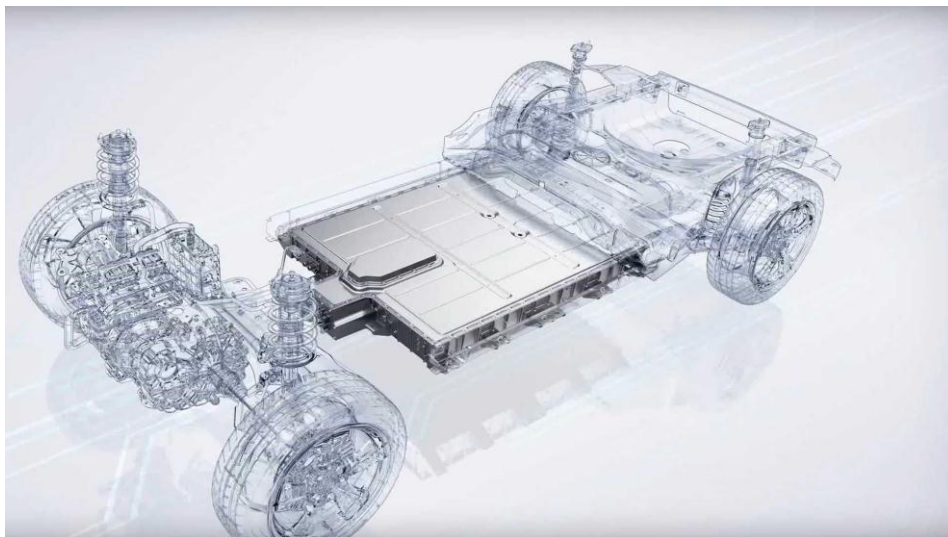


Electrical Components

KR EV Battery 2020: Momentum to rebuild



- We expect Korean battery makers to benefit from competition for new EVs (between global OEMs and Tesla) and the strong EU EV market.
- Korean EV battery makers should turn profitable in FY20-21F on the back of ~ 60% yoy EV battery sales growth in FY20-21F and margin expansion.
- We also highlight Korean cathode and elecfoil producers on strong capacity expansion, with greater demand for key materials from Korean cell makers.

Analyst(s)

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TABLE OF CONTENTS

Key Charts	4
Questions on battery industry (EV/ESS)	6
Korean EV battery makers at overcapacity?.....	6
EV/ESS battery could turn profitable in 2020?.....	8
ESS battery fires: can this be resolved?	9
EV industry outlook ➤	10
EV sales growth to recover from 2H20	10
Tighter emission standards fueling electrification	12
New EV models by EU OEMs and Tesla.....	15
Strong EU EV sales by subsidy and incentives	19
EV battery outlook ➤.....	20
High quality battery sellers' market for the next three years	20
KR battery to benefit from strong EU market	25
Decline in EV battery price to lead virtuous cycle of EV sales.....	29
Improvement in battery technology to lift demand for EVs	30
EV battery materials ➤.....	31
Cathodes are a crucial component of battery cells.....	31
Mid-term drivers of cost reduction could come from cathodes	34
Anode development with silicon mix	37
Elecfoil supplies remain tight.....	38
KR EV battery material plays ➤	39
Selective approach for cathode players.....	41
Positive on Korean elecfoil players	43
Valuation and recommendation ➤.....	44
Korean EV battery players' P/Es at 2017 levels	44
Company section ➤	55
LG Chem	56
Samsung SDI	64
SKC	72
Iljin Materials	85
Posco Chemical	97

South Korea
Overweight

Highlighted Companies

LG Chem
ADD, TP W380,000, W309,000 close

We see LGC as a key beneficiary of the fierce competition between EU OEMs and Tesla for new passenger EV models in FY20F/21F. The growing battery cell size of new passenger EVs will eventually lead to an EV battery earnings turnaround and justify LGC's aggressive capacity expansion, in our view.

Samsung SDI
ADD, TP W320,000, W233,000 close

We believe SDI has the potential to be a leader in the EV battery market, given its competitiveness in high-technology mass production after the early stages of the EV market. As a high-energy density battery player, we expect SDI's share price performance to remain robust as its large-sized battery (EV/ESS) sales increase in earnest from FY20F.

SKC
ADD, TP W62,000, W46,050 close

SKC is transforming into a battery material (elecfoil) player, as suggested by the acquisition of high tech elecfoil supplier KCFT. We expect a valuation re-rating and multiple expansion for SKC given the ~W2tr value of KCFT.

Summary Valuation Metrics

P/E (x)	Dec-19F	Dec-20F	Dec-21F
LG Chem	37.46	16.59	13.27
Samsung SDI	30.05	16.47	13.35
SKC	28.61	12.06	9.82

P/BV (x)	Dec-19F	Dec-20F	Dec-21F
LG Chem	1.26	1.20	1.13
Samsung SDI	1.28	1.19	1.10
SKC	1.09	1.02	0.94

Dividend Yield	Dec-19F	Dec-20F	Dec-21F
LG Chem	1.94%	1.94%	1.62%
Samsung SDI	0.43%	0.43%	0.43%
SKC	2.17%	2.17%	2.17%

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Electrical Components

KR EV Battery 2020: Momentum to rebuild

- We expect Korean battery makers to benefit from competition for new EVs (between global OEMs and Tesla) and the strong EU EV market.
- Korean EV battery makers should turn profitable in FY20-21F on the back of ~60% yoy EV battery sales growth in FY20-21F and margin expansion
- We also highlight Korean cathode and elecfoil producers on strong capacity expansion, with greater demand for key materials from Korean cell makers.

Upside potential from increasing battery cell size

New passenger EVs by global OEMs in 2020F would need larger battery cell sizes (more than 75kWh vs. our average 60kWh assumption previously) for increased driving ranges of over 450km to compete against Tesla's popular Models 3 and Y Long Range. Given an increase in the pure EV segment and the larger battery cell size per unit, we expect global EV battery demand to grow at a fast 53% CAGR in 2019-23F, outpacing the EV/PHEV sales CAGR of 34% in 2019-23F.

Strong EU EV sales on supportive policies

The EU has set strict regulations on CO2 emissions for passenger cars at 95g/km in 2021 (and 81g/km by 2025). The global EV OEMs should be targeting the EU market, which will be focusing on meeting the emission targets to avoid hefty fines. The major EU OEMs (incl. Volkswagen) are targeting to have EVs form 20-30% of their new model line-ups by 2025F in a bid to wrest the EV market leadership from Tesla. We expect the EU EV/PHEV sales to grow at a 38% CAGR in 2020-21F, with subsidies and incentives.

Korean battery cell makers well positioned for 2020-21F

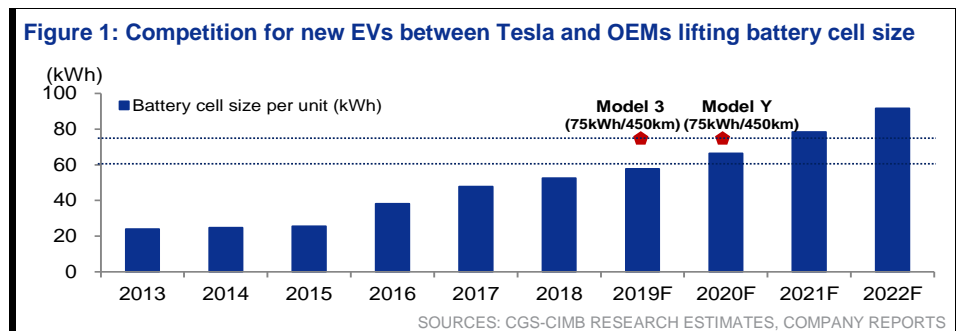
Given the increasing new models by EU OEMs and demand for high-energy density EV batteries for new passenger EVs from 2020F, we expect Korean EV battery cell makers (LG Chem (LGC) and Samsung SDI (SDI)) to be well positioned to deliver strong sales on their order backlog. Only LGC, SDI and China's Contemporary Amperex Technology (CATL) can produce high-quality batteries at competitive costs for the new EU OEM models in 2020F, in our view. LGC should be a prime beneficiary of the EU EV battery growth, based on its leading position in EU battery capacity building (from 6GWh in 2018 to 55GWh by 2020F).

Korean EV battery makers to turn profitable from 2020F

We believe Korean EV battery makers should finally turn profitable in 2020-21F — the first time in 10 years — given: 1) lower fixed costs on economies of scale (we forecast EV battery revenue growth of ~60% yoy in 2020-21); and 2) normalisation of new EU capacity production yield.

Prefer Korean cathode and elecfoil producers in materials play

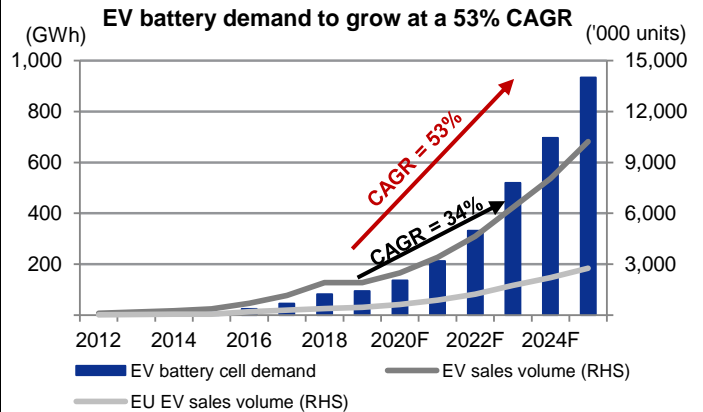
As the low-quality EV battery material market consolidates as a result of the slowdown of the Chinese EV battery market, we expect Korean battery material producers that supply the high-quality nickel cathodes and elecfoil to grow on strong capacity expansion. We highlight Posco Chemical (cathode and anode), Iljin Materials and SKC (elecfoil), to meet the higher demand for key EV battery materials.



KEY CHARTS

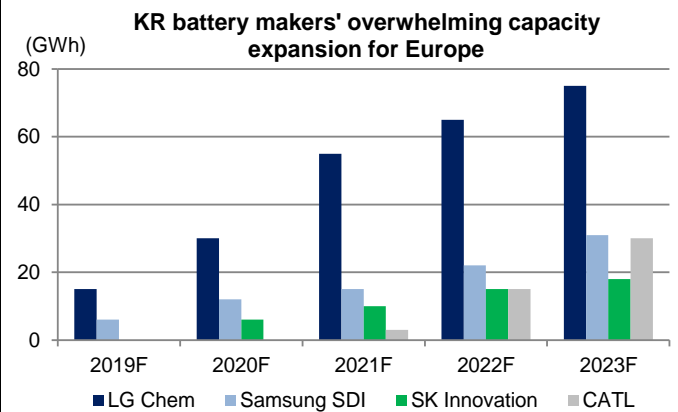
EV battery demand to grow at a 53% CAGR on larger battery cell size and strong EU market >

We expect the global electric vehicle (EV) battery demand could be stronger than expected with a CAGR of 53% in 2019-23F, faster than the electric vehicle/plug-in hybrid electric vehicle (EV/PHEV) sales CAGR of 34% in 2019-23F. We think the new passenger EV battery energy capacity per unit will likely increase to more than 75kwh to compete against the Tesla Models 3 and Y. We believe that EU EV/PHEV sales will remain strong, with a CAGR of 38% in 2020-21F, supported by: 1) new EV models to meet the tight emission regulations; 2) reasonable EV prices with improving driving ranges; and 3) expanding subsidies and charging infrastructure.



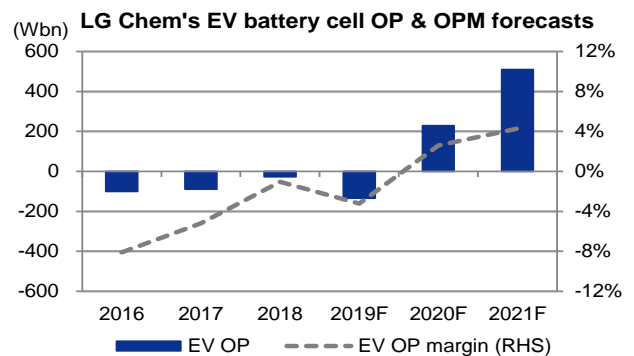
KR battery makers well positioned to deliver strong battery sales for EU OEMs >

We expect Korean EV battery cell makers [LG Chem (051910 KS, Add, TP; W380,000), Samsung SDI (006400 KS, Add, TP; W320,000)] to be well positioned to deliver strong EV battery sales and win additional orders from European original equipment manufacturers (OEMs). Only LGC, SDI and Contemporary Amperex Technology (300750 CH, Not Rated) can produce high-quality batteries at competitive costs for the new models by EU OEMs in 2020-2021F, in our view. We believe LGC should benefit given its battery production capacity expansion plan for Europe (6GWh in 2018 to 55GWh by 2020F).



KR EV battery makers' profitability to turn around from 2020F >

We expect Korean EV battery cell makers to start making profits from 2020F onwards, given: 1) lower fixed costs on economies of scale (EV battery revenue to grow at an average of 60% yoy in 2020F, based on our estimates); and 2) normalisation of new EU capacity production yield. Given its operating profit (OP) margin expansion from 2020F, we forecast LGC's OP to grow 121% yoy in 2021F.



Over 50% average capacity expansion over next three years for KR key battery material producers >

We recommend investors to focus on the Korean high-quality nickel cathode makers and elecfoil producers, given the battery materials' supply and demand outlook. Based on our expectations of battery material capacity and technology, we highlight Posco Chemical (003670 KS, Add, TP; W56,000) (cathode and anode), Iljin Materials (020150 KS, Add, TP; W49,000) and SKC (011790 KS, Add, TP; W62,000) (elecfoil) as the leading Korean battery material producers to meet the demand for Korean EV batteries.

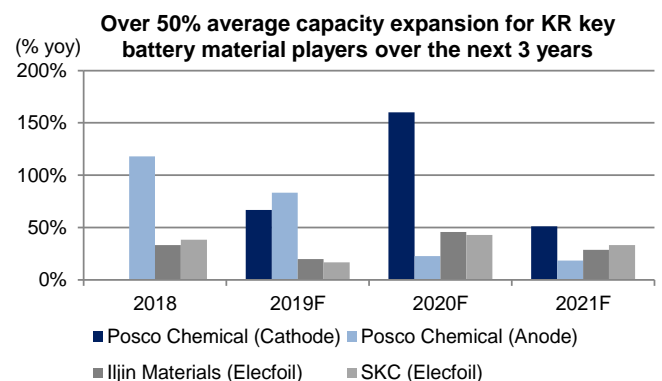


Figure 2: Sector peer comparisons

Company	Ticker (Bloomberg)	Recomm	TP (Lcy)	Price (Lcy)	Mkt cap (US\$m)	P/E (x)		P/BV (x)		ROE		EV/EBITDA (x)		Div yield	
						FY19F	FY20F	FY19F	FY20F	FY19F	FY20F	FY19F	FY20F	FY19F	FY20F
Cell															
LG Chem	051910 KS	ADD	380,000	309,000	18,498	37.3	15.1	1.3	1.2	3%	7%	9.3	7.1	1.9%	1.6%
Samsung SDI	006400 KS	ADD	320,000	233,000	13,587	13.1	10.4	1.3	1.2	4%	7%	9.2	5.7	0.4%	0.4%
Contemporary Amperex Technology	300750 CH	NR	na	87	27,452	43.4	36.4	5.1	4.6	12%	12%	24.2	19.4	0.2%	0.2%
BYD	002594 CH	REDUCE	32	43	15,593	45.3	37.5	2.3	2.4	5%	6%	10.4	9.3	0.4%	0.5%
Panasonic	6752 JP	NR	na	1,009	22,619	12.6	12.2	1.2	1.1	9%	9%	4.9	4.7	2.9%	2.9%
SK Innovation	096770 KS	ADD	215,000	147,500	11,566	13.7	7.9	0.7	0.7	5%	9%	6.2	5.1	4.1%	5.4%
Cell Average						29.4	21.7	2.3	2.1	7%	9%	12.0	9.6	1.5%	1.6%
Cathode															
Posco Chemical	003670 KS	ADD	56,000	49,000	2,534	25.4	23.4	2.8	2.6	13%	11%	17.0	12.3	0.8%	1.0%
Umicore	UM BB	NR	na	39	10,625	30.4	25.4	3.5	3.4	12%	14%	15.3	13.4	2.0%	2.1%
Nichias	5393 JP	NR	na	2,638	1,635	11.8	10.9	1.4	1.3	12%	12%	6.1	5.4	2.8%	2.9%
BASF SE	BAS GR	NR	na	69	69,679	17.8	15.2	1.6	1.6	14%	10%	10.1	8.8	4.6%	4.7%
L&F	066970 KS	NR	na	20,700	435	na	29.7	3.5	3.2	2%	12%	33.2	14.9	0.5%	0.5%
Mitsui & Co.	8031 JP	NR	na	1,950	31,046	7.5	7.5	0.8	0.7	10%	10%	15.5	15.5	4.2%	4.3%
Ecopro BM	247540 KS	NR	na	50,900	887	27.5	16.3	3.8	3.1	18%	22%	16.2	10.5	0.0%	0.0%
Beijing Easpring Material	300073 CH	NR	na	21	1,327	25.8	18.6	2.6	2.3	10%	12%	19.5	13.0	0.7%	0.9%
Ningbo Shanshan	600884 CH	NR	na	12	1,843	21.7	17.4	1.2	1.1	4%	5%	15.5	12.2	0.5%	0.5%
Xiamen Tungsten	600549 CH	NR	na	12	2,421	52.0	31.2	2.3	2.1	3%	5%	na	na	0.5%	0.7%
Cathode Average						17.2	14.7	1.6	1.6	13%	10%	12.1	10.9	3.9%	4.0%
Anode															
Posco Chemical	003670 KS	ADD	56,000	49,000	2,534	25.4	23.4	2.8	2.6	13%	11%	17.0	12.3	0.8%	1.0%
Mitsubishi Chemical	4188 JP	NR	na	824	11,348	8.4	8.1	0.8	0.8	10%	10%	8.2	7.8	4.9%	4.9%
Hitachi Chemical	4217 JP	NR	na	3,945	7,512	34.7	28.3	1.9	1.8	5%	7%	10.9	9.7	1.5%	1.6%
JFE Holdings	5411 JP	NR	na	1,401	7,866	15.3	9.7	0.4	0.4	3%	5%	8.5	6.7	2.2%	3.3%
Ningbo Shanshan	600884 CH	NR	na	12	1,843	21.7	17.4	1.2	1.1	4%	5%	15.5	12.2	0.5%	0.5%
Anode Average						18.7	15.2	1.2	1.1	7%	8%	10.1	8.6	2.8%	3.1%
Elecfoil															
SKC	011790 KS	ADD	62,000	46,050	1,466	28.0	11.8	1.1	1.0	4%	9%	8.9	8.0	2.2%	2.2%
Iijin Materials	020150 KS	ADD	49,000	39,500	1,545	39.3	23.6	3.0	2.8	8%	12%	18.7	12.9	1.7%	1.7%
Furukawa Electric	5801 JP	NR	na	3,030	1,957	13.7	11.4	0.8	0.8	6%	8%	7.2	6.5	2.7%	2.7%
Elecfoil Average						25.0	16.8	1.8	1.7	7%	10%	12.3	9.4	2.3%	2.3%
Separator															
Toray Industries	3402 JP	NR	na	726	10,824	13.5	12.2	1.0	0.9	7%	8%	7.8	7.2	2.2%	2.4%
Asahi Kasei	3407 JP	NR	na	1,245	15,859	12.3	12.2	1.2	1.1	10%	9%	6.8	6.4	2.9%	3.0%
Shenzhen Senior Technology	300568 CH	NR	na	25	824	20.5	16.3	2.7	2.4	13%	14%	na	na	1.1%	1.3%
SK Innovation	096770 KS	ADD	215,000	147,500	11,566	13.7	7.9	0.7	0.7	5%	9%	6.2	5.1	4.1%	5.4%
Separator Average						13.3	11.0	1.0	1.0	8%	9%	6.8	6.1	3.0%	3.5%
Electrolyte															
Soulbrain	036830 KS	NR	na	70,900	1,046	8.7	8.1	1.4	1.2	18%	16%	4.7	3.9	1.2%	1.2%
Mitsubishi Chemical	4188 JP	NR	na	824	11,348	8.4	8.1	0.8	0.8	10%	10%	8.2	7.8	4.9%	4.9%
Ube Industries	4208 JP	NR	na	2,365	2,295	8.7	8.0	0.7	0.7	8%	9%	5.2	4.8	3.8%	4.0%
Electrolyte Average						8.5	8.1	0.8	0.8	10%	10%	7.5	7.1	4.4%	4.5%
Total Average						18.7	14.6	1.5	1.4	9%	9%	10.1	8.6	3.0%	3.2%

NOTE: DATA FOR NOT RATED COMPANIES IS BASED ON BLOOMBERG CONSENSUS ESTIMATES

SOURCES: CGS-CIMB RESEARCH, BLOOMBERG

* DATA AS AT 28 NOV 2019

Questions on the Korean battery industry (EV/ESS)

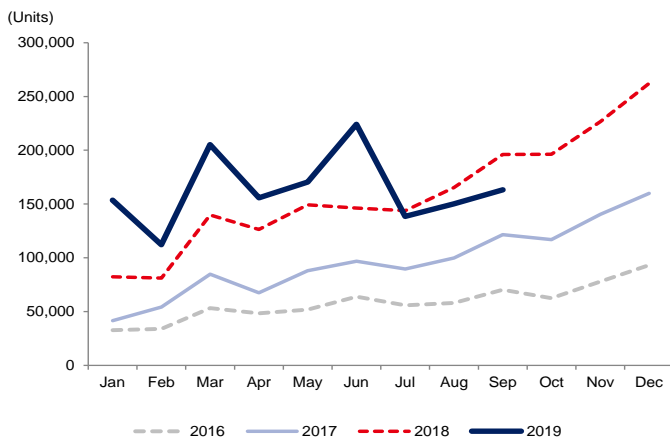
1) Korean EV battery makers at overcapacity? ➤

The global Electric Vehicle/Plug-in Hybrid Electric Vehicle (EV/PHEV) sales in 9M2019 expanded 20% yoy (vs. 65% yoy in 2017-18), due to slower growth in the Chinese market (26% yoy in 9M2019 vs. 80%+ in 2017-18), and declines in the US market (-8% yoy in 9M2019 vs. 80%+ in 2018) according to Marklines (an institution which engages in provision of online information service specialised in the automotive industry). The slower growth was mainly attributed to the discontinuation of government subsidies for EVs. The EU market's sales growth remained relatively stable at 26% yoy in 9M2019 (vs. 31% in 2018).

As Chinese and US EV/PHEV sales in 9M2019 have recently decreased by 19% yoy and 28% yoy, respectively, investors are questioning the EV demand for 2020F, which will have an impact on the overall EV battery sector.

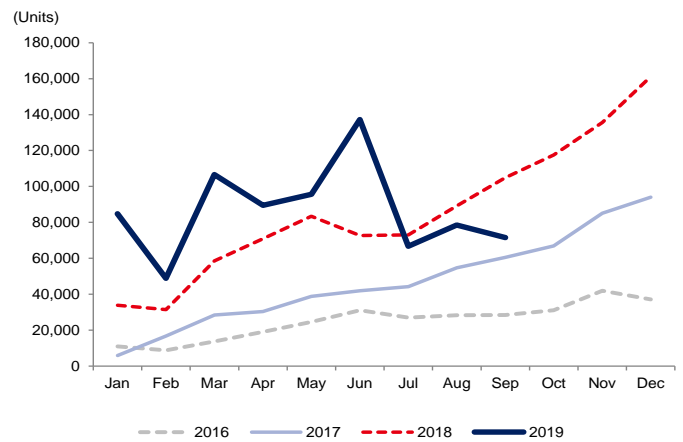
However, we expect EV sales growth to increase gradually in 2020F, given the strong EU market with new models to meet the CO2 emission regulations. Germany plans to increase its EV subsidy by 50% over the next five years from 2020. The subsidy should increase from €3,000 to €4,500. For EVs priced more than €40,000, the subsidy could rise to €5,000 according to the German government. We expect global growth to rebound from 2H20F or 2021F onwards, as demand growth for Chinese new energy vehicles (NEVs) could resume with the influx of new launches in the market of locally-produced Tesla Model Ys and major global/European OEMs.

Figure 3: Global EV (EV/PHEV) sales trend



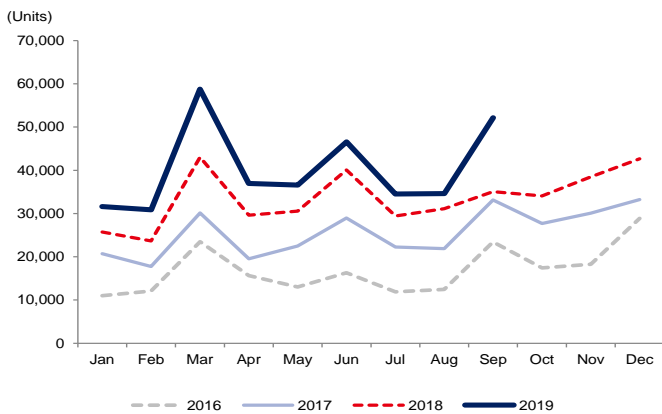
SOURCES: CGS-CIMB RESEARCH, MARKLINES

Figure 4: China EV (EV/PHEV) sales trend



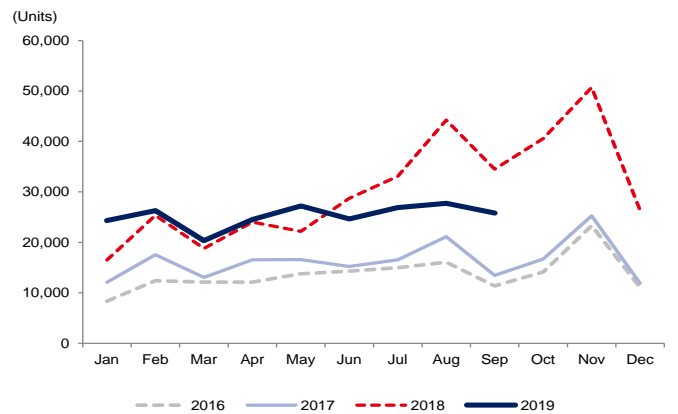
SOURCES: CGS-CIMB RESEARCH, MARKLINES

Figure 5: EU EV (EV/PHEV) sales trend



SOURCES: CGS-CIMB RESEARCH, MARKLINES

Figure 6: US EV (EV/PHEV) sales trend

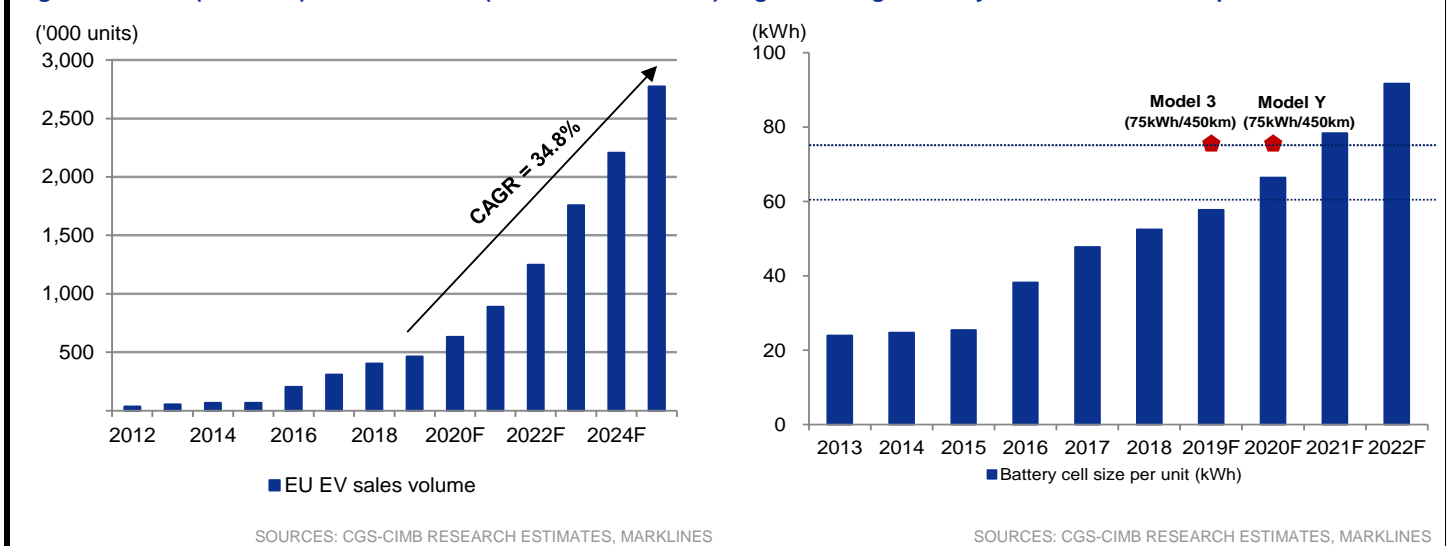


SOURCES: CGS-CIMB RESEARCH, MARKLINES

For 2020-21F, we see strong EV sales for the European market. The EU has set tighter rules on CO2 emissions (95g/km by 2021) for passenger cars. In view of this, we believe the global OEMs will likely raise their EV sales portion for the EU market.

