80	89
Attributable to owners	55	80	89
Attributable to minority interests	-1	-1	-1
EBITDA	58	77	115
FCF	17	87	74
EBITDA margin (%)	15.3	16.6	16.5
OP margin (%)	14.3	15.7	16.1
Net margin (%)	14.0	17.0	12.8

Balance sheet (summarized)

(Wbn)	2021	2022F	2023F
Current assets	437	1,015	1,665
Cash & equivalents	31	221	482
AR & other receivables	61	53	78
Inventory	290	591	885
Other current assets	55	150	220
Non-current assets	139	159	156
Investments in associates	0	0	0
PP&E	102	133	130
Intangible assets	3	3	3
Total assets	576	1,175	1,821
Current liabilities	363	773	1,134
AP & other payables	71	74	111
Short-term financial liabilities	25	35	29
Other current liabilities	267	664	994
Non-current liabilities	36	148	348
Long-term financial liabilities	35	147	347
Other non-current liabilities	1	1	1
Total liabilities	399	921	1,482
Equity attributable to owners	187	263	349
Capital stock	11	11	11
Capital surplus	56	56	56
Retained earnings	124	199	285
Minority interests	-9	-9	-10
Shareholders' equity	178	254	339

Key valuation metrics/ratios

	2021	2022F	2023F
P/E (x)	18.6	14.0	12.3
P/CF (x)	17.2	12.3	9.6
P/B (x)	5.2	4.1	3.1
EV/EBITDA (x)	17.5	16.3	10.9
EPS (W)	2,355	3,465	3,932
CFPS (W)	2,548	3,937	5,065
BPS (W)	8,380	11,766	15,551
DPS (W)	150	150	150
Dividend payout ratio (%)	6.3	4.3	3.8
Dividend yield (%)	0.3	0.3	0.3
Revenue growth (%)	-3.2	23.1	49.6
EBITDA growth (%)	-1.0	32.2	50.1
OP growth (%)	-1.6	34.9	52.7
EPS growth (%)	40.3	47.1	13.5
AR turnover (x)	6.9	8.4	11.0
Inventory turnover (x)	1.6	1.1	0.9
AP turnover (x)	4.8	5.1	6.0
ROA (%)	10.4	8.9	5.9
ROE (%)	33.5	35.0	29.2
ROIC (%)	28.8	33.9	46.9
Debt-to-equity ratio (%)	224.3	362.5	436.8
Current ratio (%)	120.5	131.4	146.9
Net debt-to-equity ratio (%)	15.5	45.1	32.5
Interest coverage ratio (x)	38.3	37.5	24.8

Source: Company data, Mirae Asset Securities Research estimates

V

Appendix 1

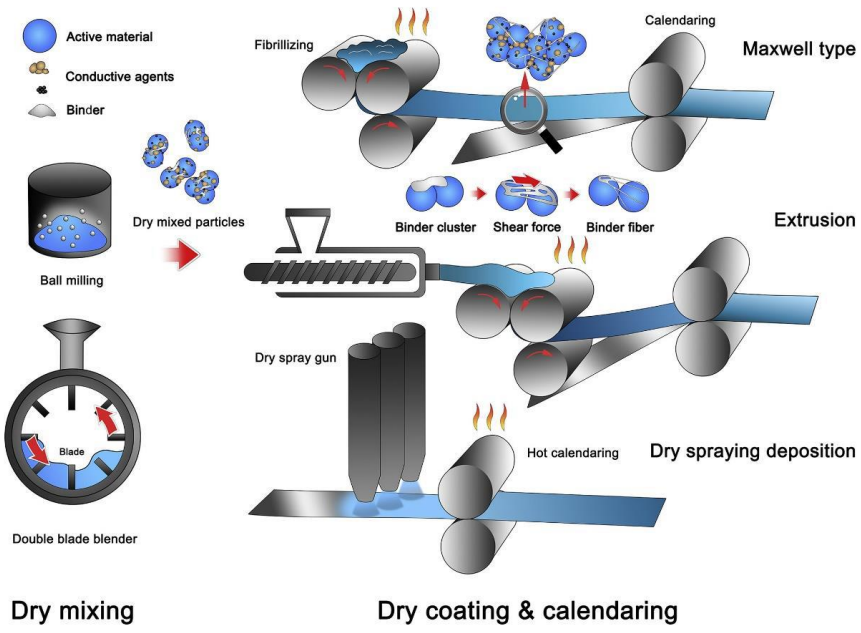


V. Appendix 1

Challenges ahead for dry coaters

- Given the challenges involved in dry coater mass production, we expect wet processes to remain the dominant coating method for at least the next three years. For dry coaters to be widely adopted, several issues need to be addressed, including: 1) the development of special binders; 2) the timing of introduction; and 3) production speed and compatibility.
- Dry coating processes require special binders, such as Teflon (PTFE) binders. However, economies of scale through mass production have yet to be achieved.
- It takes at least three years from pilot production to mass production. The production speed of dry coaters, at around 10m/min according to Fraunhofer IWS, is not yet fast enough for mass production.