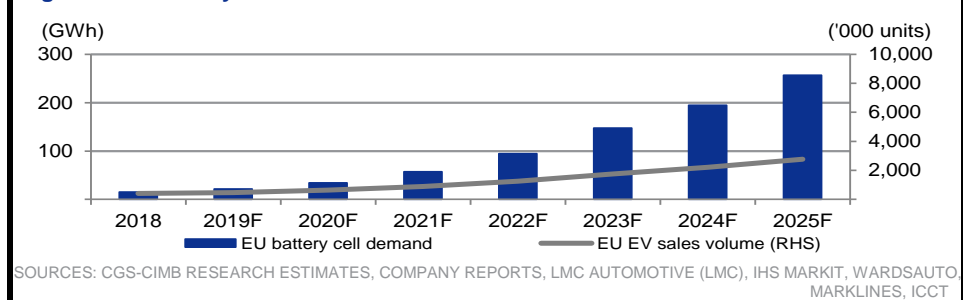
Moreover, we think EU automakers will make EVs commercially viable and compete with Tesla (TSLA US, Not Rated, CP; US\$331.3) in terms of driving range to wrest the leadership of the EV industry. We expect Tesla's Model 3 and Model Y sales to be strong in the near term, given the company's technological strength and performance. However, we expect Volkswagen's (VOW GR, Not Rated, CP; EUR176.2) new ID.3 model (standard: €30,000 (as at Nov 2019)) to be just the beginning of mass passenger EVs by EU OEMs. We expect the average battery cell size for passenger EVs to increase to over 75kwh in 2021F (vs. Tesla Models 3 and Y Long-Range versions). Various new passenger EVs with larger battery sizes (over 80kWh) are expected to be released by EU OEMs [VW, Audi (NSU GR, Not Rated, CP; EUR792.0), Porsche (POAHY US, Not Rated, CP; US\$7.5), Volvo (VOLVB SS, Not Rated, CP; SEK149.8) and BMW (BMW GR, Not Rated, CP; EUR74.7)] in 2020-2021F. As such, we see stronger-than-expected battery demand for passenger EVs, with the high-quality EV battery market at the cusp of taking off from 2020F onwards. We think Korean battery makers should benefit most given their high exposures to EU OEMs.

Figure 7: EU EV (EV/PHEV) sales forecasts (CGS-CIMB forecasts) **Figure 8: Larger battery sizes needed to compete with Tesla**



While we forecast EU EV sales to grow at a CAGR of 38% in 2020-21F, we expect EU EV battery demand for passenger EVs to grow faster at a CAGR of 51% in 2020-21F, on the back of: 1) greater battery capacities for longer driving ranges, and 2) larger number of new pure EV model rollouts. Given the Korean battery production capacity expansion from 8GWh in 2018 to 80Gwh in 2020F, with a 70% utilisation rate (including new capacity additions), we see limited risk of overcapacity in 2021F for Korean battery cell makers.

Figure 9: EV battery cell demand vs. EV sales volume for EU



2) Can EV/ESS battery turn profitable in 2020? >

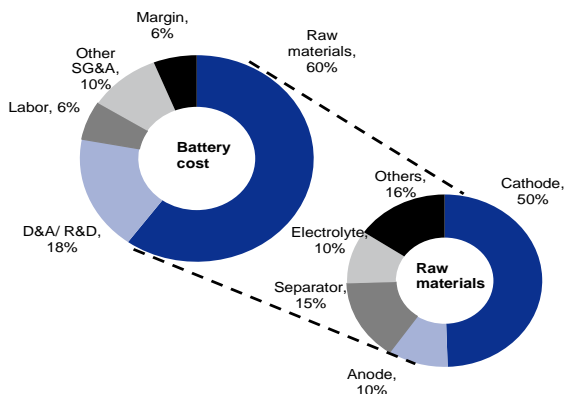
As the EV battery market is still at a nascent stage, EV battery production is still a loss-making business, mainly due to lack of scale, in our view. LGC's (top Korean EV battery maker based on order backlog (as at Nov 2019)) 2019 net profit was lower than expected due to fixed costs on the back of low EV battery capacity utilisation, as well as hefty R&D expenses in developing the third-generation EV batteries.

Korean battery makers have been accelerating their capacity expansion to meet global OEM's new EV model orders. While LGC is in the process of expanding its EV battery capacity to 100GWh by 2020F (vs. 25GWh in 2018), the initial yield for its new EV battery operation and production in 2H19 has been lower than expected.

We believe the battery production concerns came from: 1) the fast and large capacity expansion; and 2) battery parts/material sourcing management problems. However, we expect LGC's EV battery segment to turn profitable at the operating profit level in 2020F, thanks to: 1) a decrease in fixed cost per unit from economies of scale; 2) a decline in variable costs with the use of high technology on battery materials; and 3) the pass-through of additional raw material costs to the battery selling price.

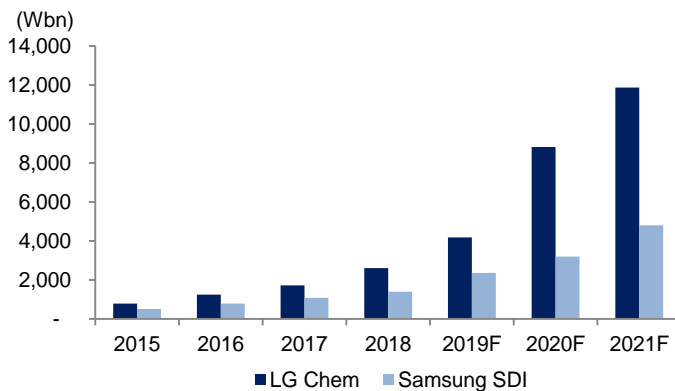
Once LGC achieves operating profit breakeven in 2020F, we believe investors will stop viewing EV battery makers as loss-making businesses and reassess their business value. We expect LGC's EV battery division's operating margins to improve from -3.2% in 2019F to over 2% in 2020F as we expect its new battery plant operations to stabilise from 1Q20F (with a 90% yield). Also, with tighter safety measures for energy storage systems (ESS), we foresee the ESS battery business to normalise from 2020F and ESS OP to turn positive in 2020F.

Figure 10: EV battery cost structure for 2020F



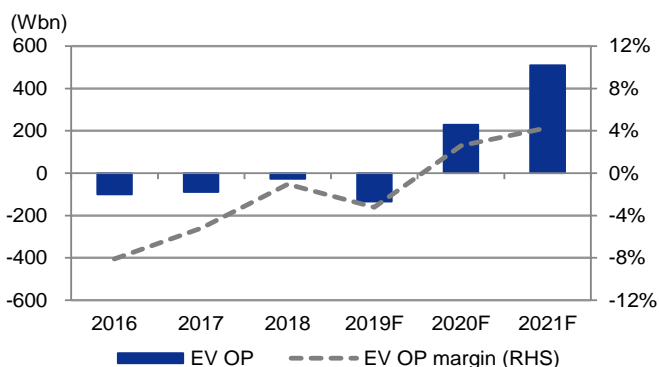
SOURCES: CGS-CIMB RESEARCH ESTIMATES, COMPANY REPORTS

Figure 11: LG Chem and Samsung SDI EV battery sales forecasts



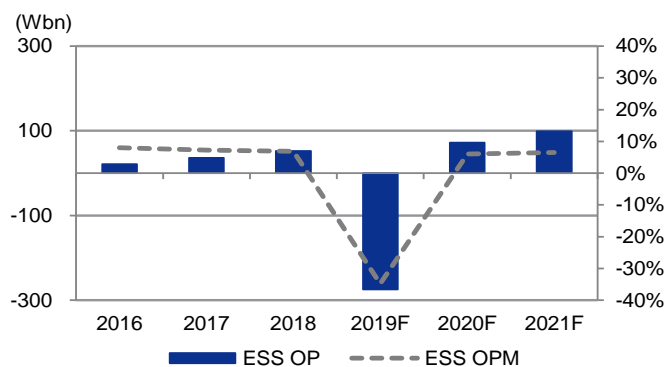
SOURCES: CGS-CIMB RESEARCH ESTIMATES

Figure 12: LGC's EV battery OP and OPM trend



SOURCES: CGS-CIMB RESEARCH ESTIMATES, COMPANY REPORTS

Figure 13: LGC's ESS battery OP and OPM trend



SOURCES: CGS-CIMB RESEARCH ESTIMATES, COMPANY REPORTS

3) ESS battery fires: can this be resolved? ➤

There have been a total of 22 ESS fire incidents in Korea in 2018-19. The government has stopped 50% of ESS operations, in 1,490 ESS sites, since 1Q19. After the government's domestic ESS explosion investigation, there were two additional ESS fires in Sep 2019.

Investors are concerned that the battery makers could be made responsible for the domestic ESS fire incidents. While the government has not finalised its probe yet, battery cell makers have been setting aside provisions for their ESS battery business from their 2019 earnings. As such, the battery safety issue has weighed down overall battery sentiment in 2019, in our view.

As the current domestic ESS problems can be resolved technically and institutionally, we believe the demand for ESS should recover gradually from 2020F onward. We estimate that SDI and LGC will book W200bn and W100bn in additional provisions respectively, for their ESS batteries in 4Q19F; at the same time, they will be implementing tighter safety measures and installing fire extinguishing systems on their ESS batteries.

While the near-term earnings for ESS batteries could be lower than expected due to the higher costs for testing and additional safety features (such as crush protection, protection against fire propagation, more complex cooling systems, and additional electronics for safety, reliability and diagnosis), the fire safety concerns over domestic ESS could be alleviated, in our view.

Given our forecasts for robust overseas ESS growth of 45% yoy in 2020F (50% in 2019F), we expect the ESS industry and battery sales growth to rebound in FY20F, with a gradual recovery for domestic ESS. We project a strong ESS battery demand (30% CAGR for global ESS battery sales in 2019-2025F) amid growth in the renewable energy market, driven by rising industrial and commercial plants and facilities, thanks to ongoing subsidies by major governments.

Figure 14: Korean government probe report on ESS fires (Jun 2019)

Major causes for ESS fires in Korea	Relevant gov't measures to prevent ESS fires
Insufficient battery protection systems against electric shock	- Mandatory installation of firewall equipment to prevent fires from overcharging - Appointment of ESS-specific firefighting object (building)
Inadequate management of operating environment	- Introduction of International ESS Safety Standard for the first time in the world - KC certificate needed for battery & PCS safety control - Strict control of temperature and humidity nearby the system
Faulty installation of the systems	- Revision of ESS installation standards to limit their capacity to a total of 600/kwh to prevent overloads - When installed outdoors, should be installed in separate, exclusive buildings
Lack of an integrated control unit	- Change regular safety inspection periods to 1~2 years from the current 4 years - Newly established regulation to punish unauthorised modification of ESS structure

* Fires not caused by regulation violations by ESS makers, thus not subject to punishment by the government

SOURCES: CGS-CIMB RESEARCH, SOUTH KOREAN MINISTRY OF TRADE, INDUSTRY AND ENERGY

Figure 15: Korean ESS makers' safety measures for ESS fires (Jun 2019)

	ESS safety measure	FY20F Investment plan
LG Chem	- Developed a spray system for preventing ESS fire from spreading - Limit the operation rate of ESS systems to 70% and cover the losses to the ESS operators - Identify the precise cause of previous fires by the end of 2019 and come up with active plans	Est. W106bn (US\$86m)
Samsung SDI	- Developed a special fire extinguishing system for ESS; made of special chemicals and fire-blocking materials that can extinguish flames quickly and prevent fires from spreading even if one battery cell is caught on fire - Apply the system to existing 1,000 ESS operation sites in Korea	W200bn (US\$169m)

SOURCES: CGS-CIMB RESEARCH, COMPANY REPORTS

EV industry

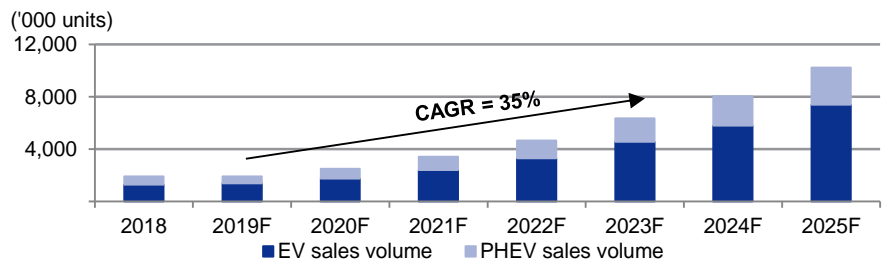
EV sales growth to recover from 2H20F ➤

We forecast EV/PHEV sales to grow at a CAGR of 35% in 2019-23F, based on: 1) more stringent CO2 emission regulations, 2) new EV models on integrated EV platforms with reasonable prices, and 3) subsidies and incentives for long-range passenger EVs. Our long-term forecast is that EV demand in major markets (EU/China/US) will rise as automakers attempt to meet each market's specific CO2 emission targets and take the advantageous position in the EV market.

We expect the EV market to reach a turning point with the release of third-generation EVs from 2H20F. We believe Volkswagen is on track for its Roadmap E (3m EV sales in 2025F on a €20bn platform capacity) and modular electric drive matrix (MEB) technology platform (150GWh battery order contracts of €50bn) for the large-scale production of its new EV model series based on comments made during its 3Q19 earnings conference call. The new generation models are expected to offer a range of more than 400km, as well as autonomous driving features, which would be able to compete with the popular Tesla Model 3, in our view.

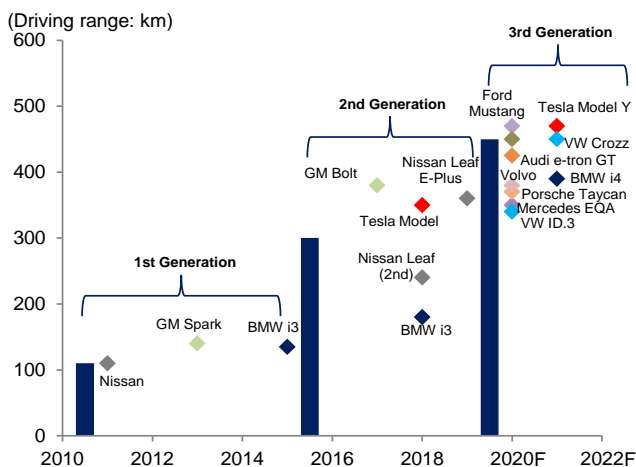
We expect EV/PHEV sales to take off from 2H20F onwards with the introduction of new models that are equipped with improved battery performance. We estimate the EV/PHEV penetration rate to rise from 2.1% in 2019F to 2.7% in 2020F, 6.1% in 2023F, and 9.4% in 2025F.

Figure 16: EV (EV/PHEV) sales volume by type, based on CGS-CIMB estimates



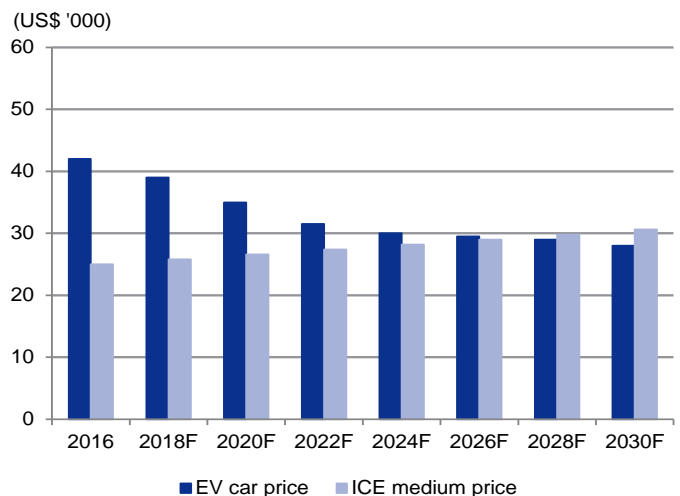
SOURCES: CGS-CIMB RESEARCH ESTIMATES, MARKLINES

Figure 17: New EV models' driving range comparison based on the company guidance



SOURCES: CGS-CIMB RESEARCH, MARKLINES, COMPANY REPORTS

Figure 18: Reasonable EV purchase price vs. Internal Combustion Engine (ICE) vehicle price (global averages)



SOURCES: CGS-CIMB RESEARCH ESTIMATES, SNE RESEARCH

* Final EV price = global EV average price (taking into account a potential subsidy) + EV battery cell price

Figure 19: EV demand by major markets, based on CGS-CIMB estimates

('000 Units)	2013	2014	2015	2016	2017	2018	2019F	2020F	2021F	2022F	2023F	2024F	2025F	CAGR (19-20F)	CAGR (19-23F)	CAGR (19-25F)
Global																
Sales	82,535	85,343	85,500	88,500	92,129	92,118	92,111	94,118	97,156	100,292	103,530	106,086	108,706	2%	3%	3%
> ICE	80,780	83,456	83,711	86,056	88,965	88,050	87,866	89,397	91,037	92,707	94,409	94,911	95,417	2%	2%	1%
> Green car (EV+PHEV)	198	267	369	702	1,161	1,916	1,921	2,499	3,408	4,647	6,337	8,048	10,221	30%	35%	32%
>> HEV	1,559	1,595	1,420	1,742	2,003	2,152	2,324	2,222	2,395	2,582	2,784	2,922	3,068	-4%	5%	5%
>> PHEV	90	105	124	260	423	632	539	756	1,008	1,344	1,793	2,248	2,819	40%	35%	32%
>> EV	109	162	245	442	737	1,283	1,381	1,744	2,399	3,302	4,544	5,800	7,402	26%	35%	32%
Penetration																
> ICE	97.9%	97.8%	97.9%	97.2%	96.6%	95.6%	95.4%	95.0%	93.7%	92.4%	91.2%	89.5%	87.8%			
> Green car (EV+PHEV)	0.2%	0.3%	0.4%	0.8%	1.3%	2.1%	2.1%	2.7%	3.5%	4.6%	6.1%	7.6%	9.4%			
>> HEV	1.9%	1.9%	1.7%	2.0%	2.2%	2.3%	2.5%	2.4%	2.5%	2.6%	2.7%	2.8%	2.8%			
>> PHEV	0.1%	0.1%	0.1%	0.3%	0.5%	0.7%	0.6%	0.8%	1.0%	1.3%	1.7%	2.1%	2.6%			
>> EV	0.1%	0.2%	0.3%	0.5%	0.8%	1.4%	1.5%	1.9%	2.5%	3.3%	4.4%	5.5%	6.8%			
Major markets in aggregate (EU, US, China)																
Sales	50,907	53,640	54,792	55,212	55,412	55,844	55,477	57,260	59,139	61,085	63,101	65,227	67,426	3%	3%	3%
> ICE	50,170	52,868	54,028	53,954	53,547	53,126	52,639	53,903	54,851	55,828	56,833	57,475	58,130	2%	2%	2%
> Green car (EV+PHEV)	163	229	336	665	1,071	1,786	1,785	2,230	2,885	3,750	4,895	6,152	7,736	25%	29%	28%
>> HEV	574	543	427	593	795	932	1,053	1,127	1,200	1,281	1,373	1,463	1,561	7%	7%	7%
>> PHEV	73	87	109	250	372	579	485	639	793	986	1,229	1,575	2,024	32%	26%	27%
>> EV	90	141	227	415	699	1,208	1,300	1,590	2,088	2,758	3,667	4,576	5,712	22%	30%	28%
Penetration																
> ICE	98.6%	98.6%	98.6%	97.7%	96.6%	95.1%	94.9%	94.1%	92.8%	91.4%	90.1%	88.1%	86.2%			
> Green car (EV+PHEV)	0.3%	0.4%	0.6%	1.2%	1.9%	3.2%	3.2%	3.9%	4.9%	6.2%	7.8%	9.4%	11.5%			
>> HEV	1.1%	1.0%	0.8%	1.1%	1.4%	1.7%	1.9%	2.0%	2.0%	2.1%	2.2%	2.2%	2.3%			
>> PHEV	0.1%	0.2%	0.2%	0.5%	0.7%	1.0%	0.9%	1.1%	1.3%	1.6%	1.9%	2.4%	3.0%			
>> EV	0.2%	0.3%	0.4%	0.8%	1.3%	2.2%	2.3%	2.8%	3.6%	4.5%	5.8%	7.0%	8.5%			
EU																
CO2 regulation (g/km)			130	123	116	110	103	95	90	85	79	74	68	-8%	-6%	-7%
Weighted avg. CO2 emmission (g.km)	127	123	123	120	117	115	112	109	106	103	101	97	94	-3%	-3%	-3%
Sales	12,970	14,690	15,370	15,450	15,310	15,317	15,470	15,790	16,150	16,519	16,895	17,395	17,909	2%	2%	2%
> ICE	12,844	14,539	15,271	15,033	14,692	14,520	14,557	14,669	14,628	14,587	14,547	14,482	14,417	1%	0%	0%
> Green car (EV+PHEV)	54	66	66	204	308	403	464	632	888	1,249	1,757	2,209	2,776	36%	39%	35%
>> HEV	73	85	33	213	310	393	449	489	521	555	591	651	716	9%	7%	8%
>> PHEV	23	17	8	109	170	197	155	189	251	332	439	561	716	22%	30%	29%
>> EV	31	49	58	95	137	207	309	442	636	916	1,318	1,647	2,060	43%	44%	37%
Penetration																
> ICE	99.0%	99.0%	99.4%	97.3%	96.0%	94.8%	94.1%	92.9%	90.6%	88.3%	86.1%	83.3%	80.5%			
> Green car (EV+PHEV)	0.4%	0.4%	0.4%	1.3%	2.0%	2.6%	3.0%	4.0%	5.5%	7.6%	10.4%	12.7%	15.5%			
>> HEV	0.6%	0.6%	0.21%	1.38%	2.0%	2.6%	2.9%	3.1%	3.2%	3.4%	3.5%	3.7%	4.0%			
>> PHEV	0.2%	0.1%	0.05%	0.70%	1.1%	1.3%	1.0%	1.2%	1.6%	2.0%	2.6%	3.2%	4.0%			
>> EV	0.2%	0.3%	0.38%	0.62%	0.9%	1.3%	2.0%	2.8%	3.9%	5.5%	7.8%	9.5%	11.5%			
US																
CO2 regulation (g/km)		0	158	155	151	144	138	132	124	118	112	106	97	-4%	-5%	-6%
Weighted avg. CO2 emmission (g.km)	165	165	161	158	156	152	150	146	144	142	140	137	135	-2%	-2%	-2%
Sales	15,953	16,928	17,200	17,240	17,280	17,305	17,485	17,828	18,291	18,767	19,254	19,823	20,409	2%	2%	3%
> ICE	15,362	16,356	16,701	16,733	16,714	16,613	16,742	16,963	17,216	17,473	17,733	18,058	18,389	1%	1%	2%
> Green car (EV+PHEV)	97	120	114	160	195	351	341	464	621	833	1,117	1,342	1,612	36%	35%	30%
>> HEV	494	451	384	347	371	341	402	401	402	403	404	406	408	0%	0%	0%
>> PHEV	49	55	43	73	91	119	105	143	172	208	250	295	347	36%	24%	22%
>> EV	48	65	72	87	104	231	236	321	447	622	866	1,047	1,265	36%	38%	32%
Penetration																
> ICE	96.3%	96.6%	97.1%	97.1%	96.7%	96.0%	95.8%	95.2%	94.1%	93.1%	92.1%	91.1%	90.1%			
> Green car (EV+PHEV)	0.6%	0.7%	0.7%	0.9%	1.1%	2.0%	2.0%	2.6%	3.4%	4.4%	5.8%	6.8%	7.9%			
>> HEV	3.1%	2.67%	2.23%	2.01%	2.1%	2.0%	2.3%	2.3%	2.2%	2.1%	2.1%	2.0%	2.0%			
>> PHEV	0.3%	0.33%	0.25%	0.42%	0.5%	0.7%	0.6%	0.8%	0.9%	1.1%	1.3%	1.5%	1.7%			
>> EV	0.3%	0.38%	0.42%	0.50%	0.6%	1.3%	1.4%	1.8%	2.4%	3.3%	4.5%	5.3%	6.2%			
China																
CO2 regulation (g/km)			161	151	141	131	121	117	112	107	102	97	93	-3%	-4%	-4%
Weighted avg. CO2 emmission (g.km)	172	166	165	162	157	152	150	147	144	142	140	136	132	-2%	-2%	-2%
Sales	21,984	22,022	22,222	22,522	22,822	23,222	22,522	23,642	24,697	25,800	26,952	28,009	29,108	5%	5%	4%
> ICE	21,965	21,972	22,056	22,187	22,141	21,992	21,339	22,271	23,007	23,767	24,553	24,935	25,324	4%	4%	3%
> Green car (EV+PHEV)	12	42	156	302	567	1,032	980	1,135	1,376	1,668	2,021	2,601	3,347	16%	20%	23%
>> HEV	7	7	10	33	113	198	203	236	276	323	377	406	437	17%	17%	14%
>> PHEV	1	15	59	68	111	262	225	307	371	447	539	720	961	36%	24%	27%
>> EV	11	28	97	233	457	770	754	827	1,005	1,221	1,482	1,881	2,387	10%	18%	21%
Penetration																
> ICE	99.9%	99.8%	99.3%	98.5%	97.0%	94.7%	94.8%	94.2%	93.2%	92.1%	91.1%	89.0%	87.0%			
> Green car (EV+PHEV)	0.1%	0.2%	0.7%	1.3%	2.5%	4.4%	4.4%	4.8%	5.6%	6.5%	7.5%	9.3%	11.5%			
>> HEV	0.0%	0.0%	0.05%	0.15%	0.5%	0.9%	0.9%	1.0%	1.1%	1.3%	1.4%	1.4%	1.5%			
>> PHEV	0.0%	0.1%	0.26%	0.30%	0.5%	1.1%	1.0%	1.3%	1.5%	1.7%	2.0%	2.6%	3.3%			
>> EV	0.1%	0.1%	0.44%	1.04%	2.0%	3.3%	3.4%	3.5%	4.1%	4.7%	5.5%	6.7%	8.2%			

SOURCES: CGS-CIMB RESEARCH ESTIMATES, COMPANY REPORTS, LMC, IHS, WARDAUTO, MARKLINES, ICCT

Tighter emission standards fuelling electrification ➤

We foresee that the tighter CO2 emission regulations could lead to the acceleration of new EV launches by global automakers, ahead of 2021. To avoid huge penalties for not meeting the CO2 emission standards, major auto makers, especially in Europe, are likely to sell green cars rather than focus on diesel cars and SUVs, in our view.

With the targets for the rates of reduction in emission between 2016 and 2020 being different in major markets (a reduction of 27% in the EU, 27% in China, and 20% in the US), we believe that the degree of achievement will also be different in different markets. The basic assumption underlying our forecast is that green car demand will grow in accordance with these major markets' CO2 emission targets. The major markets now plan to reduce the CO2 emission by 5-6% p.a. by 2025F.

As automakers continue to strive to improve the fuel efficiency of internal combustion engine (ICE) vehicles through the use of fuel-saving technologies, the CO2 emission of ICE vehicles should fall 1-2% p.a. across major auto markets by 2025F, based on our estimates. To comply with the emission regulations, we think the major automakers and governments will try to expand the EV/PHEV penetration rate by 1-2% pts p.a. and trim the ICE penetration rate by 1-1.5% pts p.a. by 2025F.

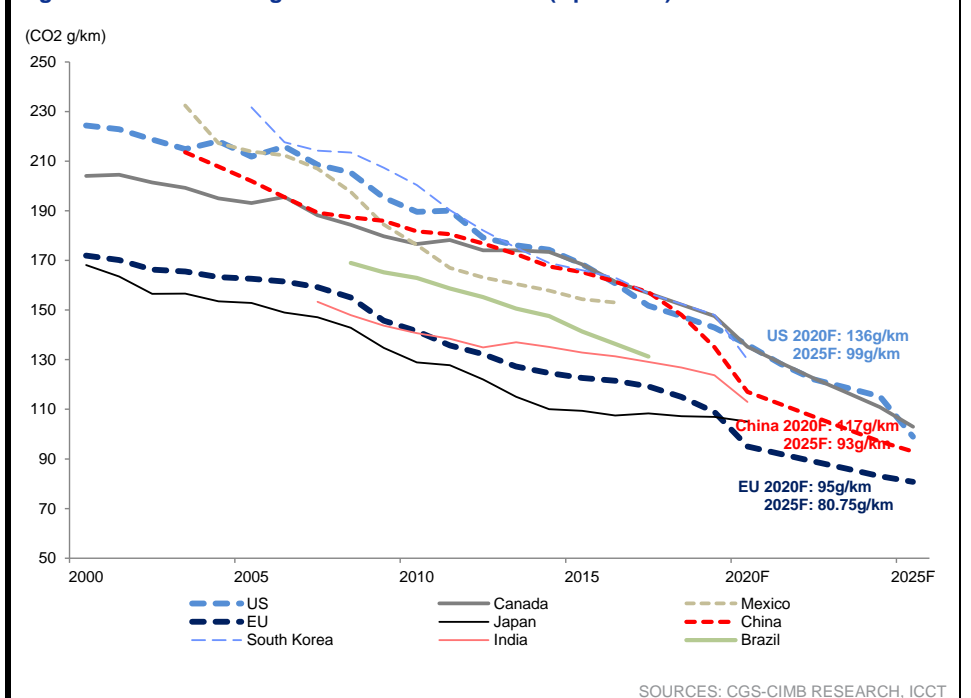
We assume average CO2 emissions of ICEs, hybrid electric vehicles (HEVs) and PHEVs of 145g/km, 73g/km and 35g/km, respectively, in 2020F. We believe that our assumptions are conservative as we have assumed that the EU, the US, and China will miss their emission targets by 12%pts, 10%pts and 19%pts in 2020F.

Figure 20: Summary of emission targets for major markets

Region	Emission targets
EU	Car fuel CO2 emission targets: 95 g/km (2020), 80.75 g/km (2025), 59.4 g/km (2030)
China	Car fuel CO2 emission targets: 117 g/km (2020), 93 g/km (2025), 70 g/km (2030)
U.S.	Car fuel CO2 emission targets: 136 g/km (2020), 99 g/km (2025), 85 g/km (2030)

SOURCES: CGS-CIMB RESEARCH, UNITED STATES ENVIRONMENTAL PROTECTION AGENCY (EPA), ICCT, MINISTRY OF INDUSTRY AND INFORMATION TECHNOLOGY (MIIT)

Figure 21: Emission targets for selected markets (April 2019)

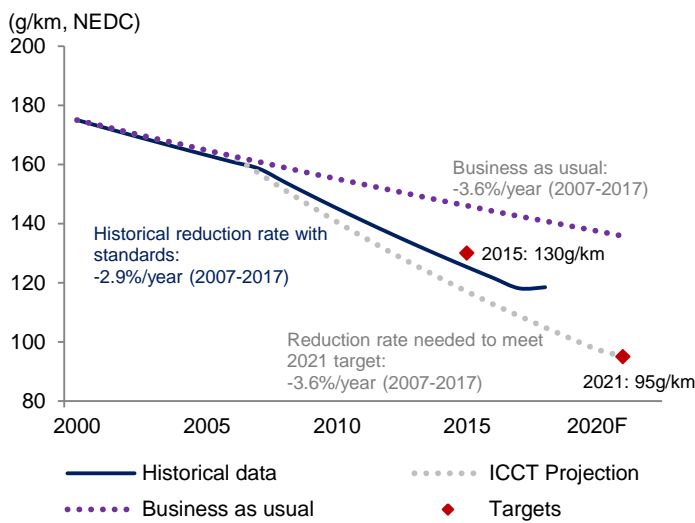


• **European Union (EU)**

The EU maintains its focus on reducing Greenhouse Gas emissions, setting strict regulations on CO2 emissions for passenger cars at 81g/km in 2025 and 59g/km in 2030 (vs. 95g/km in 2021 and 130g/km in 2015) after the Volkswagen emissions scandal ('Dieselgate' – Volkswagen emissions scandal in which the company had intentionally programmed turbocharged direct injection (TDI) diesel engines to activate their emissions controls only during laboratory emissions testing) in 2015. The EU CO2 emissions target for 2021, defined in 2014 as Regulation (EU) for passenger cars, sets a 20% reduction from 2018 levels. The CO2 emission targets for 2025 and 2030 were voted on by the European Council and Parliament. The CO2 reduction target for 2025 is -15% from the 2021 target for passenger cars. Given the limitation on ICE performance improvement, we believe that further emission cuts are likely to be driven by vehicle electrification.

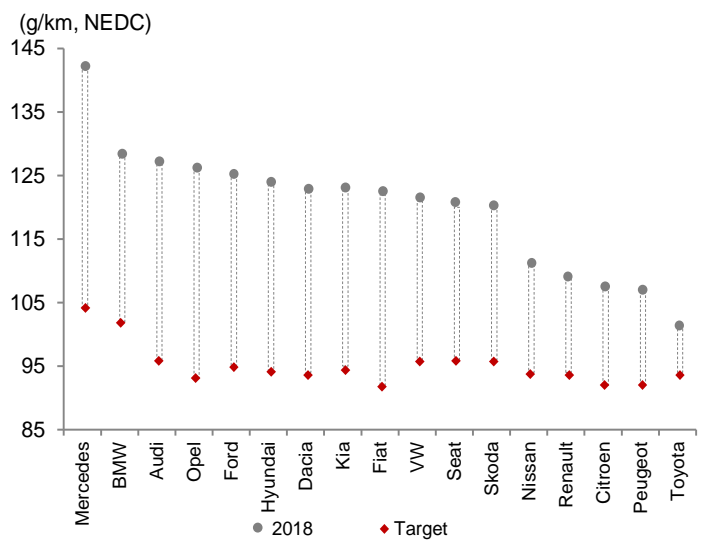
Based on the latest guidelines, manufacturers that fail to meet their emission targets will need to pay €95 for every g/km of excess emissions per vehicle. This means that manufacturers that miss the emission requirement by 5g/km would need to pay a fine of €500 per vehicle, the approximate average net profit per vehicle sold in the European market (April 2019, source: ICCT). As such, the failure to meet the new target could result in fines of several billion euros, according to the International Council on Clean Transportation (ICCT).

Figure 22: CO2 emission trends and targets by Europe



SOURCES: CGS-CIMB RESEARCH, ICCT

Figure 23: CO2 emission cuts needed by major automakers for the EU market (by 2020F)



SOURCES: CGS-CIMB RESEARCH, JATO DYNAMICS, ICCT

Figure 24: Fines major European automakers will face if current conditions continue

Company	2018 CO2 emission actual average (g/km)	2021F CO2 emission target (g/km)	Difference (actual – target, g/km)	2021F Penalty (EUR bn)
Volkswagen	121.2	94.6	26.6	9.19
Groupe PSA	114.2	91.1	23.1	5.39
Renault	113.2	90	23.2	3.57
BMW	127.1	99.6	27.5	2.66
Hyundai Motors/KIA Motors	121.9	91.9	30	2.88
Ford	123.7	96.6	27.1	2.56
Fiat Chrysler Automobiles	125.3	89.8	35.5	3.24
Daimler	134.3	100.7	33.6	3.01
Toyota	101.3	93.5	7.8	0.55
Nissan	112.9	93.9	19	1.14

SOURCES: CGS-CIMB RESEARCH, JATO ESTIMATES, ICCT

• US

In the US, the Environment Protection Agency (EPA) and the Department of Transportation's National Highway Traffic Safety Administration (NHTSA) jointly established a national programme (Jun 2018) for the new emissions and fuel economy standards, as a response to President Obama's call for a strong and coordinated federal greenhouse gas (GHG) and fuel economy programme. NHTSA and the EPA are proposing the "Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Years 2021-2026".

Penalties are in place to assess the fines on vehicle manufacturers for failure to meet the fuel economy and emission standards. For example, OEMs whose fleets fail to meet the standards are liable for a penalty of US\$14 per vehicle for every 0.1 mpg exceeded.

A nine-state coalition released the 2018 Zero Emission Vehicle (ZEV) action plan — a multi-state effort that builds on earlier action plans to speed up the nation's transition to zero emission cars. The nine ZEV states (California, Connecticut, Maryland, Massachusetts, New York, Oregon, Rhode Island, Vermont and New Jersey) represent nearly 30 percent of the new car sales market in the US (as at 2H18) and have committed to coordinated actions to ensure the successful implementation of their state ZEV programmes. The plan covers battery-electric vehicles (BEVs), PHEVs, and hydrogen fuel cell electric vehicles (FCEVs). The 2018 ZEV action plan is targeting 12 million cumulative ZEVs on the road by 2030 in the nine Task Force states (including California).

• China

In China, the Ministry of Industry and Information Technology (MIIT) sets the fuel consumption standards. The final version of the China 6 emission standard for light-duty vehicles was released on 23 Dec 2016. Phase 4 passenger vehicle fuel consumption standards are in place and are being phased in from Jan 2016, with an average fuel consumption target of 5L/100km (~119g/km CO₂) by 2020. Phase 5 fuel consumption standards, with a target of 4.0L/100km (~95g/km CO₂) by 2025, are being worked out and expected to be published soon.

At the moment, MIIT could ban the production of new models that fail to meet its specific weight-based standard target, if the manufacturer misses its corporate-average fuel consumption (CAFC) target for the current year. These measures clearly incentivise automakers to comply with the standards, which should lead to the more rapid development of EVs in China, in our view.

Figure 25: CO₂ emission standards in Europe, China and US

	EU	China	U.S.
Targets (Passenger cars)			
2015	130 g/km	6.9 l/100km	33.8 mpg
2020F	95 g/km ²	5.0 l/100km	41.7 mpg
2025F	80.75 g/km ³	4.0 l/100km	55 mpg
2030F	59.38 g/km ³	3.0 l/100km	64 mpg
Targets (NEDC, g/km)			
2015	130 g/km	161 g/km	171 g/km
2020F	95 g/km	117 g/km	136 g/km
2025F	80.75 g/km (-15% vs. 2020F)	93 g/km	99 g/km
2030F	59.4 g/km (-37.5% vs. 2020F)	70 g/km	85 g/km
Penalty	1) Until 2018: EUR 5 per vehicle for the first, EUR 15 for the second, EUR 25 for the third and EUR 95 for each subsequent g/km exceeded 2) From 2019F: EUR 95 per vehicle for each g/km exceeded	1) Approval denied or suspended for types of high CO ₂ emission models 2) Fiscal incentives withdrawal	1) Approval denied 2) USD 14 per vehicle for each 0.1 mpg exceeded
Credits	Super credits granted for low emission vehicles (<50g/km) in 2020-22F	Super credits granted for new energy vehicles (NEVs) and certain energy saving vehicles (<2.8 l/100km)	1) Super credits for BEVs, FCEVs, PHEVs and CNGVs 2) Incentives for hybridisation of full-size pick-up trucks
SOURCES: CGS-CIMB RESEARCH, ICCT, INNOVATIVE CENTER FOR ENERGY AND TRANSPORTATION (ICET) * NEDC stands for "New European Driving Cycle". * CNGV stands for "Compressed Natural Gas Vehicle".			

New EV models by EU OEMs and Tesla >

We believe EU automakers will likely produce EVs based on the implementation of the following: 1) the tightening of CO2 emission standards in the major markets, 2) supportive policies for EVs, and 3) introduction of new models to compete with the popular Tesla Model 3.

We expect demand for EVs in the EU to be especially strong from 2020F onward. The major European automakers (VW, Renault (RNO FP, Not Rated, CP; EUR43.9), Volvo, Daimler (DAI GR, Not Rated, CP; EUR52.4), BMW) are targeting to increase the percentage of EVs in their new model line-ups to 20-30% by 2025F. As such, while the portion of ICE cars in total new sales should fall from 94% in 2018 to 85% in 2025F, we think EVs (including HEVs) in the EU should account for c.14% of auto sales in 2025F.

VW is now focusing on the mass segment with ID.3, a mid-range model priced at around €30-40k, while aiming to become the top EV manufacturer by 2025F. VW is applying its MEB platform to new EV models, such as other ID models, including the Crozz, Roomzz, Vizzion, and Buzz, with a target to produce more than 1m units of EVs annually from 2021F onward. Audi's E-Tron has secured orders of 20k units and has delivered c.1k units per month in Europe since Mar 2019. VW plans to increase the portion of its pure EV sales volume to 30% by 2025F.

We believe Renault will adopt the new EV platform in 2020F and launch new models with higher cost competitiveness. The company has announced that it is set to release an upgraded ZOE model, with a driving range of 360km (vs. 260km for the existing model), at a similar price to that of the current model in 2021F. It also plans to launch a compact hatchback model using an EV platform in 2021-2022F. In 2Q19, Renault guided that it targets to increase the proportion of its pure EV sales volume to 10% by 2022F.

Volvo plans to raise the percentage of its pure EV sales volume to 50% by 2025F, according to its 1Q19 guidance. We think it will bolster its cost competitiveness by adopting its compact modular architecture (CMA). We expect Volvo to release the Polestar 2 (a pure electric SUV model) in 2020F at a price of €50k initially, before launching a €35k mass model (XC 40). The company is set to roll out the Polestar 3 and XC90 in 2021F (source: InsideEV). Volvo has developed a dedicated EV platform jointly with Geely (175 HK, Add, TP; HK\$12.94, CP; HK\$15.1) (as at 2019) and should produce major EV models in China as well from 2020F.

At present, BMW is focusing on both EVs and PHEVs. BMW will likely launch the iX3 in 2020F and i4 in 2021F. The compact all-electric four-door fastback SUV and sedan, designed to compete with Tesla Models Y and 3, will have a driving range of over 500km and target the mass market. BMW is on a flexible strategy based on integrated platforms for conventional vehicles, PHEVs and BEVs. BMW targets to raise the proportion of its pure EV sales volume to 20% by 2025F.

Daimler's EQC SUV is scheduled to produce 25k units in 2019F and 50k units in 2020F. We expect it to release the EQA (Daimler's electric luxury SUV brand), a pure electric hatchback model with a driving range of 350-400km and price of €40k (in 2020F). According to its guidance, Daimler plans to roll out a total of 10 EV models (further EQ models, including the EQV and EQS (Daimler's EV model) by 2022F. Daimler plans to increase the proportion of its pure EV sales volume to 25% by 2025F and 50% by 2030F.

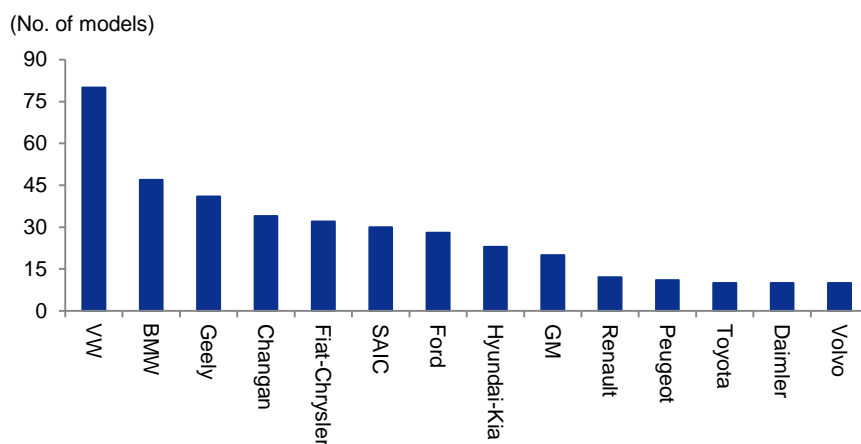
Figure 26: OEMs' EV/PHEV production plan

Company	Year	Detailed EV production plan	Remarks
Tesla	By 2019F	360,000-400,000 units (Model 3)	
	By 2020F	500,000 units (Model 3)	
Renault	By 2019F	120,000 units	
	By 2022F	1,000,000 units	
Hyundai/Kia	By 2019F	100,000 units	
	By 2025F	-	Increase model types to 14
Nissan	By 2019F	150,000 units	
	By 2025F	3,000,000 units	
BYD	By 2019F	650,000 units	Increase model types to 10
	By 2022F	3,000,000 units	
Toyota	By 2020F	-	Introduce 10 new EV model types in China
	By 2030F	5,500,000 units	
GM	By 2020F	-	Introduce 10 new EV model types in China
	By 2025F	-	Increase EV model types to 20
BMW	By 2025F	-	EV proportion of total sales expected to be 15-25%
	By 2026F	1,000,000 units	
Ford	By 2025F	-	Introduce 40 new EV model types
Volvo	By 2025F	1,000,000 units	EV proportion of total sales expected to be 50%
VW	By 2025F	3,000,000 units	Introduce 80 new EV model types
	By 2030F	-	Increase EV model types to 300

* Production plans above guided by each company at 1H19

SOURCES: CGS-CIMB RESEARCH, COMPANY REPORTS

Figure 27: Global automakers – EV models by 2025F



SOURCES: CGS-CIMB RESEARCH, INSIDEEV ESTIMATES

Figure 28: EV/PHEV new models by OEMs

Tesla



Tesla Model Y
Launch year: 2021
Base price: US\$70,000
Body type: SUV
Seats: 7
EV Range: 450 km
Battery capacity: 75.0 kWh



Tesla Roadster
Launch year: 2021
Base price: US\$230,000
Body type: Cabriolet
Seats: 4
EV Range: 970 km
Battery capacity: 200.6 kWh

VW



VW ID.3
Launch year: 2020
Base price: US\$34,000
Body type: Hatchback
Seats: 5
EV Range: 345 km
Battery capacity: 72.0 kWh



VW ID.Crozz
Launch year: 2021
Base price: -
Body type: SUV
Seats: 5
EV Range: 450 km
Battery capacity: 83.0 kWh



VW ID. Roomzz
Launch year: 2021
Base price: -
Body type: SUV
Seats: 5
EV Range: 450 km
Battery capacity: 82.0 kWh



VW ID. Vizion
Launch year: 2022
Base price: -
Body type: Sedan
Seats: 4
EV Range: 600 km
Battery capacity: 111.0 kWh

Audi



Audi e-tron GT
Launch year: 2020
Base price: US\$80,000
Body type: Sedan
Seats: 4
EV Range: 415 km
Battery capacity: 90.7 kWh



Audi Q4 e-tron
Launch year: 2020
Base price: US\$70,000
Body type: SUV
Seats: 5
EV Range: 425 km
Battery capacity: 83.0 kWh



Audi e-tron Sportback
Launch year: 2021
Base price: US\$77,300
Body type: Sedan
Seats: 4
EV Range: 360 km
Battery capacity: 95.0 kWh

Porsche



Porsche Taycan
Launch year: 2020
Base price: US\$115,000
Body type: Sedan
Seats: 4
EV Range: 365 km
Battery capacity: 79.2 kWh



Porsche Macan Turbo
Launch year: 2020
Base price: US\$90,000
Body type: SUV
Seats: 5
EV Range: 450 km
Battery capacity: 90.2 kWh

BMW



BMW iX3
Launch year: 2020
Base price: US\$62,000
Body type: SUV
Seats: 5
EV Range: 350 km
Battery capacity: 75.0 kWh



BMW iNext
Launch year: 2021
Base price: -
Body type: SUV
Seats: 5
EV Range: 450 km
Battery capacity: 80.5 kWh



BMW i4
Launch year: 2021
Base price: -
Body type: Sedan
Seats: 4
EV Range: >300 km
Battery capacity: 85.0 kWh

Volvo



Volvo XC40 Recharge
Launch year: 2020
Base price: US\$65,000
Body type: SUV
Seats: 5
EV Range: 375 km
Battery capacity: 78.0 kWh



Polestar 2
Launch year: 2020
Base price: US\$64,000
Body type: Liftback sedan
Seats: 5
EV Range: 450 km
Battery capacity: 78.0 kWh

Daimler



Mercedes EQA
Launch year: 2020
Base price: US\$45,000
Body type: Hatchback
Seats: 5
EV Range: 350 km
Battery capacity: 72.0 kWh



Ford Mustang
Launch year: 2020
Base price: US\$70,000
Body type: SUV
Seats: 5
EV Range: 470 km
Battery capacity: 86.0 kWh

Others



Skoda Vision 4
Launch year: 2020
Base price: US\$42,000
Body type: SUV
Seats: 4
EV Range: 450 km
Battery capacity: 83.0 kWh



Lucid Air
Launch year: 2020
Base price: US\$72,000
Body type: Sedan
Seats: 5
EV Range: 350 km
Battery capacity: 75.0 kWh



Peugeot e-208
Launch year: 2020
Base price: US\$38,000
Body type: Hatchback
Seats: 5
EV Range: 325 km
Battery capacity: 70.0 kWh

SOURCES: CGS-CIMB RESEARCH, EV DATABASE.ORG, INSIDEEV

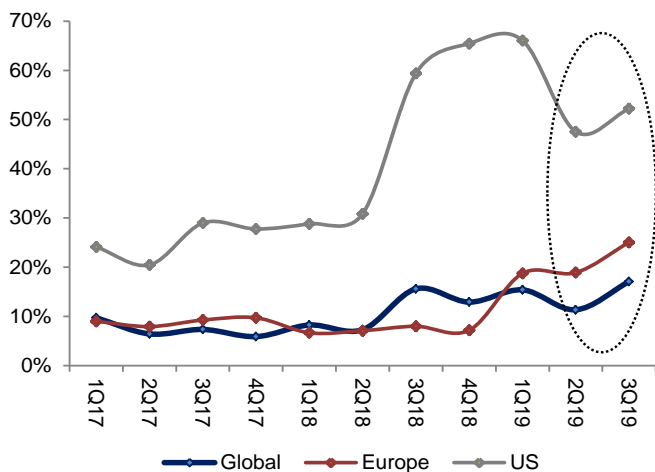
For the US EV OEMs, we believe that Tesla’s successful operations for its new Chinese factory should serve as a crucial factor influencing the EV market sentiment. Elon Musk announced during Tesla’s 3Q19 results conference call that the Shanghai Gigafactory should operate in earnest from 2020F.

Tesla has guided the Shanghai Gigafactory should start producing 250k units on an annual basis (starting in 2020F), with a weekly output of 5k. The weekly output could be raised to 10k units by end-2020F, according to Tesla, which is equivalent to an annual production of 520k units from 2021F onwards (a measure of successful mass production, in our view). As such, Tesla expects it to raise EV production from 380k units in 2019F to 600k units in 2020F. Tesla is aiming to sell over 1m units of its Model 3 line-up by 2021F, which should accelerate the number of new EV models, in our view.

Moreover, Tesla is scheduled to launch the crossover SUV Model Y in 2Q20F. We expect Tesla’s Model Y to be another catalyst for the overall EV market going forward. We see global automakers striving to release an increasing number of new models to compete against Tesla.

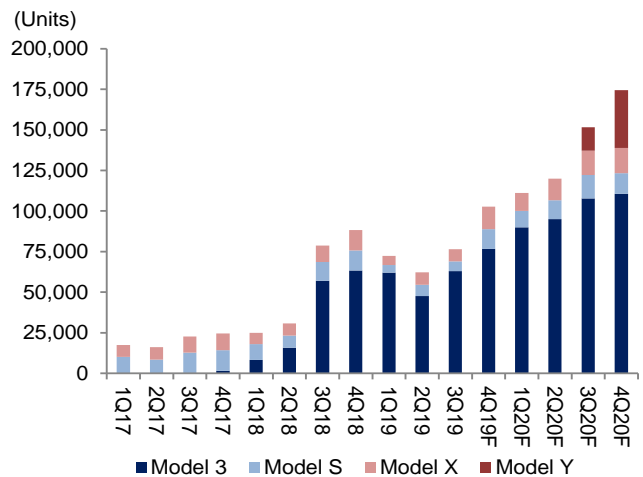
Elon Musk said on 13 Nov 2019 that its fourth Gigafactory will be built just outside Berlin, Germany. The Berlin Gigafactory will produce Model 3 and Model Y vehicles. After construction of the Berlin Gigafactory in 2021F, we expect the EV sales boom to start from the EU market, with competition among OEMs’ new models and reasonable EV prices.

Figure 29: Tesla market share in terms of EV units sold (Pure EV+PHEV)



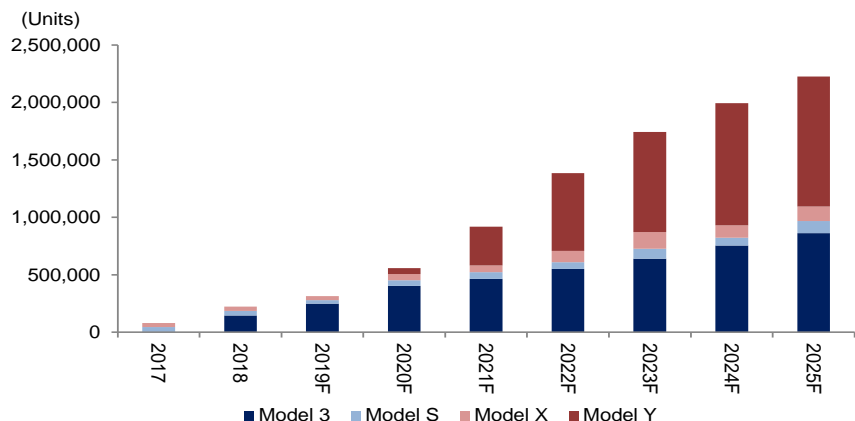
SOURCES: CGS-CIMB RESEARCH, MARKLINES

Figure 30: Tesla quarterly EV sales forecasts by model (Tesla estimates)



SOURCES: CGS-CIMB RESEARCH, MARKLINES, COMPANY REPORTS

Figure 31: Tesla annual EV sales forecasts by model (Tesla estimates)



SOURCES: CGS-CIMB RESEARCH, MARKLINES, COMPANY REPORTS

Strong EU EV sales by subsidy and incentives ►

Governments around the world have set goals to increase the footprint of EVs, motivated by the long-term targets for climate change mitigation and reduction of petroleum use. To accomplish these goals, governments have enacted direct subsidies and fiscal incentives, along with regulatory policies to help accelerate the movement of EVs into the mainstream market.

Given the higher upfront costs for EVs, we believe that one of the factors that will initially drive vehicle electrification would be government incentives (i.e. direct subsidies and tax incentives). We note the types of government incentives as well as levels that are available in different markets currently (Fig 32). Besides direct subsidies (a one-time bonus upon purchase of an EV) and fiscal incentives (a reduced purchase price and/or annual tax for EVs), fuel savings also come into play when determining EVs' economics vs. ICE vehicles.

There are numerous direct-subsidy programmes in EU/China/US, and they are relatively easy to quantify as subsidies are usually defined as fixed amounts that are paid if a certain set of pass/fail criteria is met.