Dry coating technologies being studied: 1) Maxwell type; 2) extrusion type; 3) dry spraying deposition



Source: Korea Institute of Energy Research, Mirae Asset Securities Research

DRYtraec developed by Fraunhofer IWS



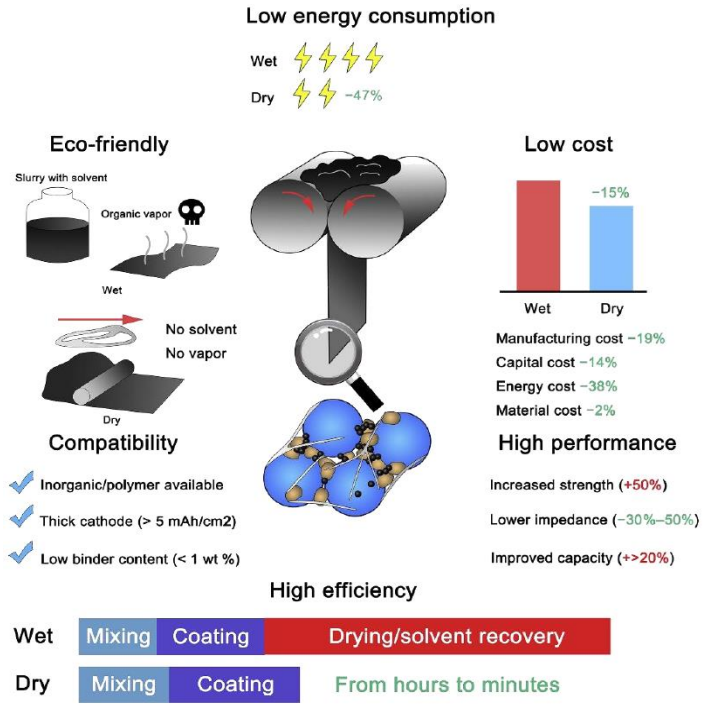
Source: Fraunhofer IWS, Mirae Asset Securities Research

V. Appendix 1

Advantages of dry coating (vs. wet processes)

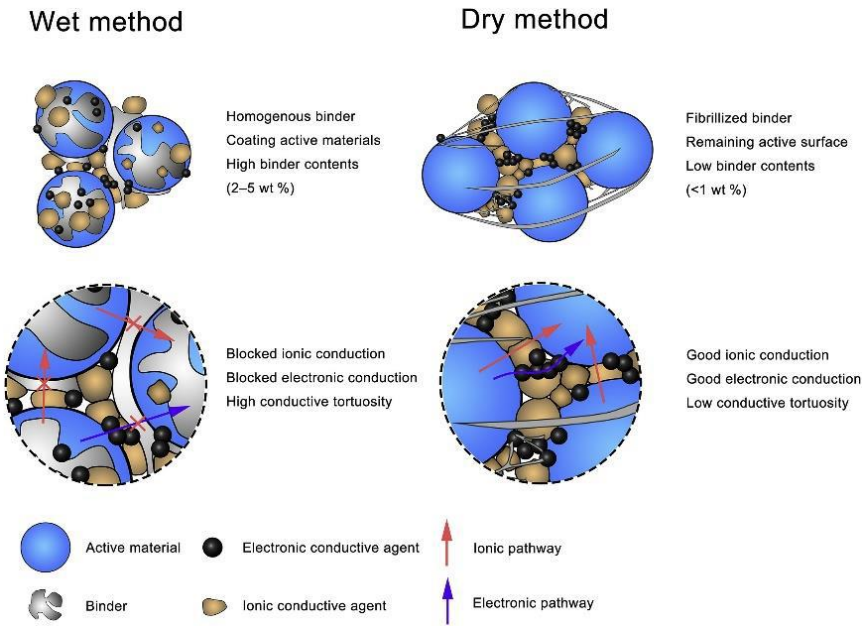
- ① Eco-friendly: No need for organic solvents → no toxic materials
- ② Energy saving: 47% lower energy consumption during production
- ③ Lower costs: -17% for production, -14% for coaters, -38% for electricity, -2% for materials
- ④ High compatibility: Thicker cathode materials (>5mAh/cm^2), lower binder content (<1wt%) → higher energy density
- ⑤ Better performance: Improved durability (+50%), larger capacity (+20%), lower impedance (-30% to -50%)