Fiscal incentives are also an integral element to encourage the purchase of EVs. There are basically four main categories where tax breaks may exist in major markets: 1) VAT, 2) one-time purchase/registration tax, 3) annual circulation tax, and 4) company car tax. We believe that fiscal incentives could have a potential impact on EV purchases in major markets.

We highlight some of the direct subsidies in EU markets. For countries such as Norway and the Netherlands where the penetration rate is relatively high, the government offers very attractive fiscal incentives instead of direct subsidies.

Figure 32: Subsidy and incentives by country (Nov 2019)

Country	Purchase Incentives	Tax Benefits (Acquisition + Ownership)	Remarks
Germany	EUR 6,000 for BEVs and FCEVs EUR 4,500 for PHEVs and EREVs	10 year tax exemption for all electric vehicles	A special tax bonus available dependent on the vehicle's battery size - list price value reduction by EUR 200/kwh (until 2025)
Norway	-	VAT (25%) exemption for electric vehicles	Import tax also exempted for pure electric and fuel cell vehicles
United Kingdom	GBP 3,500 for BEVs GBP 8,000 for electric vans	Total exemption for zero-emission vehicles	EV drivers can enter the London Congestion Zone without paying GBP 11.5 daily charge
France	EUR 6,000 eco-bonus for purchase of an EV	Total or 50% exemption for green vehicles	Maximum EUR 2,500 scrappage bonus for older petrol or diesel models
Sweden	EUR 5,600 for BEVs EUR 930 for PHEVs (less than 60g CO2/km)	40% tax reduction for BEVs and PHEVs	-
Spain	EUR 5,500 for BEVs and PHEVs	75% tax reduction for BEVs in main cities	-
Austria	EUR 3,000 for new BEVs and FCEVs EUR 3,500 for PHEVs and EREVs	VAT exemption for zero-emission vehicles	Purchase incentive scheme until end of 2020
Italy	EUR 4,000 eco-bonus for purchase of an EV	5 year tax exemption for electric vehicles & 75% tax reduction after 5 years	Maximum EUR 2,000 scrappage bonus (Jan 17 - Feb 18) Purchase incentive scheme until end of 2021
Ireland	EUR 5,000 for BEVs and PHEVs	Minimum rate (EUR 120) for electric vehicles	Purchase incentive scheme until end of 2021
Finland	EUR 2,000 for a new EV	Minimum rate for zero-emission vehicles	-
Romania	EUR 10,000 for BEVs EUR 4,500 for HEVs	-	EUR 1,500 bonus for scrapping a vehicle older than 8 years
China	CNY 25,000 for BEVs (range ≥ 400km) CNY 18,000 for BEVs (range < 400km)	Acquisition tax exemption on electric vehicles	Electric vehicles not subject to registration restrictions or driving bans on certain days China EV purchase incentive history: - CNY 66,000 for BEVs of range over 250km (Jan 17 - Feb 18) - CNY 55,000 for BEVs of range over 400km (Feb 18 - June 19) - CNY 36,000 for BEVs of range between 250km and 400km (Feb 18 - June 19)
United States		Federal tax credit of up to USD 7,500	-

SOURCES: CGS-CIMB RESEARCH, ICCT, CONTINENTAL AG

EV battery outlook

High-quality battery sellers' market for the next three years >

While we forecast xEV (all electric vehicles) sales volume to grow at a CAGR of 18% over 2019-23F, we expect EV battery demand to grow much faster at a volume CAGR of 53% over the same period, on the back of 1) greater battery capacities, significantly improving EVs driving range; and 2) larger number of new EVs (battery EVs and plug-in hybrid electric vehicle, PHEVs) being rolled out by automakers.

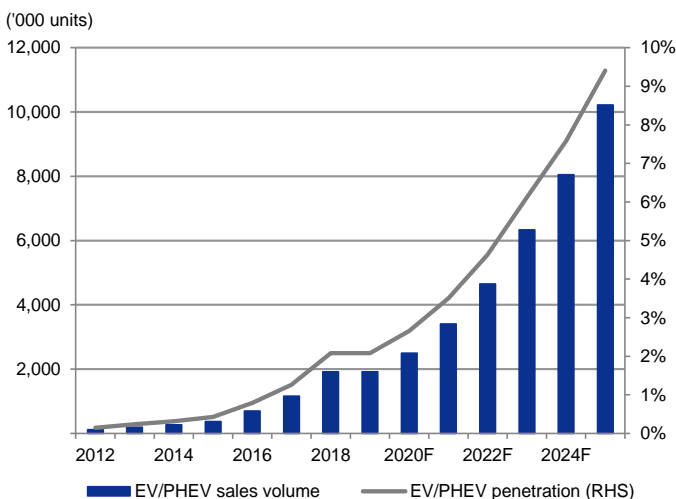
We project automakers to launch new 3rd-generation EVs globally from 2H20F. These EVs need greater battery cell size, i.e. average battery size of over 75kWh capacity vs. 30-40kWh for 2nd-generation EVs and 2kWh for hybrid EVs (HEVs).

We project EV (EV/PHEV) sales volume to grow from 1.9m units (2.1% of new vehicle sales) in 2019F to 6.3m units in 2023F (6%), or a CAGR of 35% over the next four years. Notably, we estimate that EVs/PHEVs will account for 45% of xEVs (including HEV) sold in 2019F, and over 70% in 2023F. As such, we project global EV battery volume demand CAGR of 53% over FY19-23.

We forecast EV battery demand to increase from 95GWh in 2019F to 212GWh in 2021F and 520GWh in 2023F. However, there is a limited number of high quality suppliers (LGC, CATL, Panasonic (6752 JP, Not Rated, CP; JPY1,009), SDI and SKI; combined capacity of 253GWh by end-2022F, based on our estimates), that can produce high-quality batteries at competitive costs, in our view.

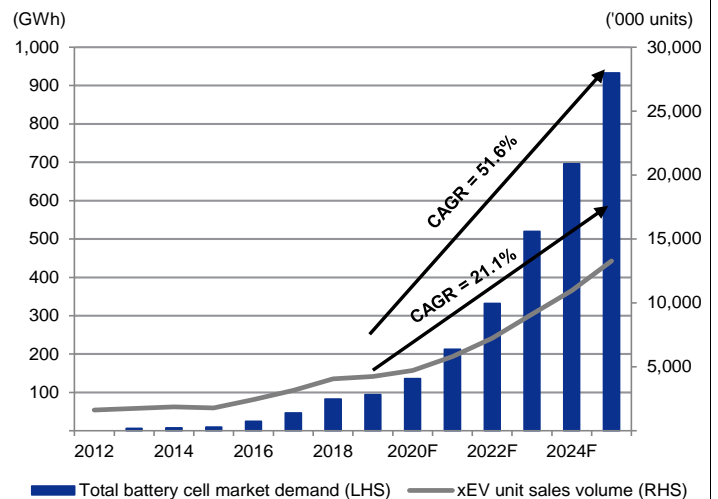
We expect the bargaining power of leading battery makers to increase and their earnings to improve as the number of battery makers capable of supplying high-quality, low-cost EV batteries will likely remain limited amid strong growth in EV demand from 2H20F and competition with model diversification by global automakers.

Figure 33: The proportion of EV/PHEV sales to new-vehicle sales to rise from 2.1% in 2019F to 9% in 2025F based on CGS-CIMB estimates



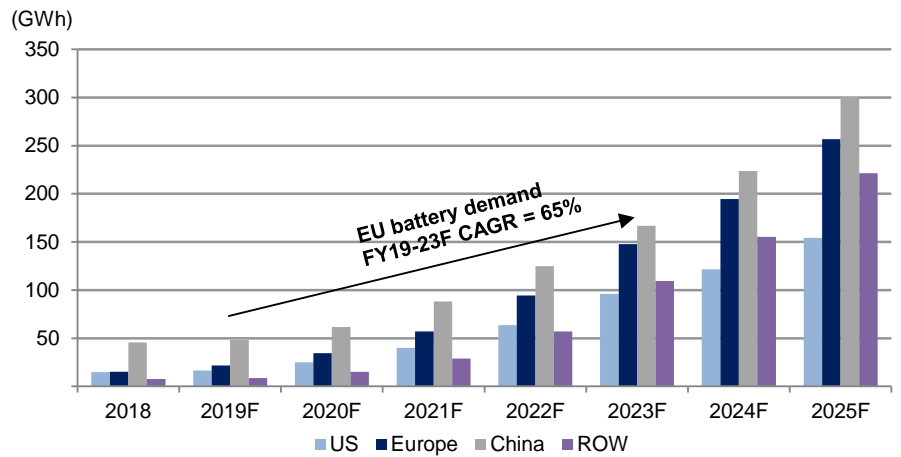
SOURCES: CGS-CIMB RESEARCH ESTIMATES, MARKLINES

Figure 34: We project EV battery volume CAGR of 52% in 2019-2023F vs. xEV unit sales CAGR of 21%



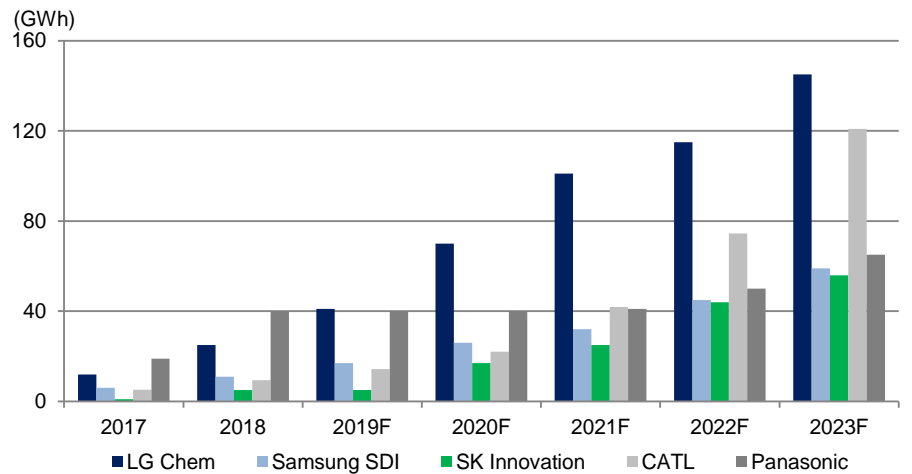
SOURCES: CGS-CIMB RESEARCH ESTIMATES, MARKLINES

Figure 35: Global EV battery demand by region



SOURCES: CGS-CIMB RESEARCH ESTIMATES, MARKLINES

Figure 36: Global EV battery makers' capacity trend

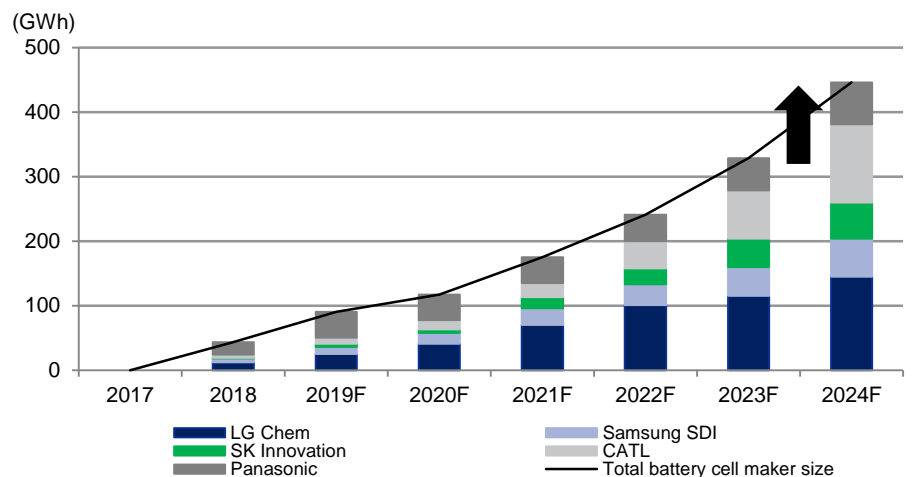


SOURCES: CGS-CIMB RESEARCH ESTIMATES, SNE RESEARCH ESTIMATES

* CGS-CIMB estimates used for LG Chem, Samsung SDI and SK Innovation

* SNE Research estimates used for CATL (300750 CH, Not Rated) and Panasonic (6752 JP, Not Rated)

Figure 37: Global EV battery demand vs. supply: limited production capacity for 3rd generation EV batteries



SOURCES: CGS-CIMB RESEARCH ESTIMATES, SNE RESEARCH ESTIMATES

* CGS-CIMB estimates used for LG Chem, Samsung SDI and SK Innovation

* SNE Research estimates used for CATL (300750 CH, Not Rated) and Panasonic (6752 JP, Not Rated)

Figure 38: EV battery demand and market forecasts based on CGS-CIMB estimates

	2013	2014	2015	2016	2017	2018	2019F	2020F	2021F	2022F	2023F	2024F	2025F	CAGR (19-20F)	CAGR (19-23F)	CAGR (19-25F)
HEV																
Battery size (kwh)	1.5	1.5	1.6	2.0	2.0	2.1	2.2	2.3	2.5	2.8	3.0	3.3	3.5	5%	9%	8%
Change in battery size (%)		3%	3%	25%	3%	3%	3%	5%	10%	10%	10%	8%	8%			
Battery cell cost (US\$/kwh)	470	456	410	267	187	172	163	155	146	136	127	120	113	-5%	-6%	-6%
Change in battery price (%)		-3%	-10%	-35%	-30%	-8%	-5%	-5%	-6%	-7%	-6%	-6%	-6%			
Vehicles ('000 units)	1,559	1,595	1,420	1,742	2,003	2,152	2,324	2,222	2,395	2,582	2,784	2,922	3,068	-4%	5%	5%
Total battery cell market size (GWh)	2.3	2.5	2.3	3.5	4.1	4.5	5.1	5.1	6.0	7.1	8.5	9.6	10.9	0%	14%	14%
Total battery cell market size (US\$m)	1,099	1,123	927	924	766	780	824	786	873	970	1,077	1,148	1,224	-5%	7%	7%
PHEV																
Battery size (kwh)	12.0	12.4	12.7	15.9	16.7	17.5	18.4	20.3	23.3	26.8	29.5	32.4	35.7	10%	12%	12%
Change in battery size (%)		3%	3%	25%	5%	5%	5%	10%	15%	15%	10%	10%	10%			
Battery cell cost (US\$/kwh)	470	456	410	267	187	172	163	155	146	137	130	124	117	-5%	-6%	-5%
Change in battery price (%)		-3%	-10%	-35%	-30%	-8%	-5%	-5%	-6%	-6%	-5%	-5%	-5%			
Vehicles ('000 units)	90	105	124	260	423	632	539	756	1,008	1,344	1,793	2,248	2,819	40%	35%	32%
Total battery cell market size (GWh)	1.1	1.3	1.6	4.1	7.1	11.1	9.9	15.3	23.1	35.0	52.9	72.9	100.5	54%	52%	47%
Total battery cell market size (US\$m)	505	591	650	1,103	1,321	1,905	1,622	2,374	3,384	4,825	6,879	9,012	11,806	46%	44%	39%
EV																
Battery size (kwh)	24.0	24.7	25.5	38.2	47.7	52.5	57.8	66.4	78.4	91.7	100.9	105.8	111.0	15%	15%	11%
Change in battery size (%)		3%	3%	50%	25%	10%	10%	15%	18%	17%	10%	5%	5%			
Battery cell cost (US\$/kwh)	470	456	410	246	165	152	146	140	130	122	116	110	105	-4%	-6%	-5%
Change in battery price (%)		-3%	-10%	-40%	-33%	-8%	-4%	-4%	-7%	-6%	-5%	-5%	-5%			
Vehicles ('000 units)	109	162	245	442	737	1,283	1,381	1,744	2,399	3,302	4,544	5,800	7,402	26%	35%	32%
Total battery cell market size (GWh)	2.6	4.0	6.2	16.9	35.2	67.4	79.8	115.8	183.2	289.8	458.4	613.7	821.5	45%	55%	47%
Total battery cell market size (US\$m)	1,226	1,828	2,555	4,152	5,806	10,228	11,625	16,199	24,085	35,811	53,246	67,617	85,867	39%	46%	40%
Total xEV battery																
Average battery size (kwh)	3.4	4.2	5.6	10.0	14.7	20.4	22.3	28.9	36.1	45.3	57.0	63.2	70.2	29%	26%	21%
Change in battery size (%)		22%	35%	78%	46%	39%	9%	29%	25%	25%	26%	11%	11%			
Battery cell cost (US\$/kwh)	470	456	410	253	170	156	148	142	133	125	118	112	106	-4%	-6%	-5%
Change in battery price (%)		-3%	-10%	-38%	-33%	-9%	-5%	-4%	-6%	-6%	-6%	-5%	-5%			
Vehicles ('000 units)	1,757	1,862	1,789	2,444	3,164	4,068	4,245	4,721	5,880	7,323	9,121	11,009	13,289	11%	21%	21%
Total battery cell market size (GWh)	6.0	7.8	10.1	24.5	46.4	83.0	94.8	136.2	212.4	331.9	519.8	696.2	932.9	44%	53%	46%
Total battery cell market size (US\$m)	2,831	3,543	4,132	6,180	7,893	12,913	14,071	19,359	28,343	41,606	61,202	77,777	98,897	38%	44%	38%

SOURCES: CGS-CIMB RESEARCH ESTIMATES, LMC, IHS, WARDAUTO, MARKLINES, ICTT

Figure 39: EV battery demand and market forecasts by region based on CGS-CIMB estimates

	2013	2014	2015	2016	2017	2018	2019F	2020F	2021F	2022F	2023F	2024F	2025F	CAGR (19-20F)	CAGR (19-23F)	CAGR (19-25F)
EU																
HEV																
Battery size (kwh)	1.5	1.5	1.6	2.0	2.0	2.1	2.2	2.3	2.5	2.8	3.0	3.3	3.5	5%	9%	8%
Battery cell cost (US\$/kwh)	470	456	410	267	187	172	163	155	146	136	127	120	113	-5%	-6%	-6%
Change in battery price (%)	-	-3%	-10%	-35%	-30%	-8%	-5%	-5%	-6%	-7%	-6%	-6%	-6%	-	-	-
Vehicles ('000 units)	73	85	33	213	310	393	449	489	521	555	591	651	716	9%	7%	8%
Total battery cell market size (GWh)	0.1	0.1	0.1	0.4	0.6	0.8	1.0	1.1	1.3	1.5	1.8	2.1	2.5	15%	17%	17%
Total battery cell market size (US\$m)	51	60	21	113	119	142	159	173	191	208	229	256	286	9%	10%	10%
PHEV																
Battery size (kwh)	12.0	12.4	12.7	15.9	16.7	17.5	18.4	20.3	23.3	26.8	29.5	32.4	35.7	10%	12%	12%
Battery cell cost (US\$/kwh)	470	456	410	267	187	172	163	155	146	137	130	124	117	-5%	-6%	-5%
Change in battery price (%)	-	-3%	-10%	-35%	-30%	-8%	-5%	-5%	-6%	-6%	-5%	-5%	-5%	-	-	-
Vehicles ('000 units)	23	17	8	109	170	197	155	189	251	332	439	561	716	22%	30%	29%
Total battery cell market size (GWh)	0.3	0.2	0.1	1.7	2.8	3.5	2.8	3.8	5.8	8.9	12.9	18.2	25.6	35%	46%	44%
Total battery cell market size (US\$m)	127	98	40	461	532	593	465	595	852	1,218	1,685	2,249	3,001	28%	38%	36%
EV																
Battery size (kwh)	24.0	24.7	25.5	38.2	47.7	52.5	57.8	66.4	78.4	91.7	100.9	105.8	111.0	15%	15%	11%
Battery cell cost (US\$/kwh)	470	456	410	246	165	152	146	140	130	122	116	110	105	-4%	-6%	-5%
Change in battery price (%)	-	-3%	-10%	-40%	-33%	-8%	-4%	-4%	-7%	-6%	-5%	-5%	-5%	-	-	-
Vehicles ('000 units)	31	49	58	95	137	207	309	442	636	916	1,318	1,647	2,060	43%	44%	37%
Total battery cell market size (GWh)	0.8	1.2	1.5	3.6	6.6	10.8	17.9	29.4	49.9	84.0	133.0	174.3	228.6	64%	65%	53%
Total battery cell market size (US\$m)	354	548	608	896	1,082	1,646	2,604	4,108	6,487	10,268	15,442	19,207	23,891	58%	56%	45%
Total xEV battery																
Average battery size (kwh)	8.9	10.3	16.6	13.9	16.2	19.0	23.8	30.6	40.5	52.4	62.9	68.1	73.5	29%	28%	21%
Battery cell cost (US\$/kwh)	470	456	410	254	172	157	149	142	132	124	118	112	106	-5%	-6%	-6%
Change in battery price (%)	-	-3%	-10%	-38%	-32%	-9%	-5%	-5%	-7%	-6%	-5%	-5%	-5%	-	-	-
Vehicles ('000 units)	127	151	99	417	618	797	913	1,121	1,408	1,803	2,348	2,859	3,492	23%	27%	25%
Total battery cell market size (GWh)	1.1	1.5	1.6	5.8	10.0	15.1	21.7	34.3	57.0	94.4	147.7	194.6	256.6	58%	62%	51%
Total battery cell market size (US\$m)	532	706	669	1,469	1,733	2,382	3,228	4,876	7,529	11,694	17,355	21,712	27,178	51%	52%	43%
U.S.																
HEV																
Battery size (kwh)	1.5	1.5	1.6	2.0	2.0	2.1	2.2	2.3	2.5	2.8	3.0	3.3	3.5	5%	9%	8%
Battery cell cost (US\$/kwh)	470	456	410	267	187	172	163	155	146	136	127	120	113	-5%	-6%	-6%
Change in battery price (%)	-	-3%	-10%	-35%	-30%	-8%	-5%	-5%	-6%	-7%	-6%	-6%	-6%	-	-	-
Vehicles ('000 units)	494	451	384	347	371	341	402	401	402	403	404	406	408	0%	0%	0%
Total battery cell market size (GWh)	0.7	0.7	0.6	0.7	0.8	0.7	0.9	0.9	1.0	1.1	1.2	1.3	1.4	5%	9%	9%
Total battery cell market size (US\$m)	348	318	251	184	142	124	143	142	147	151	156	160	163	-1%	2%	2%
PHEV																
Battery size (kwh)	12.0	12.4	12.7	15.9	16.7	17.5	18.4	20.3	23.3	26.8	29.5	32.4	35.7	10%	12%	12%
Battery cell cost (US\$/kwh)	470	456	410	267	187	172	163	155	146	137	130	124	117	-5%	-6%	-5%
Change in battery price (%)	-	-3%	-10%	-35%	-30%	-8%	-5%	-5%	-6%	-6%	-5%	-5%	-5%	-	-	-
Vehicles ('000 units)	49	55	43	73	91	119	105	143	172	208	250	295	347	36%	24%	22%
Total battery cell market size (GWh)	0.6	0.7	0.5	1.2	1.5	2.1	1.9	2.9	4.0	5.6	7.4	9.6	12.4	50%	40%	36%
Total battery cell market size (US\$m)	277	311	224	309	284	360	315	448	584	762	960	1,181	1,453	42%	32%	29%
EV																
Battery size (kwh)	24.0	24.7	25.5	38.2	47.7	52.5	57.8	66.4	78.4	91.7	100.9	105.8	111.0	15%	15%	11%
Battery cell cost (US\$/kwh)	470	456	410	246	165	152	146	140	130	122	116	110	105	-4%	-6%	-5%
Change in battery price (%)	-	-3%	-10%	-40%	-33%	-8%	-4%	-4%	-7%	-6%	-5%	-5%	-5%	-	-	-
Vehicles ('000 units)	48	65	72	87	104	231	236	321	447	622	866	1,047	1,265	36%	38%	32%
Total battery cell market size (GWh)	1.1	1.6	1.8	3.3	5.0	12.1	13.6	21.3	35.0	57.1	87.4	110.8	140.4	56%	59%	48%
Total battery cell market size (US\$m)	538	734	749	815	822	1,842	1,986	2,981	4,556	6,977	10,152	12,208	14,679	50%	50%	40%
Total xEV battery																
Average battery size (kwh)	4.2	5.2	6.0	10.2	12.8	21.6	22.1	29.1	39.2	51.7	63.1	69.6	76.3	31%	30%	23%
Battery cell cost (US\$/kwh)	470	456	410	254	172	156	149	142	132	124	117	111	106	-4%	-6%	-6%
Change in battery price (%)	-	-3%	-10%	-38%	-32%	-9%	-4%	-4%	-7%	-6%	-5%	-5%	-5%	-	-	-
Vehicles ('000 units)	591	572	499	507	566	692	743	865	1,021	1,233	1,521	1,748	2,021	16%	20%	18%
Total battery cell market size (GWh)	2.5	3.0	3.0	5.2	7.3	15.0	16.4	25.1	40.0	63.7	96.0	121.7	154.2	53%	55%	45%
Total battery cell market size (US\$m)	1,163	1,363	1,223	1,309	1,247	2,325	2,444	3,571	5,287	7,890	11,269	13,549	16,295	46%	47%	37%

SOURCES: CGS-CIMB RESEARCH ESTIMATES, LMC, IHS, WARDAUTO, MARKLINES, ICCT

Figure 40: EV battery demand and market forecasts by region based on CGS-CIMB estimates