Dry coating is superior to wet processes by every measure



Source: Korea Institute of Energy Research, Mirae Asset Securities Research

Dry coating: Higher ionic conductivity thanks to lower binder content



Source: Korea Institute of Energy Research, Mirae Asset Securities Research

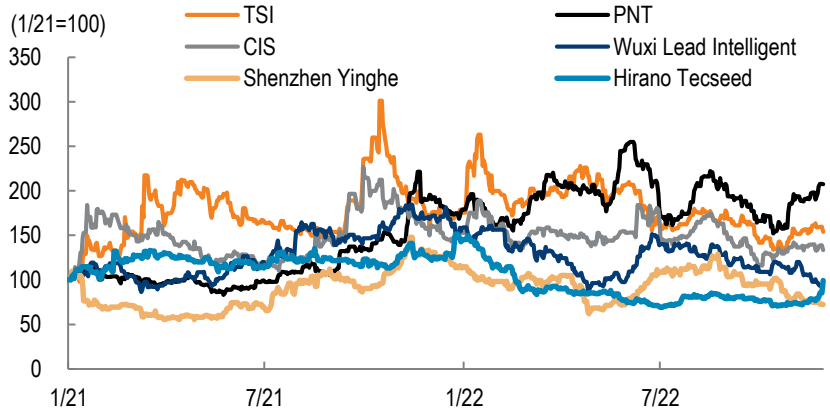
V. Appendix 1

Peer valuations: Electrode fabrication equipment suppliers (Wbn, %, x)

Company	Market cap (Wbn)	Revenue		OP		NP		ROE		P/E		P/B		EV/EBITDA	
		2022F	2023F	2022F	2023F	2022F	2023F	2022F	2023F	2022F	2023F	2022F	2023F	2022F	2023F
TSI	178	149	232	9	27	8	16	17.4	27.3	22.5	11.2	3.6	2.7	24.2	9.3
PNT	1,102	444	621	72	105	68	88	32.6	29.1	16.0	12.5	4.3	2.9	16.3	10.4
CIS	816	156	224	17	28	15	24	5.7	8.2	100.7	57.9	5.4	4.9	-	-
Wuxi Lead Intelligent	13,417	3,047	4,359	544	806	502	753	24.0	28.0	26.4	17.6	6.1	4.9	23.4	15.5
Shenzhen Yinghe	2,439	1,676	2,189	110	197	107	188	9.5	14.6	22.8	12.9	2.1	1.8	24.6	14.3
Hirano Tecseed	275	396	444	32	43	25	31	7.2	-	10.8	8.5	-	-	-	-
Avg.								14.8	19.2	29.9	18.5	3.7	3.0	19.1	11.2

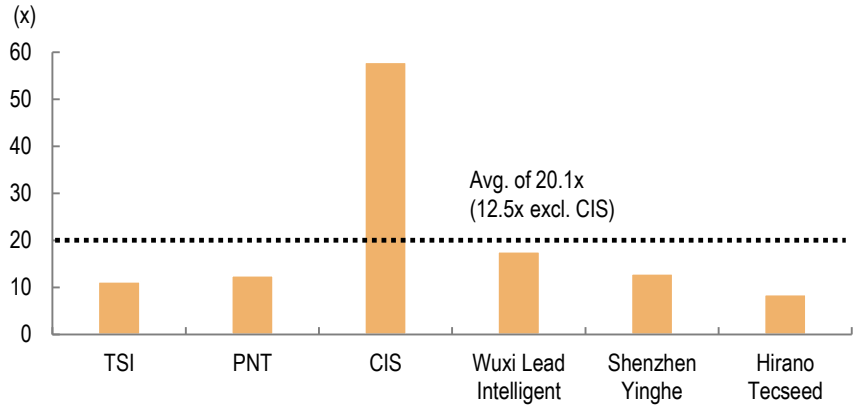
Source: Bloomberg, Mirae Asset Securities Research

Share performances of electrode fabrication equipment suppliers



Source: Bloomberg, Mirae Asset Securities Research

2023F P/Es of electrode fabrication equipment suppliers



Source: Bloomberg, Mirae Asset Securities Research

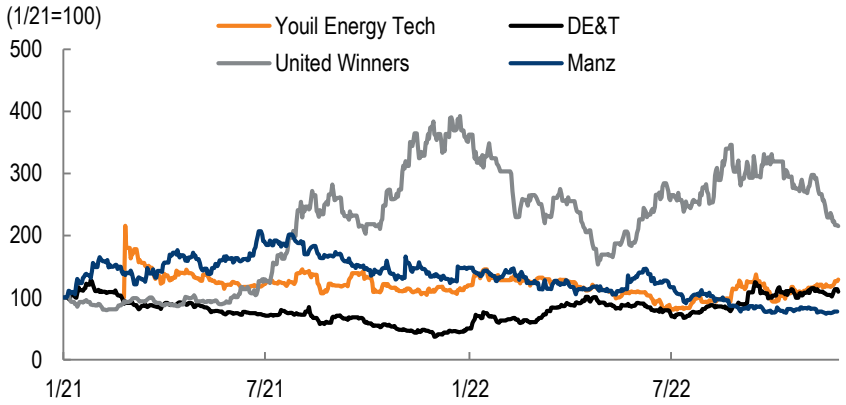
V. Appendix 1

Peer valuations: Cell assembly equipment suppliers (Wbn, %, x)

	Market cap (Wbn)	Revenue		OP		NP		ROE		P/E		P/B		EV/EBITDA	
		2022F	2023F	2022F	2023F	2022F	2023F	2022F	2023F	2022F	2023F	2022F	2023F	2022F	2023F
DE&T	149	56	121	1	20	2	18	6.4	48.7	86.5	8.4	5.4	3.3	74.1	7.2
Fujian Nebula	998	465	672	51	73	50	71	17.4	19.8	20.9	14.7	3.7	3.0	15.8	10.8
United Winners	1,755	870	1,136	122	172	107	155	25.4	27.0	16.3	11.9	4.1	3.2	13.7	10.0
Manz	292	495	588	21	34	12	22	6.9	10.3	22.2	13.3	1.4	1.2	8.6	6.2
Avg.								24.6	25.7	17.0	11.3	3.1	2.3	11.3	8.0

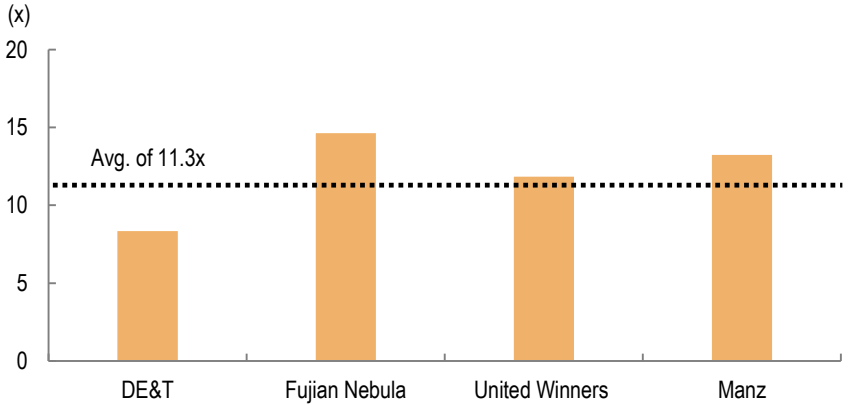
Source: Bloomberg, Mirae Asset Securities Research

Share performances of cell assembly equipment suppliers



Source: Bloomberg, Mirae Asset Securities Research

2023F P/Es of cell assembly equipment suppliers



Source: Bloomberg, Mirae Asset Securities Research

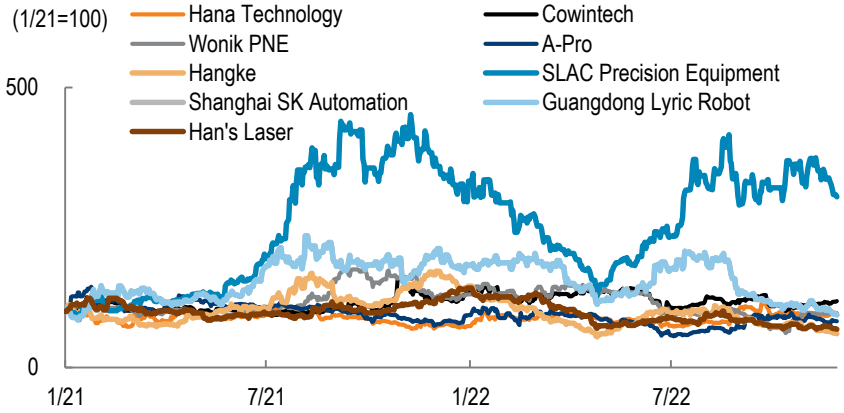
V. Appendix 1

Peer valuations: Formation equipment suppliers (Wbn, %, x)