	2013	2014	2015	2016	2017	2018	2019F	2020F	2021F	2022F	2023F	2024F	2025F	CAGR (19-20F)	CAGR (19-23F)	CAGR (19-25F)
China																
HEV																
Battery size (kwh)	1.5	1.5	1.6	2.0	2.0	2.1	2.2	2.3	2.5	2.8	3.0	3.3	3.5	5%	9%	8%
Battery cell cost (US\$/kwh)	470	456	410	267	187	172	163	155	146	136	127	120	113	-5%	-6%	-6%
Change in battery price (%)	-	-3%	-10%	-35%	-30%	-8%	-5%	-5%	-6%	-7%	-6%	-6%	-6%	-	-	-
Vehicles ('000 units)	7	7	10	33	113	198	203	236	276	323	377	406	437	17%	17%	14%
Total battery cell market size (GWh)	0.0	0.0	0.0	0.1	0.2	0.4	0.4	0.5	0.7	0.9	1.1	1.3	1.5	22%	27%	23%
Total battery cell market size (US\$m)	5	5	7	17	43	72	72	84	101	121	146	159	174	16%	19%	16%
PHEV																
Battery size (kwh)	12.0	12.4	12.7	15.9	16.7	17.5	18.4	20.3	23.3	26.8	29.5	32.4	35.7	10%	12%	12%
Battery cell cost (US\$/kwh)	470	456	410	267	187	172	163	155	146	137	130	124	117	-5%	-6%	-5%
Change in battery price (%)	-	-3%	-10%	-35%	-30%	-8%	-5%	-5%	-6%	-6%	-5%	-5%	-5%	-	-	-
Vehicles ('000 units)	1	15	59	68	111	262	225	307	371	447	539	720	961	36%	24%	27%
Total battery cell market size (GWh)	0.0	0.2	0.7	1.1	1.8	4.6	4.1	6.2	8.6	12.0	15.9	23.3	34.3	50%	40%	42%
Total battery cell market size (US\$m)	6	83	306	290	345	790	677	965	1,259	1,641	2,068	2,884	4,024	43%	32%	35%
EV																
Battery size (kwh)	24.0	24.7	25.5	38.2	47.7	52.5	57.8	66.4	78.4	91.7	100.9	105.8	111.0	15%	15%	11%
Battery cell cost (US\$/kwh)	470	456	410	246	165	152	146	140	130	122	116	110	105	-4%	-6%	-5%
Change in battery price (%)	-	-3%	-10%	-40%	-33%	-8%	-4%	-4%	-7%	-6%	-5%	-5%	-5%	-	-	-
Vehicles ('000 units)	11	28	97	233	457	770	754	827	1,005	1,221	1,482	1,881	2,387	10%	18%	21%
Total battery cell market size (GWh)	0.3	0.7	2.5	8.9	21.8	40.4	43.6	55.0	78.8	111.9	149.5	199.0	264.9	26%	36%	35%
Total battery cell market size (US\$m)	126	312	1,016	2,193	3,597	6,136	6,349	7,688	10,246	13,686	17,369	21,930	27,688	21%	29%	28%
Total xEV battery																
Average battery size (kwh)	15.3	17.8	19.5	30.1	35.1	37.0	40.7	45.0	53.3	62.7	69.4	74.4	79.5	11%	14%	12%
Battery cell cost (US\$/kwh)	470	456	410	249	167	154	147	142	132	124	118	112	106	-4%	-5%	-5%
Change in battery price (%)	-	-3%	-10%	-39%	-33%	-8%	-4%	-4%	-7%	-6%	-5%	-5%	-5%	-	-	-
Vehicles ('000 units)	19	49	166	334	681	1,230	1,182	1,371	1,652	1,990	2,399	3,006	3,784	16%	19%	21%
Total battery cell market size (GWh)	0.3	0.9	3.2	10.1	23.9	45.5	48.2	61.7	88.1	124.8	166.6	223.7	300.7	28%	36%	36%
Total battery cell market size (US\$m)	137	400	1,329	2,501	3,986	6,998	7,098	8,737	11,606	15,447	19,583	24,974	31,886	23%	29%	28%
ROW																
HEV																
Battery size (kwh)	1.5	1.5	1.6	2.0	2.0	2.1	2.2	2.3	2.5	2.8	3.0	3.3	3.5	5%	9%	8%
Battery cell cost (US\$/kwh)	470	456	410	267	187	172	163	155	146	136	127	120	113	-5%	-6%	-6%
Change in battery price (%)	-	-3%	-10%	-35%	-30%	-8%	-5%	-5%	-6%	-7%	-6%	-6%	-6%	-	-	-
Vehicles ('000 units)	985	1,052	993	1,149	1,208	1,220	1,270	1,095	1,165	1,267	1,411	1,451	1,507	-14%	3%	3%
Total battery cell market size (GWh)	1.5	1.6	1.6	2.3	2.5	2.6	2.8	2.5	2.9	3.5	4.3	4.8	5.3	-10%	12%	12%
Total battery cell market size (US\$m)	695	741	648	610	462	442	451	387	426	474	546	570	601	-14%	5%	5%
PHEV																
Battery size (kwh)	12.0	12.4	12.7	15.9	16.7	17.5	18.4	20.3	23.3	26.8	29.5	32.4	35.7	10%	12%	12%
Battery cell cost (US\$/kwh)	470	456	410	267	187	172	163	155	146	137	130	124	117	-5%	-6%	-5%
Change in battery price (%)	-	-3%	-10%	-35%	-30%	-8%	-5%	-5%	-6%	-6%	-5%	-5%	-5%	-	-	-
Vehicles ('000 units)	17	18	15	10	51	54	55	116	194	330	565	669	795	113%	79%	56%
Total battery cell market size (GWh)	0.2	0.2	0.2	0.2	0.9	0.9	1.0	2.4	4.5	8.8	16.6	21.7	28.3	134%	102%	74%
Total battery cell market size (US\$m)	95	99	80	43	160	162	164	365	660	1,210	2,166	2,681	3,328	122%	91%	65%
EV																
Battery size (kwh)	24.0	24.7	25.5	38.2	47.7	52.5	57.8	66.4	78.4	91.7	100.9	105.8	111.0	15%	15%	11%
Battery cell cost (US\$/kwh)	470	456	410	246	165	152	146	140	130	122	116	110	105	-4%	-6%	-5%
Change in battery price (%)	-	-3%	-10%	-40%	-33%	-8%	-4%	-4%	-7%	-6%	-5%	-5%	-5%	-	-	-
Vehicles ('000 units)	89	21	18	26	39	76	81	153	273	489	878	1,218	1,690	88%	81%	66%
Total battery cell market size (GWh)	2.1	0.5	0.4	1.0	1.8	4.0	4.7	10.2	21.4	44.9	88.5	128.9	187.6	116%	108%	85%
Total battery cell market size (US\$m)	1,003	235	183	248	305	604	686	1,422	2,788	5,487	10,282	14,198	19,609	107%	97%	75%
Total xEV battery																
Average battery size (kwh)	3.5	2.2	2.2	2.9	4.0	5.6	6.0	11.0	17.7	27.4	38.4	46.5	55.4	83%	59%	45%
Battery cell cost (US\$/kwh)	470	456	410	261	179	161	153	145	134	125	119	112	106	-6%	-6%	-6%
Change in battery price (%)	-	-3%	-10%	-36%	-31%	-10%	-5%	-6%	-7%	-7%	-5%	-5%	-5%	-	-	-
Vehicles ('000 units)	1,091	1,090	1,026	1,186	1,298	1,350	1,407	1,364	1,633	2,086	2,853	3,337	3,992	-3%	19%	19%
Total battery cell market size (GWh)	3.8	2.4	2.2	3.5	5.2	7.5	8.5	15.0	28.9	57.2	109.5	155.3	221.3	77%	90%	72%
Total battery cell market size (US\$m)	1,793	1,074	911	901	927	1,208	1,301	2,175	3,874	7,171	12,994	17,450	23,538	67%	78%	62%

SOURCES: CGS-CIMB RESEARCH ESTIMATES, LMC, IHS, WARDAUTO, MARKLINES, ICCT

Korean battery makers to benefit from strong EU market over the next three years ➤

While we forecast a sales CAGR of 40% for EU EV (EVs/PHEVs) in 2019-23 on strong government subsidies and incentives, we expect China EV (EVs/PHEVs) sales to grow at a slower CAGR of 20% in 2019-23F given the impact of subsidy cuts. We expect EU EV (EVs/PHEVs) sales to drive overall passenger EV growth for the next three years.

In 2018-2019 (in YTD Sep 2019), Korean battery players secured large-scale battery contracts with European customers, such as Volkswagen group including Audi, Renault, Volvo and BMW – and US clients –Tesla, General Motors (GM US, Not Rated, CP; US\$36.1) and Ford (F US, Not Rated, CP; US\$9.1) – based on its competitive edge in quality and technology. As such, we expect Korean EV battery makers' capacity to increase to 215GWh based on strong passenger EV battery demand of over 330GWh for 2022F.

We believe European and US automakers are set to release new EV models in the EU over the next three years to secure market share and meet environmental regulations/EV sales targets. As such, we expect Korean battery players to benefit the most from the growing EU market given their strong order backlog. We expect Korean battery makers' margins to improve from 2020F, aided by a rapid increase in EV battery revenue from the EU market.

A strong track record of mass-produced high-density cells for EU and US OEMs should lead to a continuous supply of contracts in the longer term in global markets, in our view. As Korea battery makers outperform competitors in terms of energy efficiency and density, we believe Korean battery players are well-positioned to receive additional orders for next generation EV batteries (mainly NCM 8 series). According to Solar And Electric Research (SNE Research, a research institution for rechargeable and renewable energy industries), CATL's mass-produced battery had energy density of c.200Wh/kg while LGC's batteries had energy density higher than 250Wh/kg in 2018. We expect Korean battery cell makers to maintain a competitive edge over the next five years given their strong safety records.

Figure 41: EU EV (EVs/PHEVs) sales to grow at a CAGR of 39% in 2019-23F

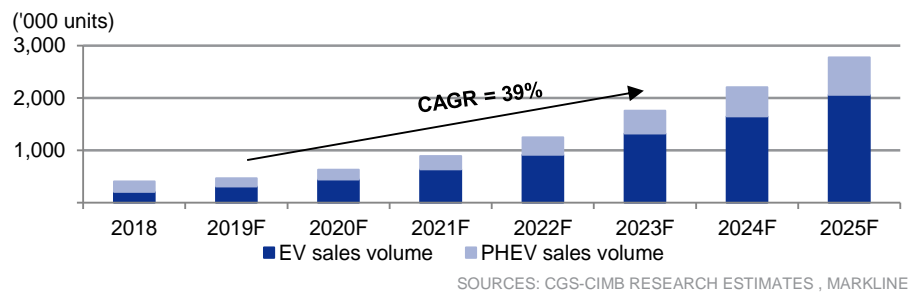


Figure 42: Korea EV battery capacity expansion plans for Europe **Figure 43: EV battery order backlog (3Q19)**

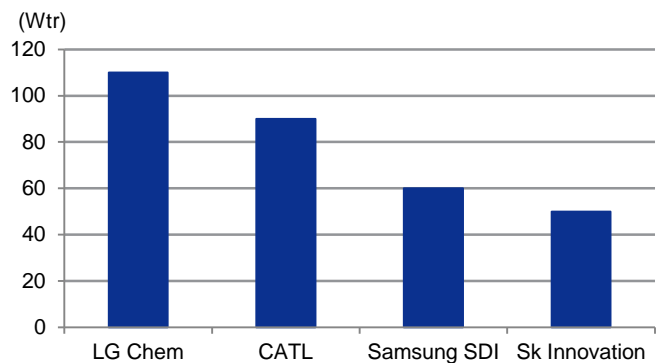
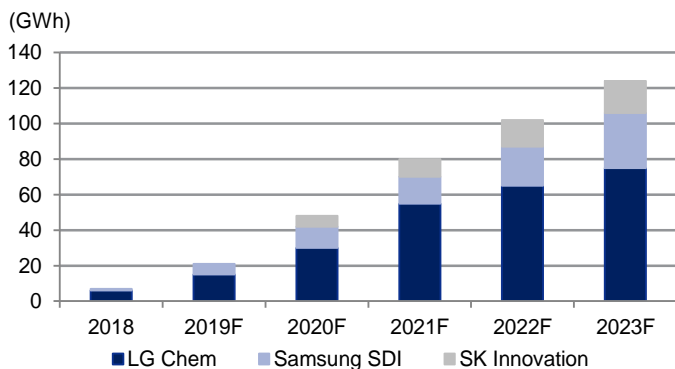


Figure 44: Summary of tie-ups between global OEMs and battery cell suppliers (3Q19)

	LG Chem	Samsung SDI	CATL	Guoxuan	Panasonic
Tesla	◆				◆
Volkswagen/Audi	◆		◆		◆
Porsche		◆			
BMW	◆	◆	◆		
Daimler	◆	◆	◆		◆
Renault	◆	◆			
Groupe PSA	◆		◆		◆
Volvo	◆				
Jaguar Land Rover	◆	◆			
General Motors	◆		◆		
Ford	◆				
Fiat Chrysler	◆	◆			
Hyundai/Kia	◆		◆		
Nissan	◆		◆		
Mitsubishi	◆				
Toyota					
Honda					◆
BAIC Motors			◆	◆	
Geely	◆		◆		
Dongfeng		◆	◆		
Great Wall	◆				
Chery	◆		◆	◆	
SAIC Motors	◆		◆		
Changfan	◆				
FAW Group	◆				
JAC Motors		◆		◆	
King Long	◆				

SOURCES: CGS-CIMB RESEARCH, SNE RESEARCH

Figure 45: Battery cell energy density comparison

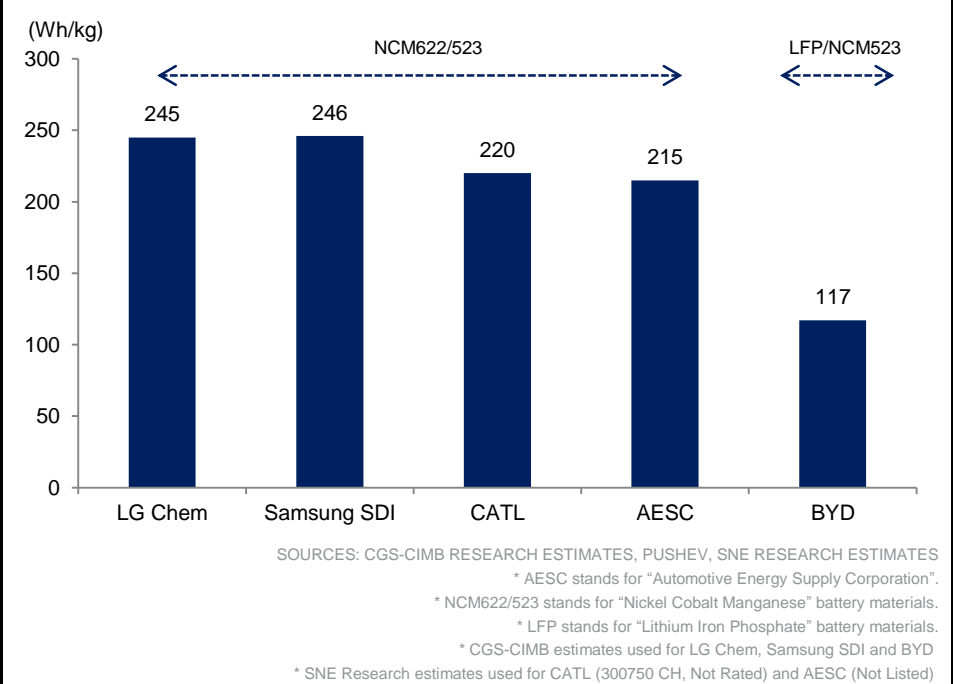
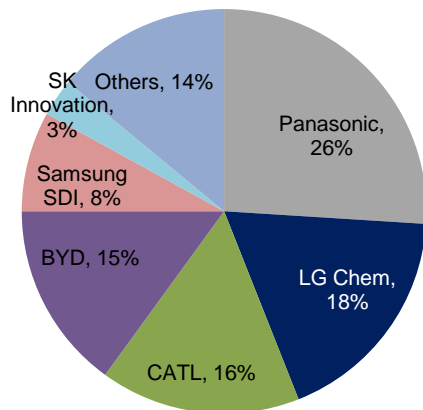


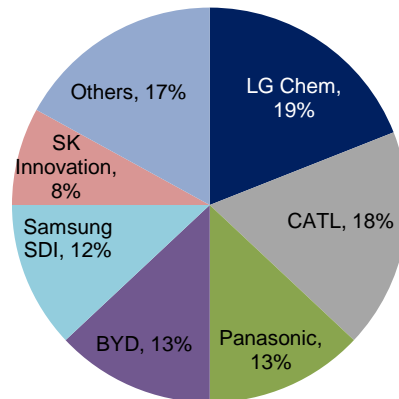
Figure 46: Summary of tie-ups between major battery suppliers and OEMs (3Q19)

Country	Battery type	Battery maker	Stake (JV)	Automotive OEM	EV type	Model				
Korea	Film pouch	LG Chem		Volvo	PHEV	Volvo V60				
					PHEV	Volvo XC60				
					PHEV	Volvo V70				
					BEV	Volvo C30				
				Renault	BEV	Renault Zoe				
					BEV	Renault Twizy				
				Hyundai/Kia	HEV	Sonata/K5 Hybrid				
					HEV	Grandeur/K7 Hybrid				
					HEV	Optima Hybrid				
				GM	PHEV	Chevrolet Volt				
	BEV	Chevrolet Spark								
	PHEV	Cadillac ELR								
	PHEV	Opel Ampera								
	Ford				BEV	Ford Focus				
					BEV	Ford Focus				
	Film pouch	SK Innovation			Kia	BEV	Soul EV			
					Mercedes-Benz	BEV	Benz SLS AMG			
	Can Prismatic	Samsung SDI			BMW	PHEV	i8			
						BEV	i3			
					Fiat	BEV	F500e			
Ferrari						HEV	LaFerrari Hybrid			
Mahindra					HEV	-				
					Delphi	HEV, BEV	-			
U.S.					Cylindrical	Johnson controls - Saft	Johnson controls 51% Saft 49%	Daimler	HEV	Mercedes-benz S400 Hybrid
								BMW	HEV	BMW7 ActiveHybrid
	Ford	PHEV	F-750							
China	Prismatic	BYD	Daimler 50% BYD Auto 50%	BYD Auto	BEV	E6				
		Shenzhen BYD Daimler New Technology		Daimler-BYD	BEV	Denza EV				
Japan	Can Prismatic	Panasonic		Tesla	BEV	Model S				
					BEV	Roadsters				
				Honda	HEV	Insight				
					Ford	HEV	Fusion Hybrid Electric			
				HEV		C-Max Hybrid Electric				
				PHEV		Fusion Energi				
				PHEV		C-Max Energi				
				Suzuki	BEV	e-Let's				
					Audi	PHEV	A3 e-Tron			
				Primearth EV Energy		Toyota 80.5% Panasonic 19.5%	Toyota	BEV	eQ	
	PHEV	Prius								
	PHEV	Prius a								
	Blue Energy Co., Ltd.		GS Yuasa International 51% Honda Motor 49%					Honda	HEV	CR-Z
				HEV	New Civic Hybrid					
				HEV	Accord Hybrid					
				PHEV	Accord Plug-in Hybrid					
	Lithium Energy Japan		GS Yuasa 51% Mitsubishi Corp 46% Mitsubishi Motors 3%	Mitsubishi Motors	BEV	i-MiEV				
					BEV	iOn				
				Peugeot Citroen	BEV	C-Zero				
					Film pouch	AESC	Nissan 51% NEC 42% NEC Tokin 7%	Renault Nissan	BEV	Fluence
BEV	City Car									
BEV	Kangoo									
BEV	LEAF									
Fuji Heavy	HEV	R1e								
	PHEV	Stella								
					HEV	G4e				

SOURCES: CGS-CIMB RESEARCH, SNE RESEARCH

Figure 47: Passenger EV battery market share (2019F)


SOURCES: CGS-CIMB RESEARCH ESTIMATES, SNE RESEARCH ESTIMATES

Figure 48: Passenger EV battery market share (2025F)


SOURCES: CGS-CIMB RESEARCH ESTIMATES, SNE RESEARCH ESTIMATES

* CGS-CIMB estimates used for LG Chem, Samsung SDI, SK Innovation and BYD

* SNE Research estimates used for CATL (300750 CH, Not Rated) and Panasonic (6752 JP, Not Rated)

Figure 49: Korean EV battery capacity expansion plans (3Q19)

(GWh)	2017	2018	2019F	2020F	2021F	2022F	2023F	Remarks
LG Chem (Korea)	12	25	41	70	101	115	145	Cathode: NCM622, Type: Pouch
yoy (%)	-	108.3%	64.0%	70.7%	44.3%	13.9%	26.1%	2019-2023F CAGR 45%
Korea	6	6	6	6	6	6	6	-
Poland	-	6	15	30	55	65	75	For EU Evs
China	3	8	15	26	30	30	44	For EU/US OEMs in China
U.S.	3	5	5	8	10	14	20	Once demand confirmed, expected to invest aggressively
SK Innovation (Korea)	1	5	5	17	25	44	56	Cathode: Hinikel NCM, Type: Pouch
yoy (%)	-	400.0%	0.0%	240.0%	47.1%	76.0%	27.3%	2019-2023F CAGR 93%
Korea	1	5	5	5	5	5	5	-
Hungary	-	-	-	6	10	15	18	Announced capacity expansion to be made by 2022F
China	-	-	-	6	10	14	18	Preparing for next tide of China's subsidy withdrawal
U.S.	-	-	-	-	-	10	15	Started in 2018, mass production expected in 2022F
Samsung SDI (Korea)	6	11	17	26	32	45	59	Cathode: NCM+NCA mix, Type: Cylinder, Square
yoy (%)	-	83.3%	54.5%	52.9%	23.1%	40.6%	31.1%	2019-2023F CAGR 40%
Korea	6	6	7	7	8	8	8	-
Hungary	-	1	6	12	15	22	31	-
China	-	4	4	7	9	15	20	New investment decision to be made
CATL (China)	5	9	14	22	42	74	121	Cathode: NCM523, Type: Square
yoy (%)	-	80.8%	53.0%	53.0%	90.2%	77.9%	62.5%	2019-2023F CAGR 26%
China (Total EV)	8	17	31	47	68	89	120	Total EV battery capacity estimates
China (Passenger EV)	5	9	14	22	39	59	91	Passenger EV battery capacity estimates
Germany	-	-	-	-	3	15	30	Mass production expected in 2021F
Panasonic (Japan)	19	40	40	40	41	50	65	Cathode: NCA, Type: Cylinder
yoy (%)	-	110.5%	0.0%	0.0%	2.5%	22.0%	30.0%	2019-2023F CAGR 19%
Japan	9	9	9	9	10	10	10	-
China	-	6	6	6	6	15	30	-
U.S.	10	25	25	25	25	25	25	Panasonic-Tesla Gigafactory 1 expansion plan halted

SOURCES: CGS-CIMB RESEARCH ESTIMATES, SNE RESEARCH ESTIMATES

* CGS-CIMB estimates used for LG Chem, Samsung SDI and SK Innovation

* SNE Research estimates used for CATL (300750 CH, Not Rated) and Panasonic (6752 JP, Not Rated)

Decline in EV battery price to lead to virtuous cycle of EV sales ➤

Battery pack prices account for about 40% of EV manufacturing costs as at 3Q19, in our view. In order to ramp up the EV business, we believe global automakers plan to develop their own EV platforms and to lower battery prices.

According to the US Department of Energy (DOE), pure EV battery cell prices fell from US\$500/kWh in 2011 to US\$200-300/kWh in 2016 and US\$150/kWh in 2018. VW announced that the battery cell cost for the MEB project will be US\$120/kWh for its own platform system by 2020F, thanks to further improvements in energy density. We forecast that the price could fall to US\$120/kWh in 2022F given raw material cost trends and economies of scale.

As battery pack prices are 55% higher than battery cell prices (as at 3Q19), we expect the battery pack price to be US\$190/kWh in 2023F (vs. US\$242/kWh in 2018), which means that battery manufacturing costs should decrease by 5% p.a., based on our calculations.

Despite the strong near-term metal prices, we expect battery cell prices to decline over the long-term as a result of a significant reduction in unit costs from 1) an improvement in electrode performance via the use of a new mix of chemistry process involving more nickel-concentrated cathodes, and a transition to silicon-based anodes, etc. to improve overall energy density and to reduce the power fade, and 2) higher efficiency in manufacturing costs via better economies of scale with long-term raw material sourcing contracts (mass production of EVs and batteries).

Assuming that battery manufacturing costs fall by 5% p.a. over the next five years, battery pack prices could decline to US\$105/kWh in 2025F. EV manufacturing costs could be equivalent to current ICE cars (US\$25k) after 2025F, which should trigger explosive growth in EV and battery demand.

We expect global OEMs and governments to produce EVs commercially to compete with ICE vehicles in terms of price and performance. With next generation batteries (cheaper and higher density) to be introduced in 2020F models, we believe that the EV and EV battery market should grow in earnest.

Figure 50: EV battery price vs. EV battery demand based on CGS-CIMB estimates

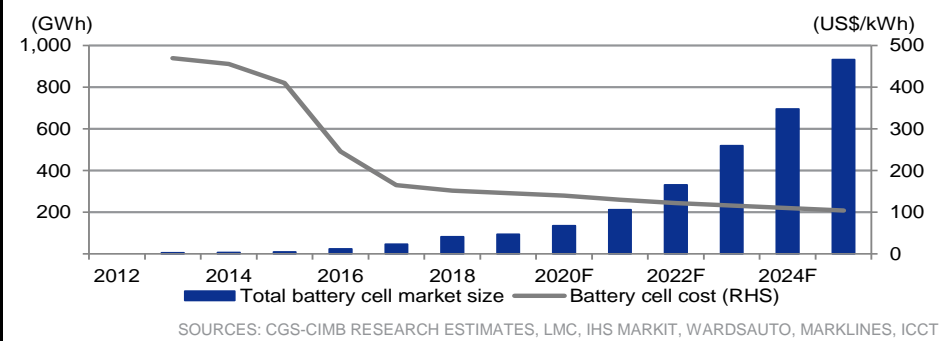
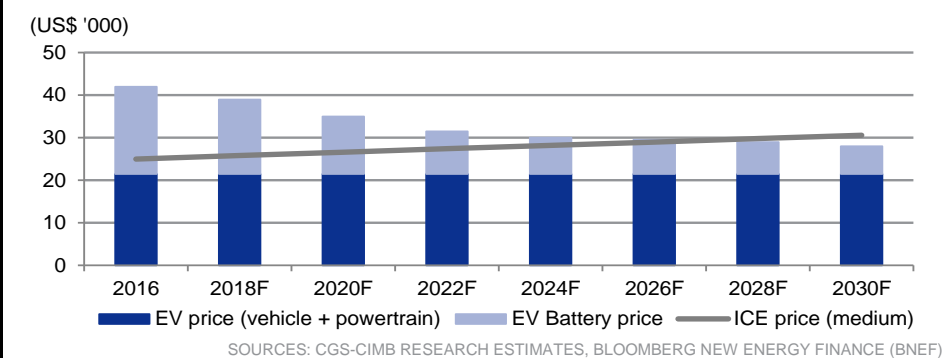


Figure 51: EV price vs. ICE price outlook based on CGS-CIMB estimates



Improvement in battery technology to lift demand for EVs ➤

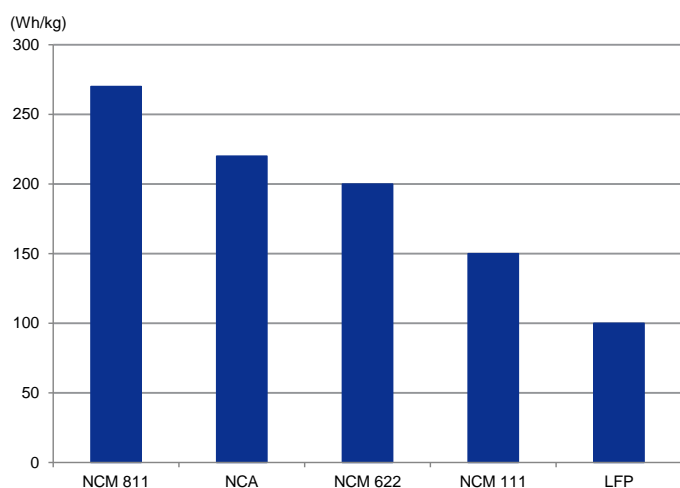
Global automakers have tried to 1) improve energy density for battery cells and 2) expand energy storage capacity in order to achieve a longer driving range compared to traditional cars (over 450km). As such, we believe major battery makers will need to improve battery technology to meet the requirements for third-generation EV batteries from 2021F.

Key changes include the transition from Nickel Cobalt Manganese (NCM) 622 to NCM 811 and improving battery energy density from 250Wh/kg to over 300Wh/kg by mixing silicon with cathode and anode materials.

With improving energy density for battery cells and enhanced packaging, we think battery storage capacity for pure EVs should rise to 60-98kWh in 2019-2023F, which could reach over a 500km driving range.

EV models have started to offer 6km/kWh of energy efficiency (e.g. GM Bolt's energy efficiency stands at 6.4km/kWh) since 2018. We expect major automakers to lift the average energy efficiency of EVs to 7km/kWh in 2020F with large-capacity batteries. Given over 70kWh battery size per units, we believe the driving range should extend to over 450km, which should strengthen EV demand going forward.

Figure 52: Energy density by cathode material



SOURCES: CGS-CIMB RESEARCH, SNE RESEARCH

Figure 53: Type of Lithium batteries and their uses

Cathode active material name	Material	Abbreviation	Technological maturity for EV
Lithium cobalt oxide	LiCoO ₂	LCO	Used in the original Tesla but rejected on safety concerns by OEMs
Lithium manganese oxide	LiMn ₂ O ₄	LMO	Already in series car (i.e. Leaf, Volt, IMIEV)
Lithium iron phosphate	LiFePO ₄	LFP	Already in series car (i.e. Fisker EV)
Lithium nickel manganese cobalt oxide	LiNiMnCoO ₂	NCM	Used in consumer goods and EV prototypes
Lithium nickel cobalt aluminium oxide	LiNiCoAlO ₂	NCA	Already in series car (i.e. Plug-in Prius)

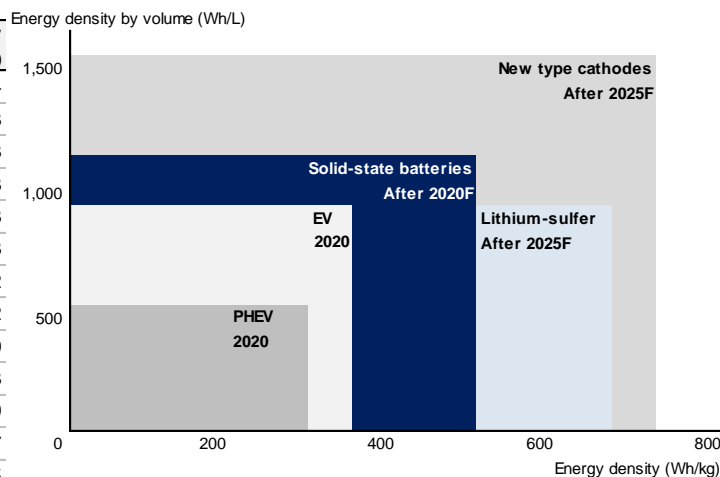
SOURCES: CGS-CIMB RESEARCH, COMPANY REPORTS

Figure 54: EV range and battery capacity

Automaker	Model	Range (km)	Battery capacity (kWh)	Energy efficiency (km/kWh)
Chevrolet	Bolt EV	383	60	6.4
Tesla	Model 3	330	52	6.3
Nissan	Leaf (2018)	241	38	6.3
Renault	Zoe	233	37	6.3
Volkswagen	e-Golf	201	32	6.3
BMW	i3	169	27	6.3
Hyundai	Kona Electric	249	40	6.2
Volkswagen	I.D (2019)	370	60	6.2
Kia	Niro EV	233	39	6.0
Tesla	Model S 75D	386	73	5.3
Mercedes	EQC (2019)	346	70	4.9
Jaguar	i-Pace	402	85	4.7
Tesla	Model X 75D	330	73	4.5

SOURCES: CGS-CIMB RESEARCH, ELECTROCHEMICAL SOCIETY (ECS)

Figure 55: Energy density technology road map



SOURCES: CGS-CIMB RESEARCH, COMPANY REPORTS, BOSCH ESTIMATES

EV battery materials

Cathodes are a crucial component of battery cells >

We believe the next generation of technologies that deliver higher density energy are likely to be high-nickel composite cathodes and high capacity anodes (with a higher silicon mix), which could gradually become available to mass-produced batteries in years to come. We believe that higher voltage cathode chemistries will occur in the next phase of development in a couple years' time. Key materials include lithium, nickel, cobalt, manganese, graphite, electrolyte chemicals, copper foil, etc.

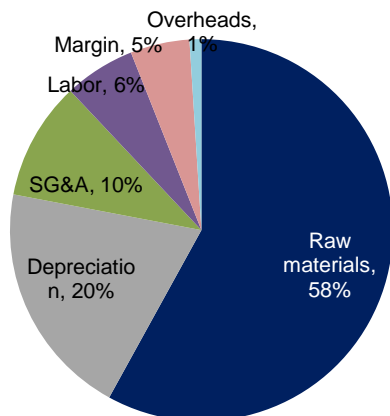
There are four major parts that make up a Lithium-ion Battery (LIB) cell – anode, cathode, separator and electrolyte. These four combine to form c.80% of an average LIB cell bill-of-materials (BOM) cost, and c.20% of coating and other production costs. As the cathode materials typically account for c.35-40% of total battery cell materials (the largest cost portion of an average battery cell), we believe the cathode is the most important component of an EV battery, and also has the most room to cut down on costs.

Figure 56: LIB materials technology roadmap

	Deployed	Being deployed	Next generation Lithium-ion	Advanced Lithium-ion	Advanced Lithium-ion
Cathode	NMC 111	NMC 622	NMC 811	Multiple	Li - Air Li - Sulphur
Anode	Graphite	Carbon Alloys	Graphite + Silicon (5-10%)	Lithium Metal	
Electrolyte	Organic Solvent + LiPF6	Gel Polymer	5V Electrolyte Salts	Variable	
	2016 - 2021F		2021F - 2027F		2028F -

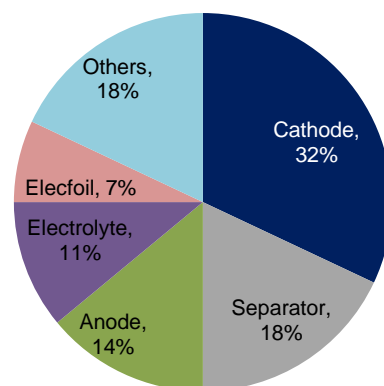
SOURCES: CGS-CIMB RESEARCH, INTERNATIONAL ENERGY AGENCY (IEA) ESTIMATES

Figure 57: Battery cell cost breakdown (3Q19)



SOURCES: CGS-CIMB RESEARCH, COMPANY REPORTS, SNE RESEARCH

Figure 58: Battery cell material cost breakdown (3Q19)



SOURCES: CGS-CIMB RESEARCH, COMPANY REPORTS, SNE RESEARCH

Technological improvements in high nickel content cathodes



We expect that the chemistry of NCM upgrades or NCA blends provide a higher efficiency (but are likely to require a more aggressive cooling process) option for battery makers. Furthermore, cost reduction could be achieved through chemistry optimisation and engineering for cathodes.

Cathode materials that have higher voltages and/or higher capacity (mAh/g) are currently being developed by cell makers. Given that they have the highest reversible capacity used in commercial cells, we think cathodes still have more room for improvement since this is significantly lower than the anode capacity (graphite-type with ~300 mAh/g).

While NCM523/NCM622 and NCA type lithium cathodes are currently being used for passenger cars (high energy efficiency and longer driving range), we believe the next paradigm for EV batteries is likely to be NCM811/NCMA/NCA cathode-type batteries, to be used for the next generation of vehicles.

Major battery companies have been trying to adopt high-nickel cathode materials (NCM622/NCA/NCM811/NCMA), replacing NCM 523 or LFP due to their superior energy density and better energy volume expansion.

While cathode makers that have been able to increase the use of nickel are likely to exist on the market, we think other companies that have not been able to develop high-nickel cathodes are likely to exit the market. Low-quality cathode players that focus only on Lithium iron phosphate (LFP) and Lithium-titanate battery (LTO) type batteries should scrap its battery material business, in our view.

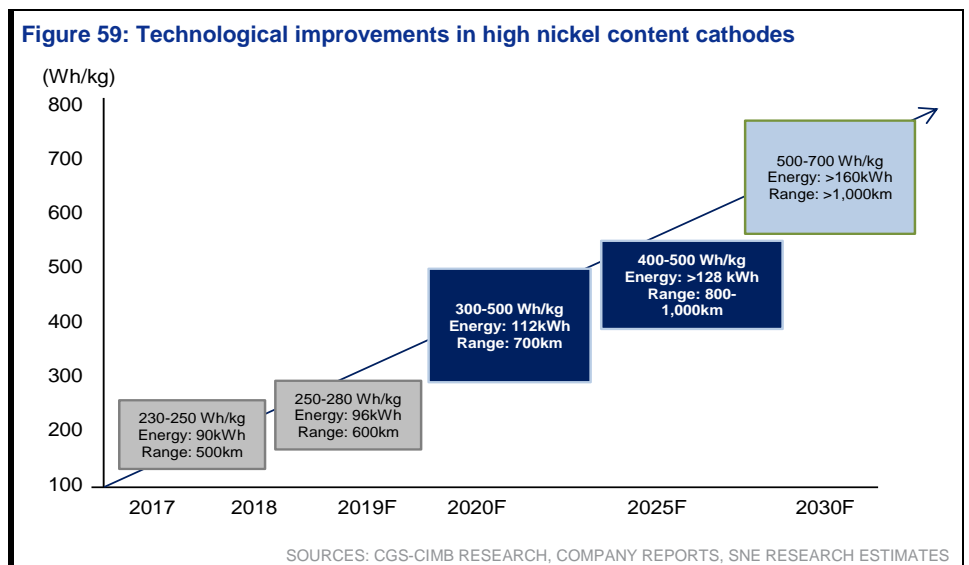


Figure 60: Cathode by battery cell makers (2Q19)

	Nickel proportion in batteries				2019F	2020F	2021F	2025F	Remarks
	LFP	< 50%	50% (NCM523)	60% (NCM622)					
LG Chem		5%		90%	5%	NCM622	NCM712	NCMA (Ni 85-88%) NCM (Ni 90%)	NCM7 series, NCM8 on plan
Samsung SDI			30%	40%	30%	NCM622 + NCA (85/15/5)	NCM622 + NCA (90/5/5)	NCM + NCA (Ni 85-88%) NCA (Ni 88%+)	NCA to be applied for EV
SK Innovation		10%		20%	70%	NCM622	NCM811	NCM9/0.5/0.5	NCM811 on plan
CATL	30%	5%	50%	15%		NCM523/622	NCM811	Ni 80%+	NCM523 proportion increased
BYD	30%	20%	50%			NCM523	NCM811		NCM523 expansion in progress
AESC		10%	60%	30%		NCM523	NCM811		NCM622 introduced

SOURCES: CGS-CIMB RESEARCH ESTIMATES, SNE RESEARCH ESTIMATES

* CGS-CIMB estimates used for LG Chem, Samsung SDI, SK Innovation and BYD

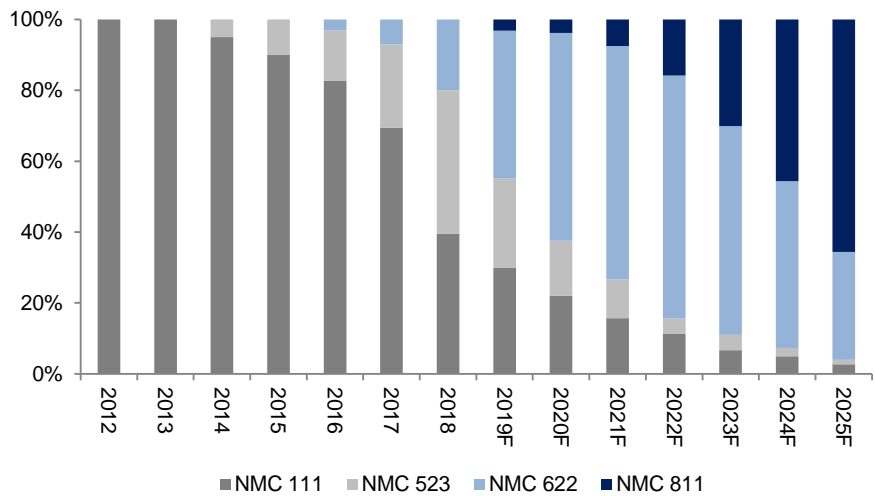
* SNE Research estimates used for CATL (300750 CH, Not Rated) and AESC (Not Listed)

Figure 61: Summary of LIB cells employed in current EVs (3Q19)

Year	Automotive OEM/Model	Cathode	Battery maker
2017	Chevrolet Bolt	NCM622	LG Chem
	BMW i3 (60Ah)	NCM523 + NCA	Samsung SDI
	Tesla Model S	NCA	Panasonic
	VW e-Golf (2014)	NCM111	Panasonic
	Nissan Leaf (30kwh)	NCM111	AESC
	BAIC EC180	NCM622	Farasis
	BAIC EC200	NCM523	CATL (Easpring)
	Hyundai New Elantra	NCM523	CATL
	Renault-Nissan Kangoo ZE	NCM622	LG Chem
	BYD E5 (2015)	LFP	BYD
	BYD Song DM	NCM111	BYD
	Geely Emgrand EV	NCM111	CATL
	JAC IEV6E (22kwh)	LFP	Guoxuan
	2018	Chevrolet Bolt	NCM622
BMW i3 (94Ah)		NCM111	Samsung SDI
Tesla Model X		NCA	Panasonic
VW e-Golf (2017)		NCM523	Panasonic
Nissan Leaf (40kwh)		NCM523	AESC
Kia Soul (2018)		NCM111	SK Innovation
BAIC SenovaX25		NCM622	Farasis
BAIC EC3		NCM523	CATL (Easpring)
Hyundai Ioniq (BEV)		NCM622	LG Chem
Renault Zoe (2017)		NCM622	LG Chem
BYD E5 (2018)		NCM523	BYD
BYD Yuan EV (42kwh)		NCM523	BYD
Geely Emgrand EV		NCM523	CATL (Zhenhua)
Roewe Ei5 (35kwh)		NCM523	CATL (Umicore)
JAC IEV6E (42kwh)	NCM523	Lishen	
2019	Chevrolet Bolt	NCM622	LG Chem
	BMW i3 (60Ah)	NCM523 + NCA	Samsung SDI
	Tesla Model 3	NCA	Panasonic
	VW e-Golf (2017)	NCM523	Panasonic
	Nissan Leaf (62kwh)	NCM622	AESC
	Kia Niro	NCM811+NCM111	SK Innovation
	Greatwall ORA iQ	NCM622	Farasis
	BAIC EU5 (53.6kwh)	NCM523	CATL
	Hyundai Kona EV	NCM622	LG Chem (Umicore)
	Renault Zoe (2017)	NCM622	LG Chem
	BYD E5 (2019)	NCM523	BYD
	BYD Yuan EV (53 kwh)	NCM622	BYD (Cylico)
	Geely Emgrand Gse	NCM523	CATL (Zhenhua)
	Roewe Marvel X	NCM523	CATL (Zhenhua)
JAC IEVS4 (61kwh)	NCM622	Lishen	

SOURCES: CGS-CIMB RESEARCH, SNE RESEARCH

Figure 62: Cathode portion for EV battery



SOURCES: CGS-CIMB RESEARCH, SNE RESEARCH ESTIMATES, ICCT

Mid-term drivers of cost reduction could come from cathodes



We believe higher energy density (Wh/l or Wh/kg) and reducing price/KWh is key to cutting costs for EV battery manufacturing. As such, the movement to high-nickel cathodes (NCM811 and NCA) should be key to lowering costs for battery makers.

Our assumption is based on a significant decline in unit costs from: 1) higher battery density resulting in fewer materials used; 2) advancement in battery chemistry and 3) increased economies of scale for both battery cell makers and raw material suppliers.

While the demand for high-nickel cathodes may be slower than expected this year due to falling raw material costs, especially for cobalt, we still believe the relative cost advantage of NCM811/NCA over NCM523/622 will remain intact. Given that raw material prices could grow in line with battery demand, battery makers should prepare to launch high-nickel batteries, in our view.

Within the next couple of years, we believe that significant battery capacity improvement (by c.50%+) will be achieved through the use of high-nickel cathodes (e.g. 300-500Wh/kg vs. 250Wh/kg currently), coupled with the potential for substantially lower costs. The key challenge would be to ensure that these advanced technologies can still provide adequate driving range without compromising safety.

Figure 63: LIB cathode material volume by type

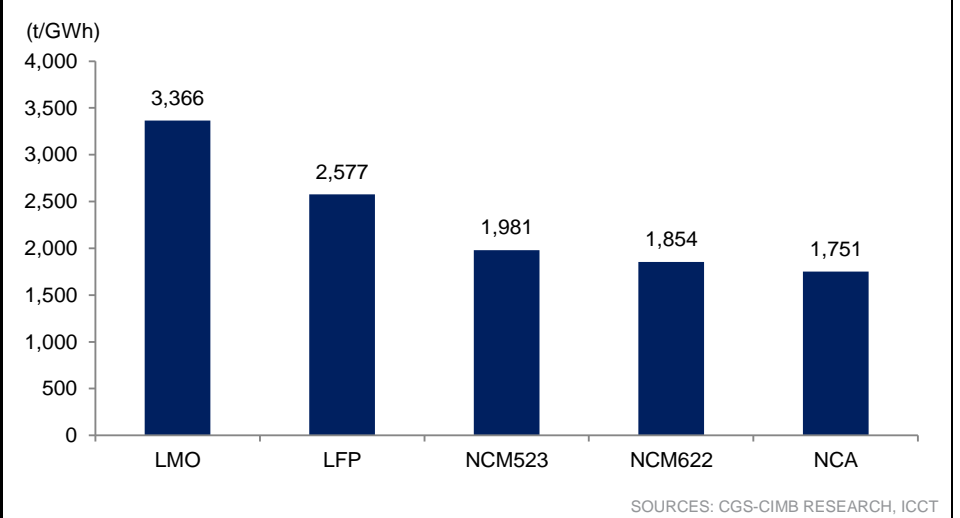


Figure 64: Cathode cost breakdown (2Q19)

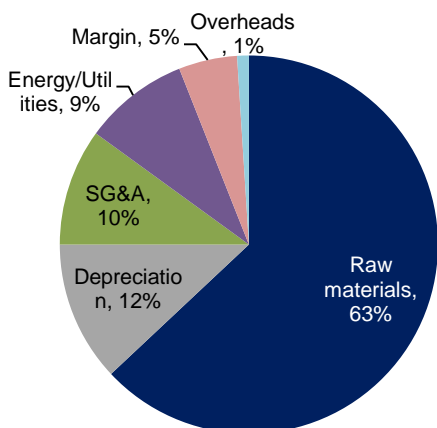


Figure 65: Cathode material cost breakdown (2Q19)

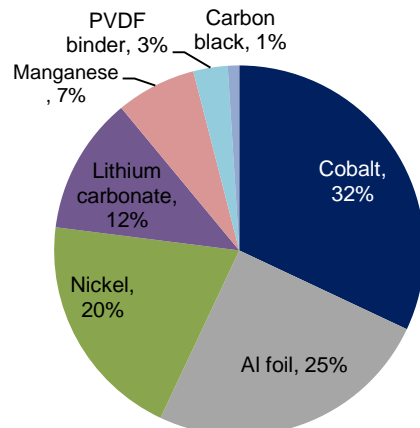
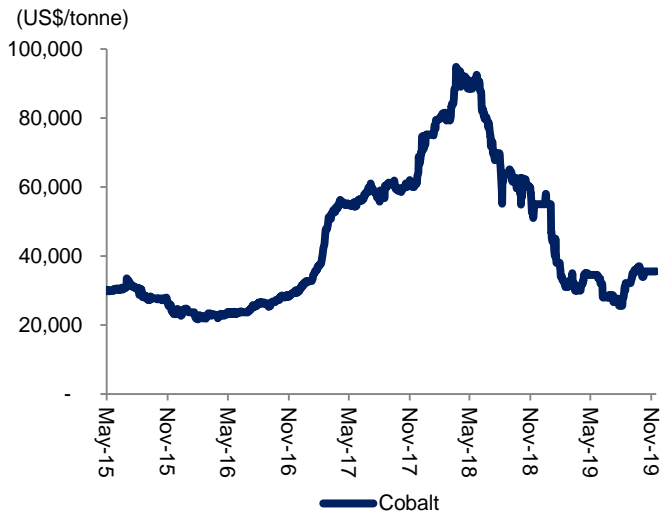
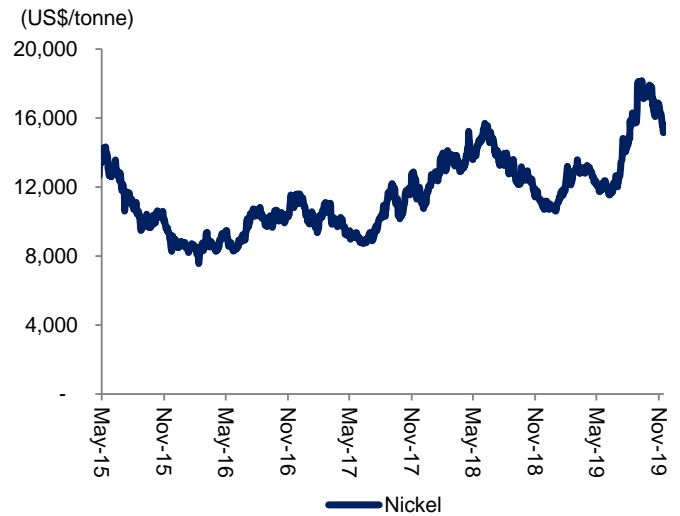


Figure 66: Nickel price trend



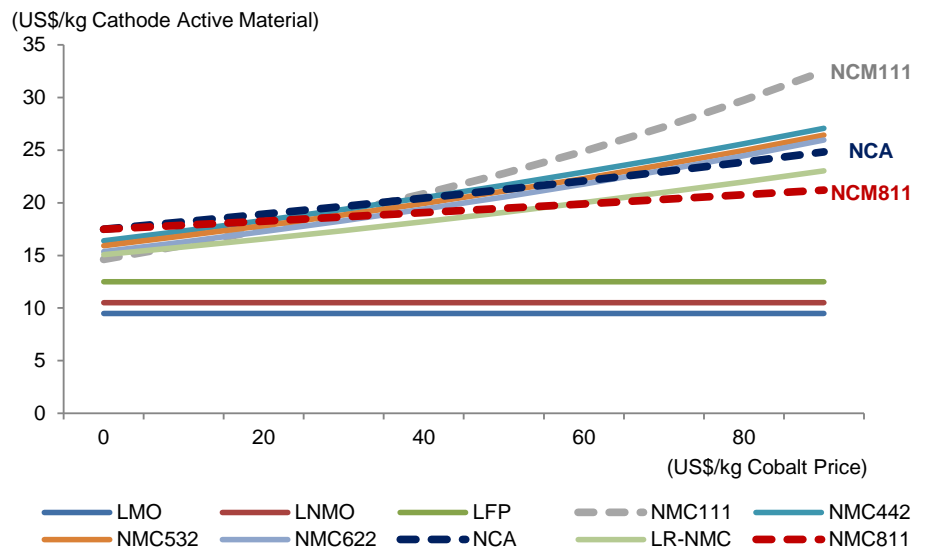
SOURCES: CGS-CIMB RESEARCH, BLOOMBERG

Figure 67: Cobalt price trend



SOURCES: CGS-CIMB RESEARCH, BLOOMBERG

Figure 68: Cost advantage for NCM811 vs. NCA (Nov 2019)



SOURCES: CGS-CIMB RESEARCH, SNE RESEARCH, ICCT

Expect competition to rise for cathode makers ▶

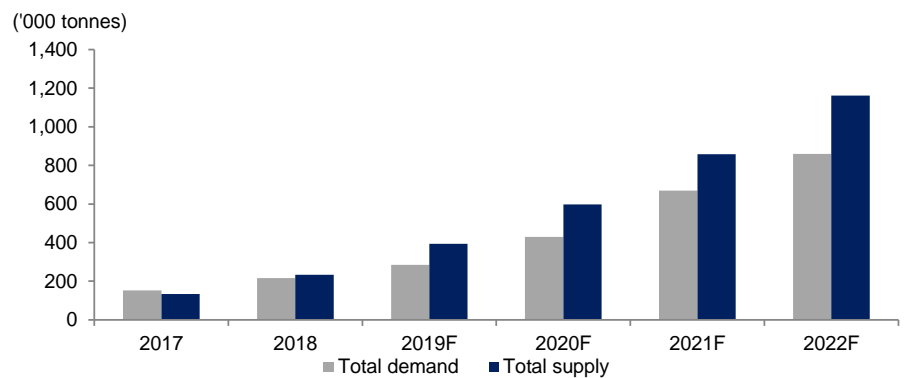
We have a cautious view on the cathode industry as it is fragmented (a large number of low-to-mid range nickel cathode makers). Given the cathode capacity expansion in China and Korea, we expect rising competition for low quality nickel cathode materials, which could put pressure on margins and earnings of cathode manufacturers.

While the Chinese NCM cathode supply for domestic use has increased by over four times since 2016, the NCM EV cathode demand for EVs has only increased by two times over the same period. BASF SE (BAS GR, Not Rated, CP; EUR69.0) plans to form a strategic partnership with SINOPEC (338 HK, Not Rated, CP; HK\$2.2) to commercialise cathode materials in China. We expect further capacity additions from Chinese producers to continue in the longer term.

Also, the battery cell makers should increase their own cathode business for self-sufficiency. As battery cell manufacturers are under pressure to reduce costs and improve profitability, we believe they could try to expand their value chains and increase vertical integration.

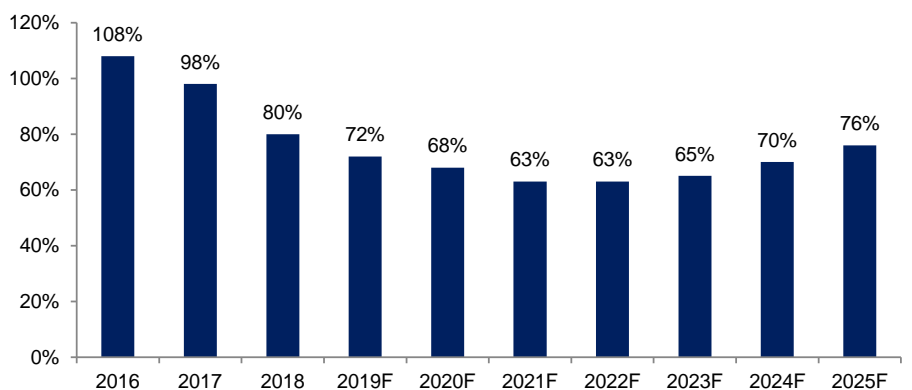
As such, while we see market consolidation for low nickel cathode producers, we believe the high nickel content cathode producers are likely to continue to expand their capacity.

Figure 69: Cathode supply and demand trend



SOURCES: CGS-CIMB RESEARCH, SNE RESEARCH ESTIMATES

Figure 70: Cathode capacity utilisation to slow down from capacity expansion



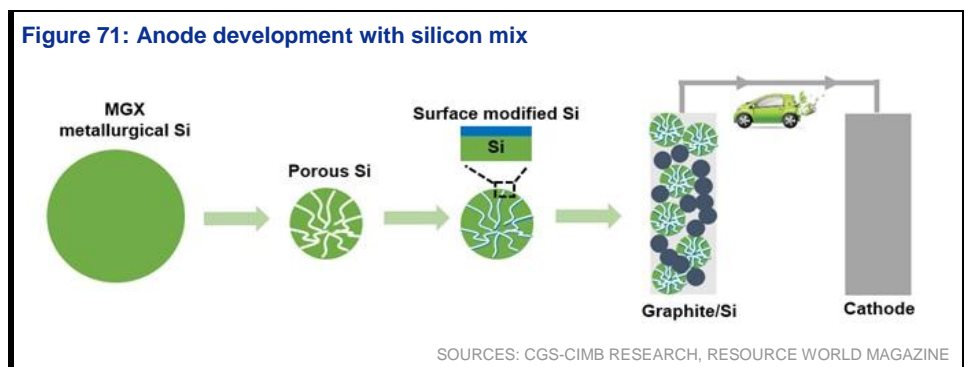
SOURCES: CGS-CIMB RESEARCH, SNE RESEARCH ESTIMATES

Anode development with silicon mix >

The development of new anode materials to achieve higher energy density is also underway. Based on our industry channel checks, the anode makers are focusing on adding silicon (Si), which theoretically has eight times higher lithium storage capacity (3,000mAh/g) than graphite (350mAh/g).

As Si can result in swelling of 300-400% (vs. graphite's 12% currently) during charging and discharging, battery makers are trying to adopt new methods, such as carbon-coated or metal/silicon-doped silicon oxide (SiOx) and silicon-carbon (Si-C) composites to reduce swelling.

The adoption of silicon-graphite mix has been slower than expected due to higher technical difficulty (SiOx mix below 5% (as at 2018)) (source: Posco Chemical)). As such, going forward, we believe only limited anode makers would be able to change anode materials for commercial and mass production.



Elecfoil supplies remain tight >

Elecfoil (copper foil, anode collector) is usually used for anode material manufacturing (coating process). Elecfoil development requires R&D capabilities to withstand high temperatures and pressure. As the elecfoil business requires large fixed costs, it has high entry barriers. The qualification process from battery cell makers takes at least 2-3 years. As such, among the battery materials, we expect the supplies of elecfoil for EV battery could remain tight with limited suppliers.

We attribute the tight elecfoil supply conditions to: 1) the emergence of large customers such as EV battery makers and 2) slower-than-expected capacity expansion (limited new production lines coming online in 2019F).

Given 95% utilisation for elecfoil capacity and 60-70% utilisation for battery capacity (based on medium/large-sized batteries) (as at 4Q19), we believe the elecfoil supply could tighten further from 2020F onwards.