	Market cap (Wbn)	Revenue		OP		NP		ROE		P/E		P/B		EV/EBITDA	
		2022F	2023F	2022F	2023F	2022F	2023F	2022F	2023F	2022F	2023F	2022F	2023F	2022F	2023F
Hana Technology	475	151	332	10	36	9	31	11.8	33.8	55.7	15.4	5.9	4.4	40.1	12.4
Cowintech	259	222	280	16	30	17	35	13.6	25.1	28.8	12.8	2.2	1.9	15.1	8.5
Wonik PNE	308	203	257	24	33	22	29	14.4	18.0	21.9	17.7	3.3	2.8	14.2	9.9
A-Pro	217	99	160	4	17	6	16	8.9	22.4	39.2	13.3	3.3	2.7	35.7	10.0
Hangke	3,646	792	1,241	126	235	118	217	18.6	26.1	31.1	14.5	5.1	4.2	25.4	13.3
Guangdong Lyric Robot	2,927	829	1,354	98	181	91	162	18.9	26.4	32.2	18.0	6.4	4.8	31.7	17.1
SLAC Precision Equipment	2,732	428	709	56	85	47	65	14.8	17.7	56.8	39.4	8.0	7.0	32.5	21.5
Shanghai SK Automation	910	422	669	29	78	39	60	14.2	19.1	24.7	15.8	4.0	3.2	74.0	13.6
Colibri	1,311	588	751	65	96	49	75	9.5	13.1	28.0	18.3	2.6	2.3	19.2	13.6
Avg.								13.9	22.4	35.4	18.4	4.5	3.7	32.0	13.3

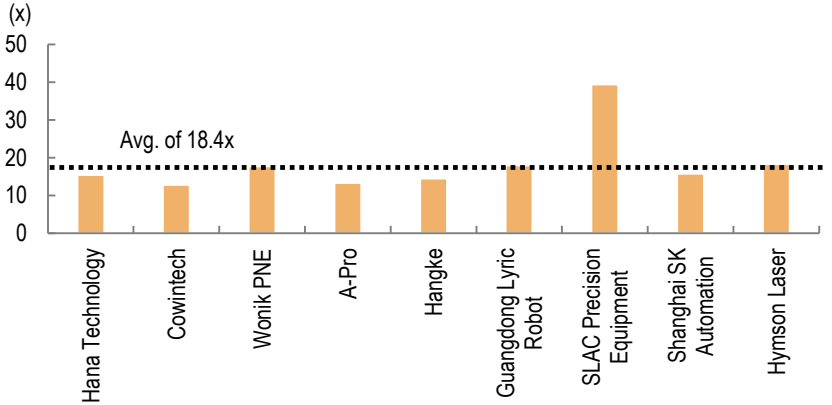
Source: Mirae Asset Securities Research

Share performances of formation & automation equipment suppliers



Source: Bloomberg, Mirae Asset Securities Research

2023F P/Es of formation & automation equipment suppliers



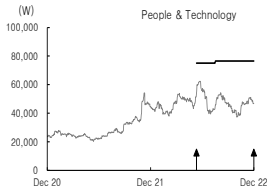
Source: Bloomberg, Mirae Asset Securities Research

Appendix 2

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Two-year rating and TP history

Company	Date	Rating	TP (W)	Company	Date	Rating	TP (W)
People & Technology (137400)							
	07/29/22	Buy	76,500				
	05/23/22	Buy	75,000				



Stock ratings	
Buy	Expected 12-month performance: +20% or greater
Trading Buy	Expected 12-month performance: +10% to +20%
Hold	Expected 12-month performance: -10% to +10%
Sell	Expected 12-month performance: -10% or worse

Sector ratings	
Overweight	Expected to outperform the market over 12 months
Neutral	Expected to perform in line with the market over 12 months
Underweight	Expected to underperform the market over 12 months

Rating and TP history: Share price (—), TP (▬), Not Rated (■), Buy (▲), Trading Buy (■), Hold (●), Sell (♦)
* Our investment rating is a guide to the expected return of the stock over the next 12 months.
* Outside of the official ratings of Mirae Asset Daewoo Co., Ltd., analysts may call trading opportunities should technical or short-term material developments arise.
* The TP was determined by the research analyst through valuation methods discussed in this report, in part based on estimates of future earnings.
* TP achievement may be impeded by risks related to the subject securities and companies, as well as general market and economic conditions.

Ratings distribution and investment banking services

	Buy	Trading Buy	Hold	Sell
Ratings distribution	86.7%	5.5%	7%	0.8%
Investment banking services	87.5%	12.5%	0%	0%

* Based on recommendations in the last 12-months (as of September 30, 2022)

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