In order to stabilise the elecfoil supply, battery manufacturers are entering the elecfoil business by acquiring equity stakes in existing players (e.g., SK Holdings (034730 KS, Not Rated, CP; W260,000) investment in Wason (Unlisted) in 2018 and SKC's investment in KCF Technologies (KCFT) (Unlisted) in 2019).

Figure 72: Global elecfoil (copper foil) supply and demand outlook

	2017	2018	2019F	2020F	2021F	2022F	2023F
EV battery capacity (GWh, on operation basis)							
LG Chem	12	25	41	70	101	115	145
Samsung SDI	6	11	17	26	32	45	59
SK Innovation	1	5	5	17	25	44	56
CATL (passenger EV)	5	9	14	22	42	74	121
Panasonic	19	40	40	40	41	50	65
BYD (passenger EV)	3	8	12	20	30	45	60
Others	30	42	25	31	39	57	124
Total	76	140	154	226	310	430	630
EV battery utilisation (%)							
60%	46	84	93	136	186	258	378
70%	53	98	108	158	217	301	441
80%	61	112	124	181	248	344	504
90%	68	126	139	203	279	387	567
EV battery demand (GWh)	46	83	95	136	212	332	520
EV elecfoil demand (at util. 80%)							
0.6kg/kWh	36	67	74	108	149	206	302
0.7kg/kWh	43	78	86	127	174	241	353
0.8kg/kWh	49	90	99	145	198	275	403
Elecfoil capacity ('000 tonnes/year)							
Iijin Materials	15	20	24	35	45	50	60
KCFT (SKC)	13	18	21	30	40	50	60
Lingbao Wason Copper Foil	10	20	25	40	55	65	75
Chang Chun Petrochemical	15	20	25	35	45	55	65
Doosan	0	4	7	12	15	20	25
Others	5	5	5	5	10	20	35
Total	58	87	107	157	210	260	320
Utilisation (%)							
70%	46	66	79	117	134	164	235
80%	53	75	90	134	153	187	265
90%	59	85	102	150	172	211	302

SOURCES: CGS-CIMB RESEARCH ESTIMATES, SNE RESEARCH ESTIMATES

* CGS-CIMB estimates used for LG Chem, Samsung SDI, SK Innovation and Iijin Materials

* SNE Research estimates used for CATL (300750 CH, Not Rated), Guoxuan (002074 CH, Not Rated), Lishen (Not Listed), Panasonic (6752 JP, Not Rated), KCFT (Not Listed), Lingbao Wason Copper Foil (Not Listed), Chang Chun Petrochemical (Not Listed) and Doosan (000150 KS, Not Rated)

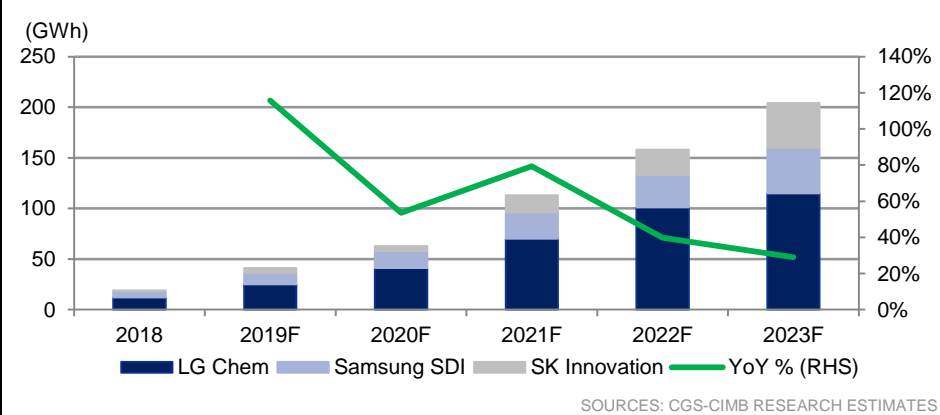
Korean EV battery material plays

Growing with KR battery cell makers ▶

The global EV battery material markets have been driven by Chinese (LFP or low nickel battery use; China makes up ~50% of demand (as at 2018)) and Japanese makers (high nickel content for Panasonic and Tesla) so far. However, we expect the Korean battery material players could outperform the global battery material players in 2020-2022F as Korean cell makers could be major vendors for European automakers.

As we expect the European OEMs to release a series of new EV models over the next three years to secure EV market share and meet emission targets, we believe the Korean EV battery material players should benefit from their high exposure to European OEMs.

Figure 73: Korean EV cell makers' capacity expansion



Cathode and elecfoil to outperform in Korea ▶

Among the Korean battery material makers, we expect high nickel content cathodes and elecfoil segments (tighter supply and/or low inventory levels) should benefit the most given the expected supply and demand conditions. Apart from the materials produced in-house by the cell makers, high value-added cathode and elecfoils segments could be differentiated from commodity battery materials, in our view.

We recommend that investors focus on battery material producers that have high exposure to the Korean big 3 battery cell makers. We highlight Posco Chemical, Iljin Materials and SKC as we see upside potential to their earnings in 2020F if EV volumes start to pick up in 2020F.

Figure 74: Korean EV materials' capacity expansion

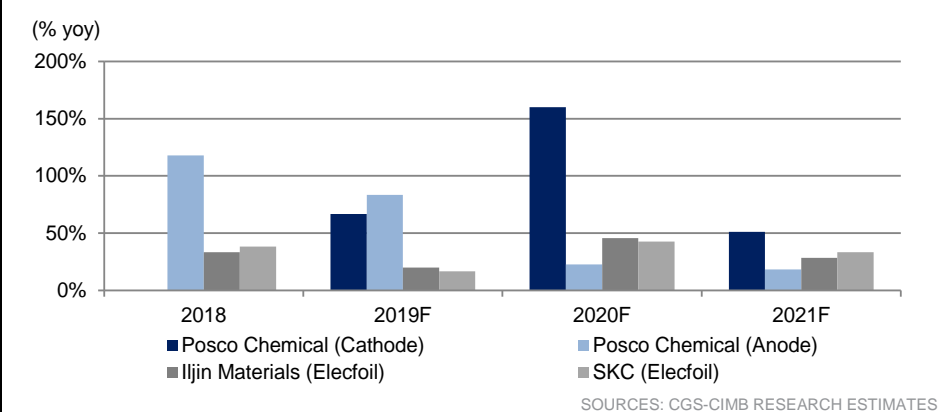
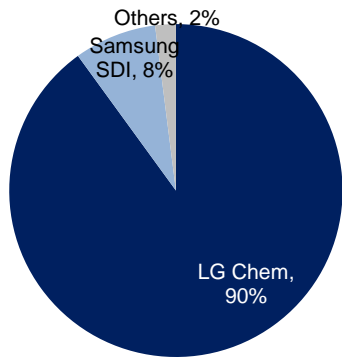
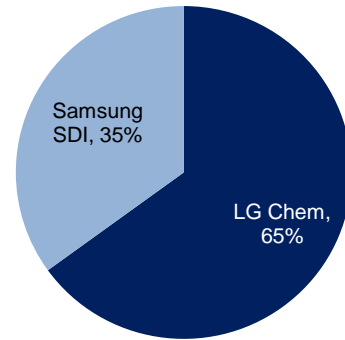


Figure 75: Posco Chemical's customers (Cathode) (2Q19)



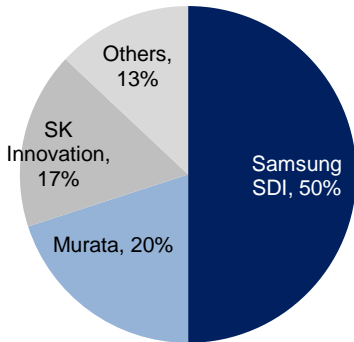
SOURCES: CGS-CIMB RESEARCH

Figure 76: Posco Chemical's customers (Anode) (2Q19)



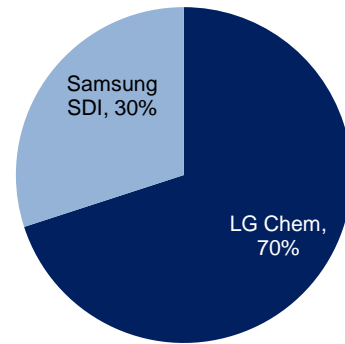
SOURCES: CGS-CIMB RESEARCH

Figure 77: EcoPro BM customers (2Q19)



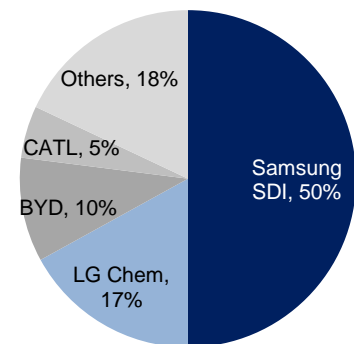
SOURCES: CGS-CIMB RESEARCH
* EcoPro BM (247540 KS, Not Rated)

Figure 78: L&F customers (2Q19)



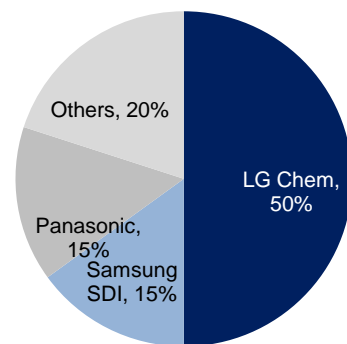
SOURCES: CGS-CIMB RESEARCH
* L&F (066970 KS, Not Rated)

Figure 79: Iljin Materials customers (2Q19)



SOURCES: CGS-CIMB RESEARCH

Figure 80: SKC customers (2Q19)



SOURCES: CGS-CIMB RESEARCH

Figure 81: Capex and OPM comparison by business segments (2020F)

	Korean Cell maker 1	Korean Cell maker 2	Korean Cell maker 3	Korean Cathode 1	Korean Cathode 2	Korean Cathode 3	Korean Anode 1 (natural carbon)	Korean Anode 2 (artificial carbon)	Korean Separator	Korean Elecfoil
Capacity	70 GWh	26 GWh	17 GWh	50,000 tonne	30,000 tonne	10,000 tonne	20,000 tonne	20,000 tonne	340 mn m2	20,000 tonne
Capex	W4.8 tr	W2.0 tr	W2.3 tr	W400 bn	W345 bn	W85 bn	W140 bn	W260 bn	W430 bn	W300 bn
Capex/unit	W68 bn/GWh	W76 bn/GWh	W135 bn/GWh	W15 bn/GWh	W20 bn/GWh	W15 bn/GWh	W7 bn/GWh	W13 bn/GWh	W25 bn/GWh	W15 bn/GWh
Normalised OPM	Mid single digit	Mid single digit	Mid single digit	Mid to high single digit	Mid single digit	Mid single digit	Low teens digit	Mid teens digit	High teens digit	High teens digit
Notes				5GWh/10k tonne	5GWh/10k tonne	5GWh/10k tonne	10GWh/10k tonne	10GWh/10k tonne	5GWh/100m m2	10GWh/10k tonne

SOURCES: CGS-CIMB RESEARCH ESTIMATES

Selective approach for cathode players ➤

While Korean cathode producers should increase their capacity given the higher orders for high nickel content cathodes, the cell manufacturers (LG Chem and SDI) are also looking to increase the degree of their integration for internal use. In the longer term, we expect LG Chem could meet c.40-50% of its own cathode demand internally, especially for next-generation cathodes.

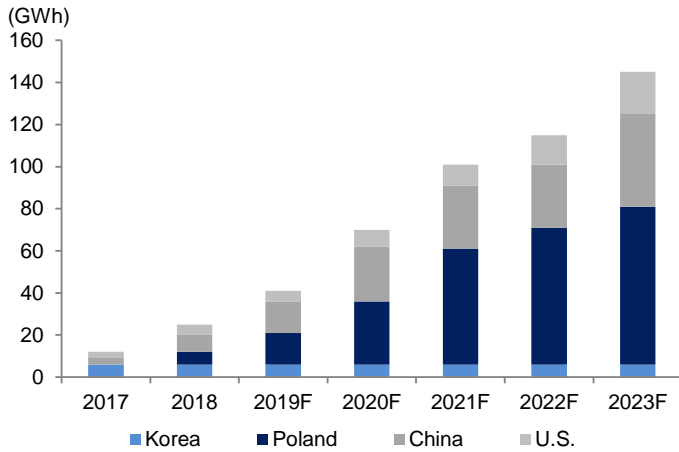
The top two Korean battery suppliers (LG Chem and SDI) do not yet have a strong focus on high nickel content cathodes, like NCM811 chemistry. We expect LG Chem is likely to mainly use its cathode chemistry from the current NCM622 to NCM712 in 2020F to NCM 811 or NCMA in 2021F. Meanwhile, we think SDI could increase the NCA proportion in its NCA blend.

As such, we expect the Korean cathode material producers, who have advanced technology for high nickel content cathodes and high exposure to Korean cell makers, to outperform going forward. Posco Chemical, Ecopro BM (247540 KS, Not Rated, CP; W50,900) are investing to develop competitive products for the big 3 Korean battery cell makers (LG Chem, SDI and SKI).

We note Posco Chemical as a key vendor for LG Chem. Posco Chemical acquired POSCO ESM (Unlisted) (cathode producer) in Apr 2019 to expand its cathode business aggressively. It added 6ktpa (NCM622 and NCM811 lines) at its Gwangyang facility phase 1 in May 2019, and the second phase expansion project (24ktpa at NCM622 line to be completed by Feb 2020F) is currently underway. As such, the company should increase its cathode capacity from 9ktpa in 1Q19 to 47ktpa in 2020F and to 57ktpa in 2022F, based on our estimates.

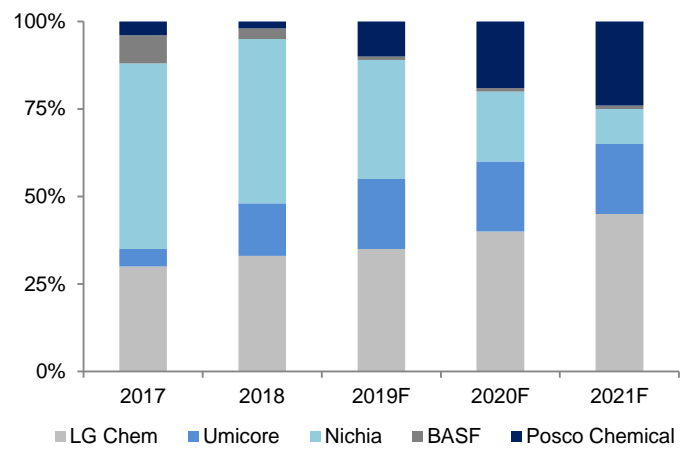
Given its high cathode portfolio (NCM622 and NCM811) and secured capacity, we think the company should be well-positioned to win additional orders from other battery cell makers in the rapidly-growing EV market.

Figure 82: LG Chem's capacity expansion



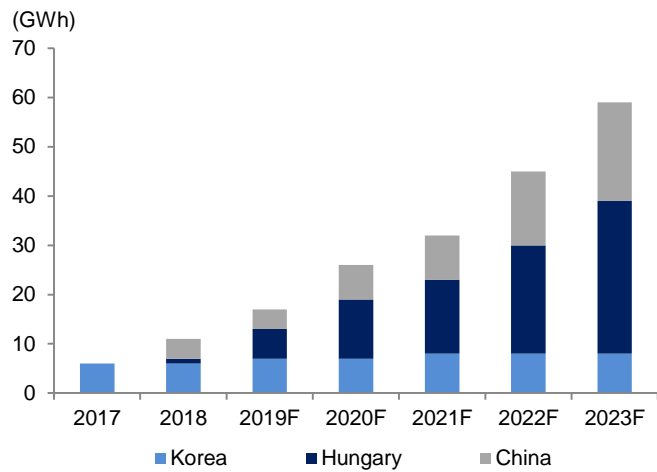
SOURCES: CGS-CIMB RESEARCH ESTIMATES

Figure 83: EV battery cathode vendors (LG Chem)



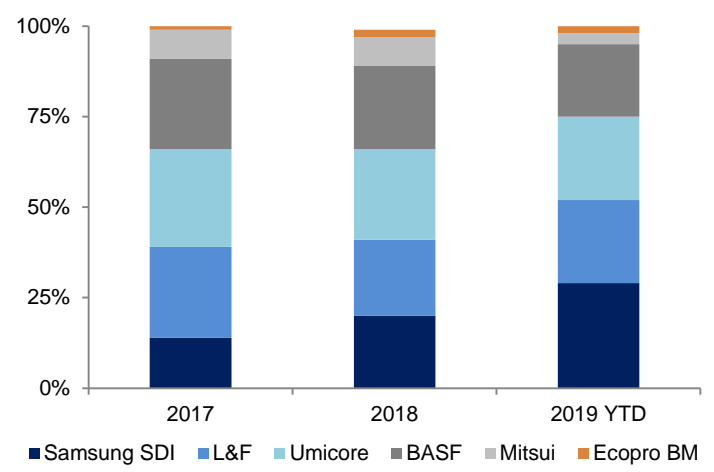
SOURCES: CGS-CIMB RESEARCH ESTIMATES

Figure 84: Samsung SDI's capacity expansion



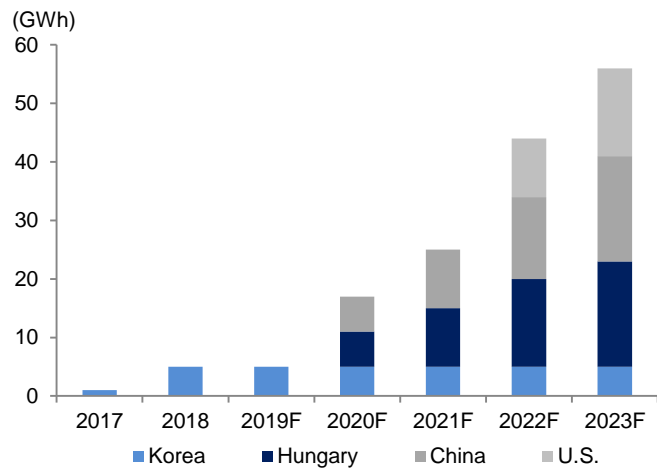
SOURCES: CGS-CIMB RESEARCH ESTIMATES

Figure 85: EV battery cathode vendors (Samsung SDI) (2Q19)



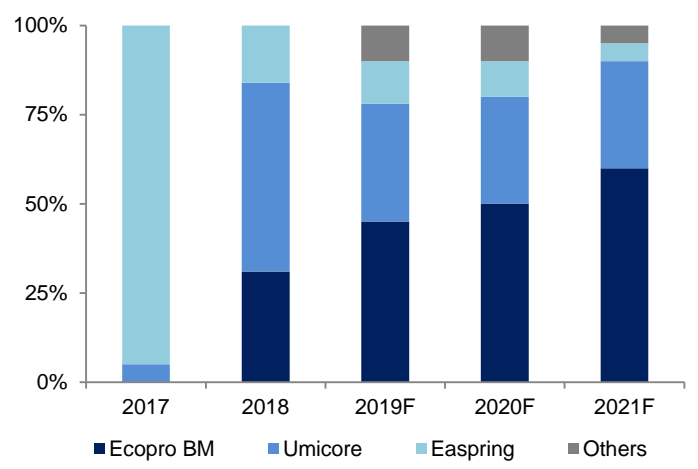
SOURCES: CGS-CIMB RESEARCH ESTIMATES

Figure 86: SK Innovation's capacity expansion



SOURCES: CGS-CIMB RESEARCH ESTIMATES

Figure 87: EV battery cathode vendors (SK Innovation)



SOURCES: CGS-CIMB RESEARCH ESTIMATES

Positive on Korean elecfoil players ➤

We believe Elecfoil companies have the lowest inventory levels with limited suppliers compared to other battery materials. We expect Korean elecfoil players could show the fastest topline growth in 2020-21F among the battery material players with strong orders from Korean battery cell makers.

As the battery cell makers want thinner elecfoil in order to increase anode active material content per battery cell space, we believe the thinner elecfoil technology is the key competitiveness for elecfoil manufacturer. The advanced technology of Korean players could generate higher ASP and better margins going forward, in our view.

We like Iljin Materials (020150 KS, Add, TP; W49,000) and SKC (011790 KS, Add, TP; W62,000) as both companies expect revenues and margins to pick up on the back of rising sales proportion of Korean EV cell components.

Iljin Materials supplies to major battery makers across the Asian region including SDI, LGC, BYD and CATL. The company is rapidly increasing production capacity in Malaysia to meet the accelerating demand growth from the EV battery segment. The management guided that its design capacity for elecfoil in Malaysia is at 100ktpa. We expect the total capacity could increase from 30ktpa in 2019F to 60ktpa in 2021F given the Malaysian capacity additions of 30ktpa over the next three years, according to the management.

SKC, a SK group affiliate, is planning to acquire KCFT (manufactures copper foils and flexible copper clad laminates for Li-batteries) at W1.2tr valuation (100% stake). KCFT's elecfoil production capacity is scheduled to climb from 20ktpa in 2019F to 32ktpa in 2020F. Following its acquisition of KCFT, SKC guided it plans to further expand the company's capacity by 30ktpa by 2022F.

Figure 88: Elecfoil capacity plan

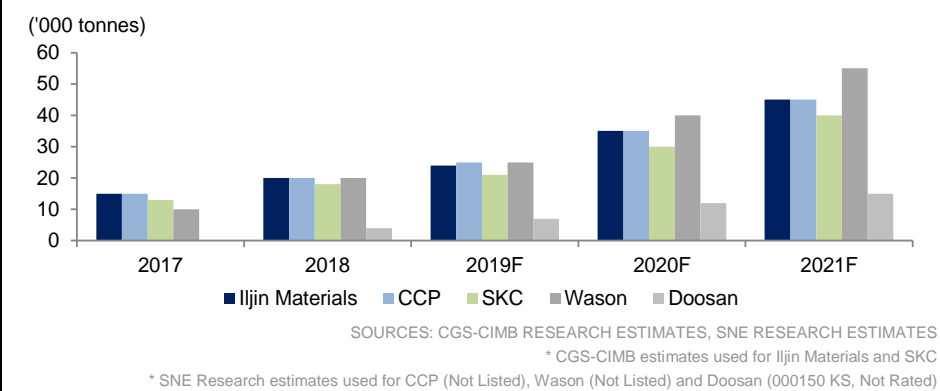


Figure 89: Iljin Materials' annual earnings

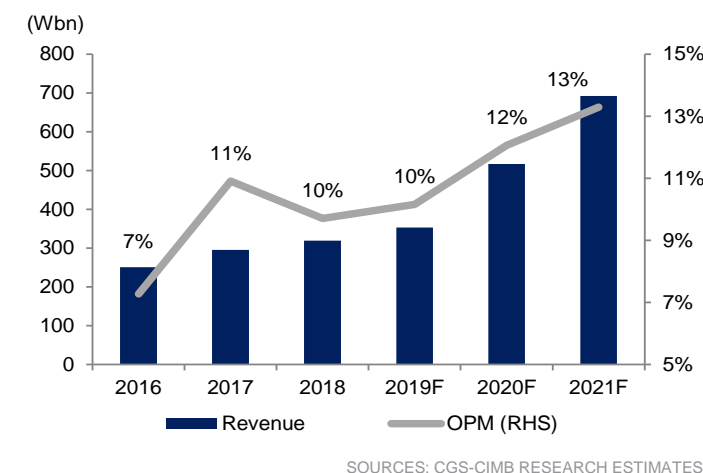
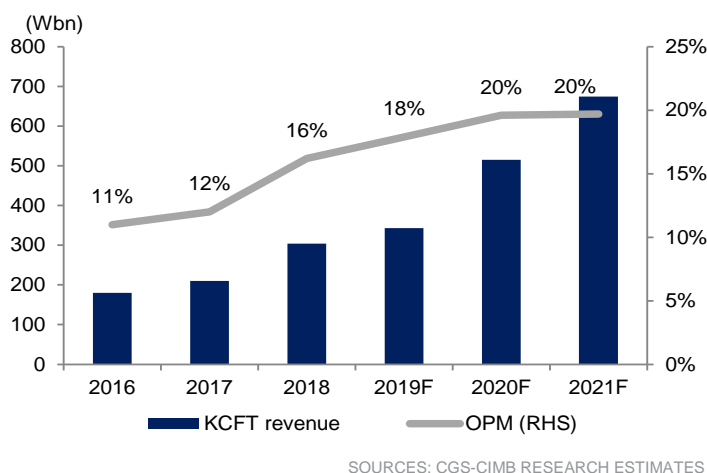


Figure 90: KCFT's annual earnings estimates

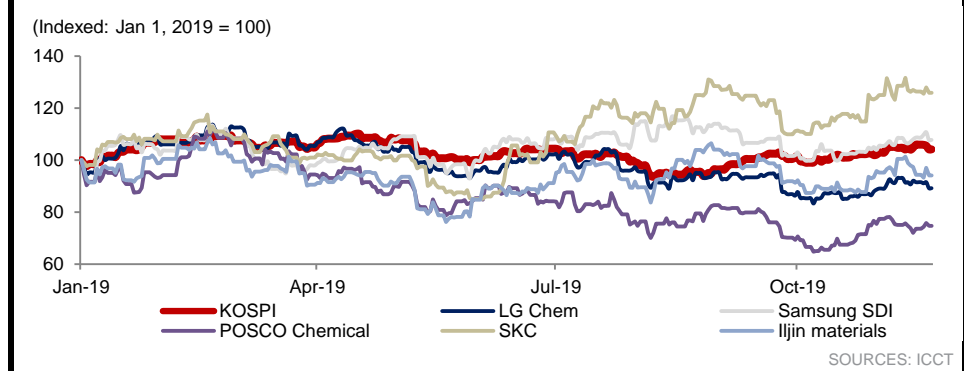


Valuation and recommendation

Overweight: Korean EV battery and materials P/Es at 2017 levels ▶

We believe the Korean EV/ESS battery (large sized) cell and battery materials sectors underperformed (vs. KOSPI) in 1H19 mainly due to 1) slow EV sales in 2019 YTD, 2) lower-than-expected EV battery production yield (battery profitability concerns) and 3) ESS battery fire incidents in Korea (battery safety issue).

Figure 91: Battery sector underperformed in 1H19



We expect the major concerns should ease from 1H20F and expectations for EV sales recovery should be reflected from 2H20F. For EV battery cell makers, given different target multiples for diversified business portfolio, sum-of-the-parts (SOP) valuation is our preferred valuation methodology (see Company Section). For pure battery players, we use the P/E valuation method, which we think is better suited to reflect their substantial core earnings growth and the industry expansion cycle.

Figure 92: LG Chemical's 1-yr forward P/E

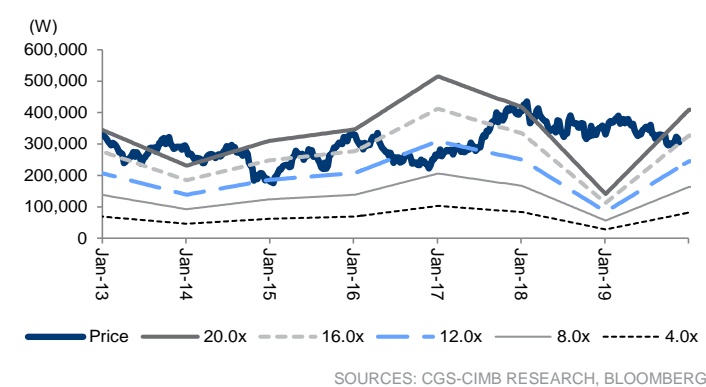


Figure 93: LG Chemical's P/BV vs. ROE

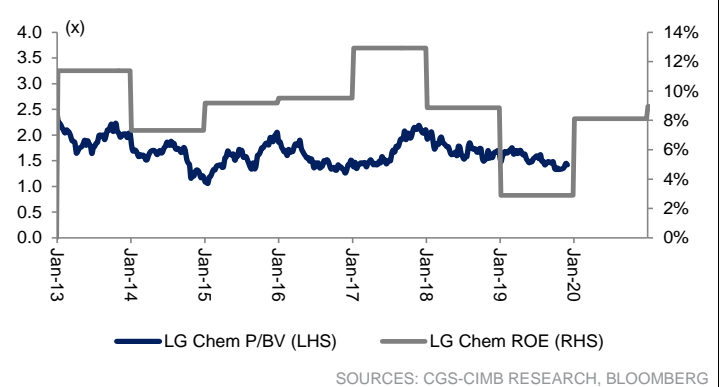


Figure 94: SDI's 1-yr forward P/E

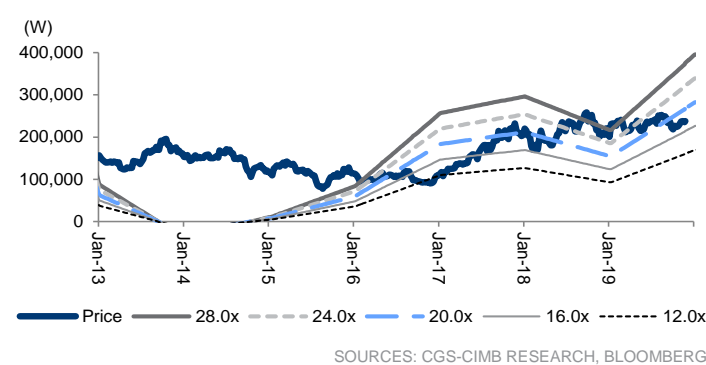


Figure 95: Samsung SDI's P/BV vs. ROE

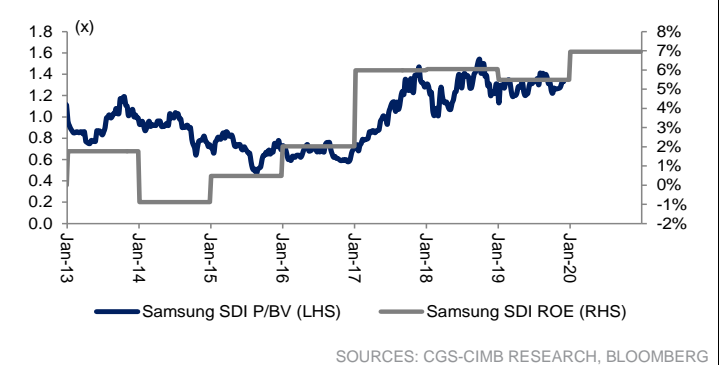
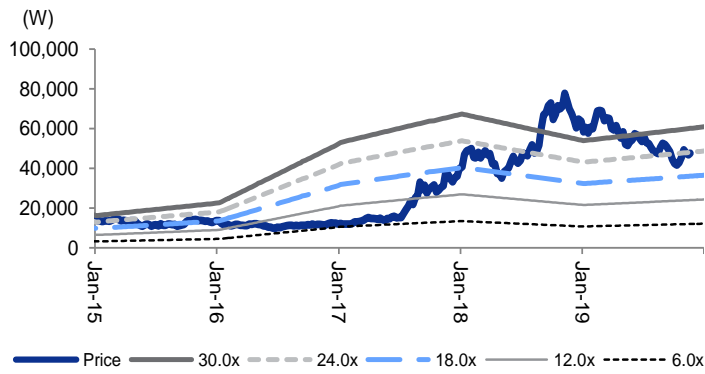
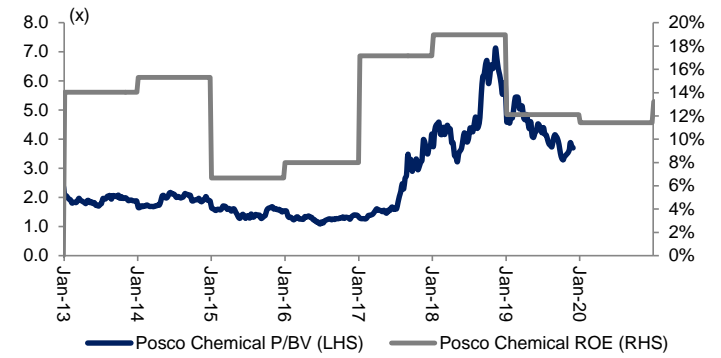


Figure 96: Posco Chemical's 1-yr forward P/E



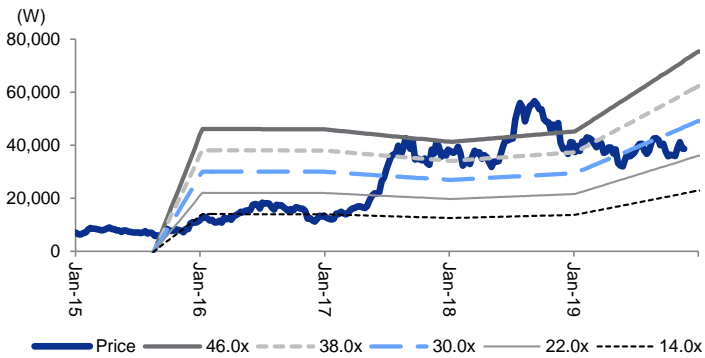
SOURCES: CGS-CIMB RESEARCH, BLOOMBERG

Figure 97: Posco Chemical's P/BV vs. ROE



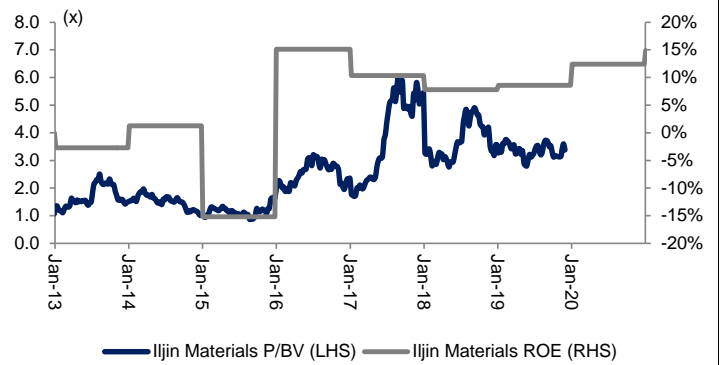
SOURCES: CGS-CIMB RESEARCH, BLOOMBERG

Figure 98: Iljin Materials' 1-yr forward P/E



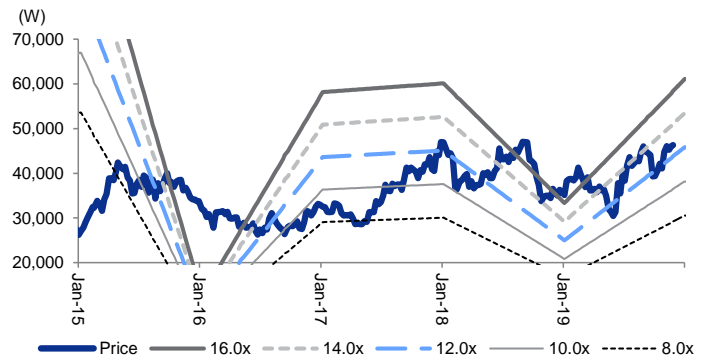
SOURCES: CGS-CIMB RESEARCH, BLOOMBERG

Figure 99: Iljin Materials' P/BV vs. ROE



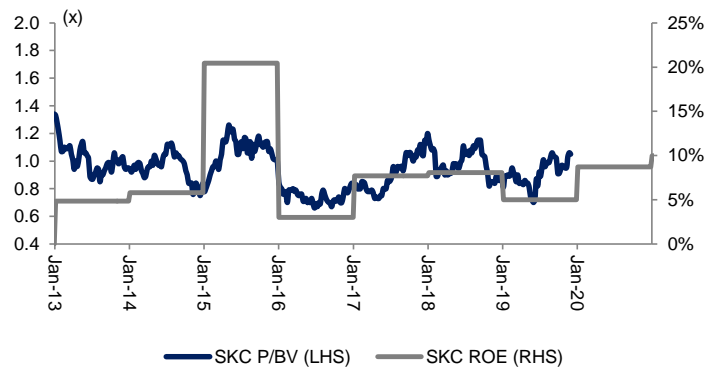
SOURCES: CGS-CIMB RESEARCH, BLOOMBERG

Figure 100: SKC's 1-yr forward P/E



SOURCES: CGS-CIMB RESEARCH, BLOOMBERG

Figure 101: SKC's P/BV vs. ROE



SOURCES: CGS-CIMB RESEARCH, BLOOMBERG

Our positive view on Korean EV battery players stems from our belief that Korean EV battery makers' earnings are likely to pick up significantly from 2H20F driven by strong European OEMs' EV sales growth of 36% yoy in 2020F.

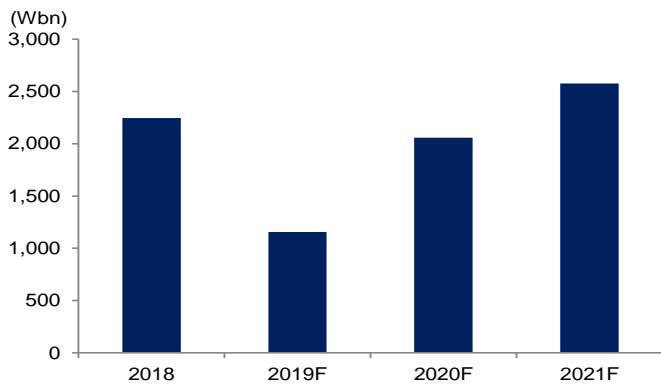
We believe the Korean hybrid battery players (LG Chem, Posco Chemical, SKC) are likely to suffer a significant earnings decline in FY19F (operating profit (OP) down 15-50% yoy) as they have reported a dismal 1H19 earnings performance. However, we expect strong EV battery sales growth of ~60% yoy in 2020F and forecast their chemical earnings to bottom given easing G2 trade tension, in our view.

As for high beta battery players (SDI and Iljin Material), we expect stable OP growth of over 60% yoy in 2020F on continuous robust top-line for EV and ESS. We expect the EV battery margins to turn profitable in earnest in 2H20F on robust their order backlog. The top-line growth of ~60% in 2020F will lead to greater leverage effects (lower R&D and depreciation expenses as a percentage of revenue), based on our estimates.

We also believe that there is upside potential to our 2021F earnings forecasts given Korean battery makers could enter the China market. Chinese OEMs could have partnership with Korean battery makers given limited high quality cell makers after the completion of China's EV subsidies from 2021. Also, we believe Korean battery makers are poised to gain indirect access to China as global OEMs plan to produce EVs with JV strategy for China market. We believe the European OEMs could include Korean EV batteries for stable supply for passenger EVs.

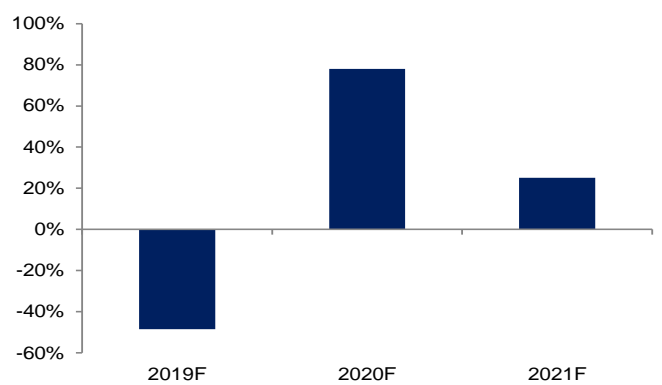
Moreover, should a global economic recovery happen with the easing of US-China trade tensions, overall vehicle consumption should lift the visibility for a electric vehicle business earnings recovery, in our view.

Figure 102: LG Chem's operating profit (2018-2021F)



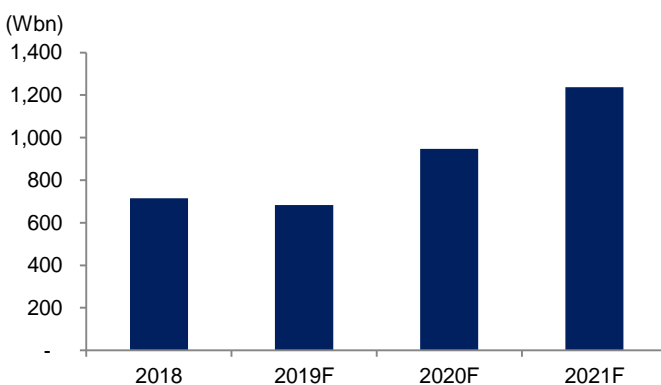
SOURCES: CGS-CIMB RESEARCH ESTIMATES, COMPANY REPORTS

Figure 103: LG Chem's operating profit growth yoy (2019-2021F)



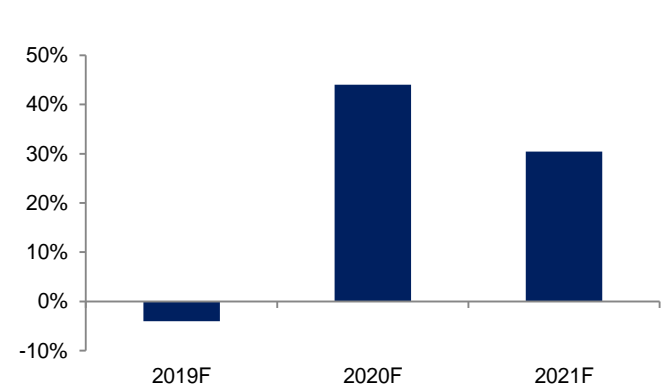
SOURCES: CGS-CIMB RESEARCH ESTIMATES, COMPANY REPORTS

Figure 104: SDI's operating profit (2018-2021F)



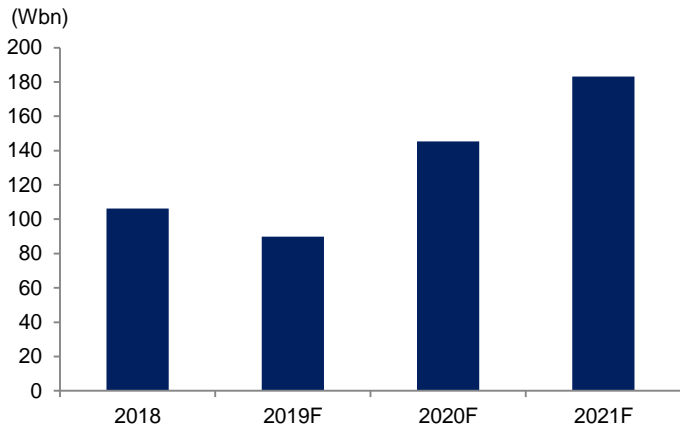
SOURCES: CGS-CIMB RESEARCH ESTIMATES, COMPANY REPORTS

Figure 105: SDI's operating profit growth yoy (2019-2021F)



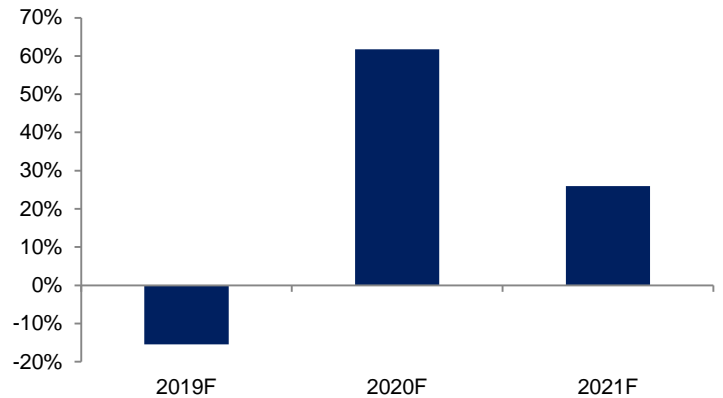
SOURCES: CGS-CIMB RESEARCH ESTIMATES, COMPANY REPORTS

Figure 106: Posco Chemical's operating profit (2018-2021F)



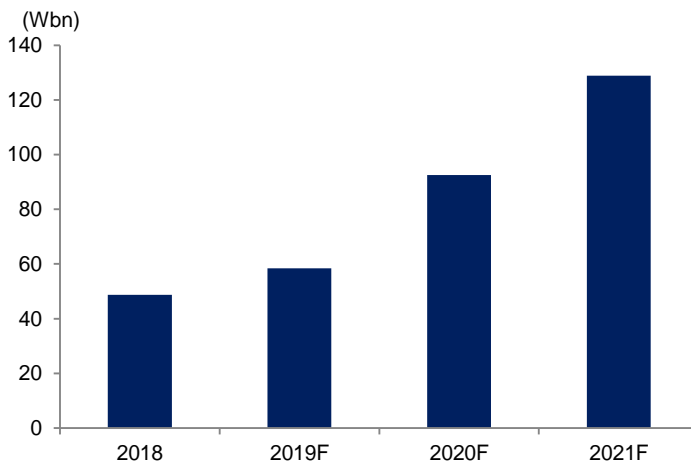
SOURCES: CGS-CIMB RESEARCH ESTIMATES, COMPANY REPORTS

Figure 107: Posco Chemical's operating profit growth yoy (2019-2021F)



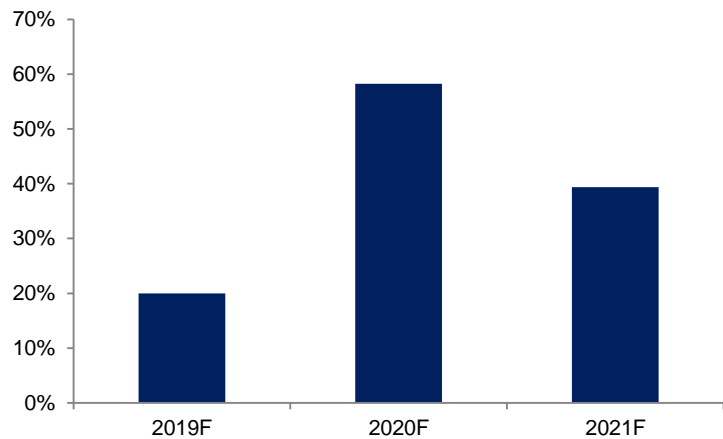
SOURCES: CGS-CIMB RESEARCH ESTIMATES, COMPANY REPORTS

Figure 108: Iljin Materials' operating profit (2018-2021F)



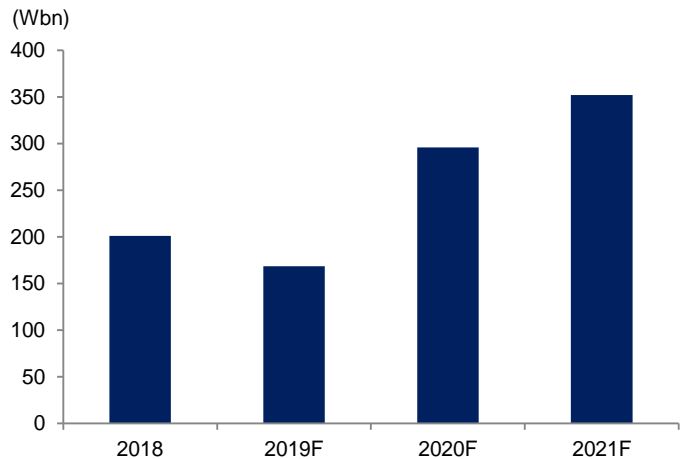
SOURCES: CGS-CIMB RESEARCH ESTIMATES, COMPANY REPORTS

Figure 109: Iljin Materials' operating profit growth yoy (2019-2021F)



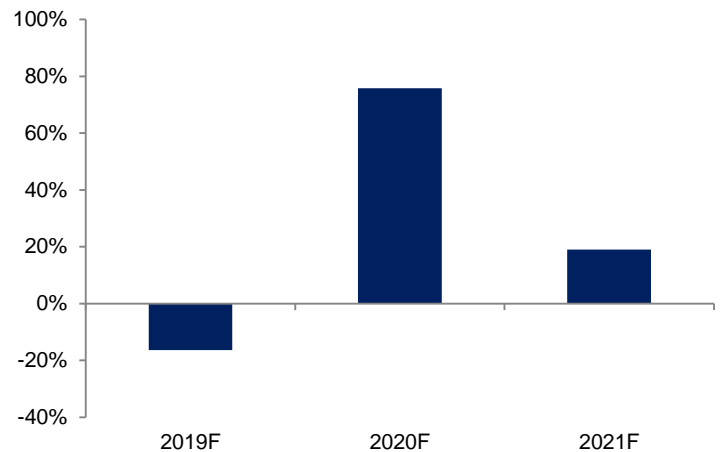
SOURCES: CGS-CIMB RESEARCH ESTIMATES, COMPANY REPORTS

Figure 110: SKC's operating profit (2018-2021F)



SOURCES: CGS-CIMB RESEARCH ESTIMATES, COMPANY REPORTS

Figure 111: SKC's operating profit growth yoy (2019-2021F)



SOURCES: CGS-CIMB RESEARCH ESTIMATES, COMPANY REPORTS

We expect SDI and Iljin Material to show robust earnings improvement in 2020F as pure battery and material plays, respectively given global economic slow-down. LG Chem could post the strongest earnings turnaround next year given its extremely weak expected performance in 2019F (based on our estimates) and its improving profitability from the normalisation capacity of the newly European EV battery plant in 1H20F, in our view.

Our preference for SKC is based on the fact that it is scheduled to take over a high tech elecfoil producer. As the elecfoil earnings should be reflected from 1Q20F, we see SKC as changing into an EV battery material player (vs. chemical company previously). As a result, we expect its valuation to re-rate as investors begin to view it as a growth stock.

Since the beginning of 2019, Bloomberg consensus earnings revisions have been on a downward trajectory, with FY19-20F consensus OP now 20-45% lower than in Oct 2019. Compared with the latest (as at 25 Nov) Bloomberg consensus forecasts, we are generally in line when it comes to 2020F operating profit. While we are more positive for LG Chem and SKC for 2H20F, we are conservative for 1H20F on an OP basis. At this juncture, we think visibility is still low for anyone to make an outright call that the earnings revision cycle has passed the inflection point. However, we believe that as long as the EV era has arrived, EV battery and material earnings should recover for the next couple of years (during the period of EV penetration from 3% to 7% (between 2021F and 2024F)).

Figure 112: Changes in Bloomberg consensus OP forecasts for LG Chem – 2019-20F (Nov 25, 2019)

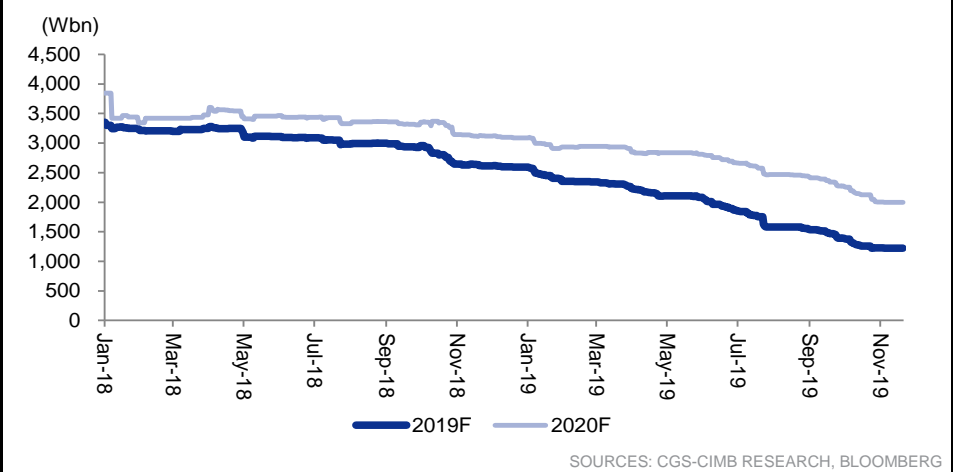


Figure 113: Changes in Bloomberg consensus OP forecasts for Samsung SDI – 2019-20F (Nov 25, 2019)

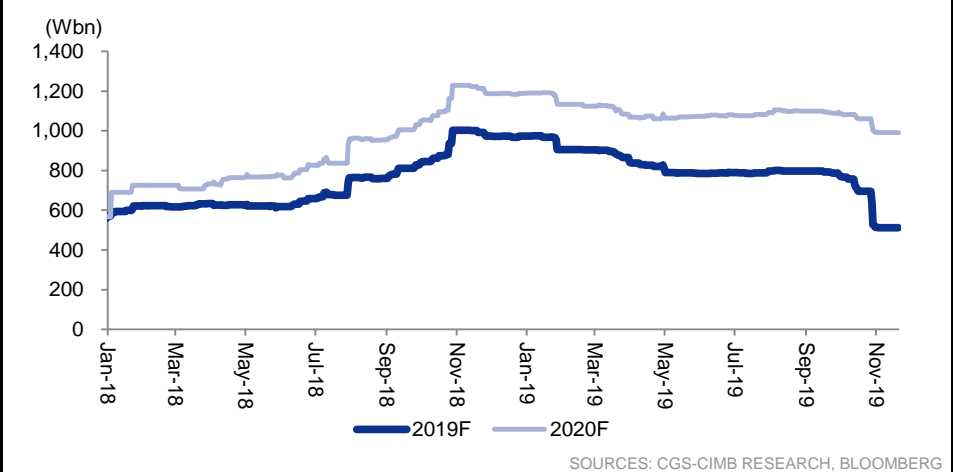
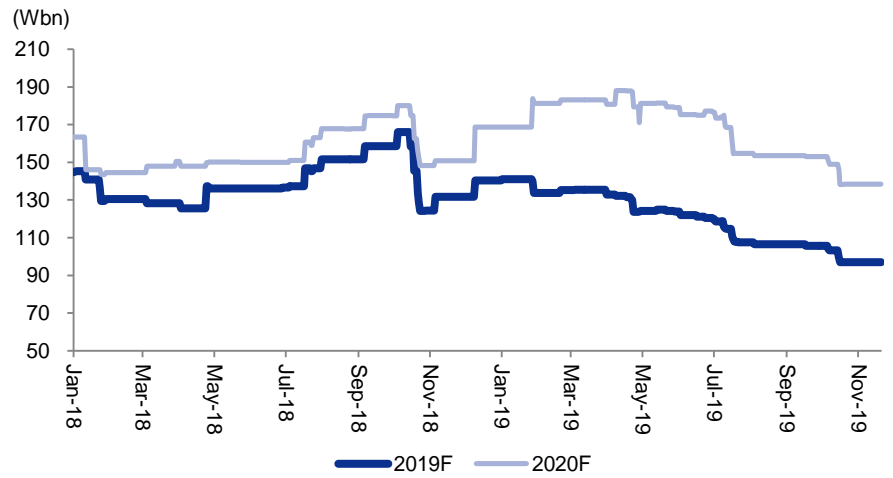
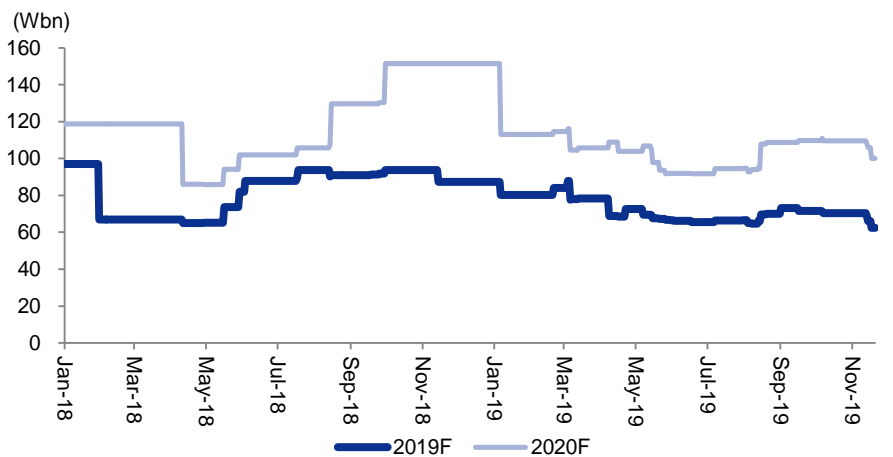


Figure 114: Changes in Bloomberg consensus OP forecasts for Posco Chemical – 2019-20F (Nov 25, 2019)



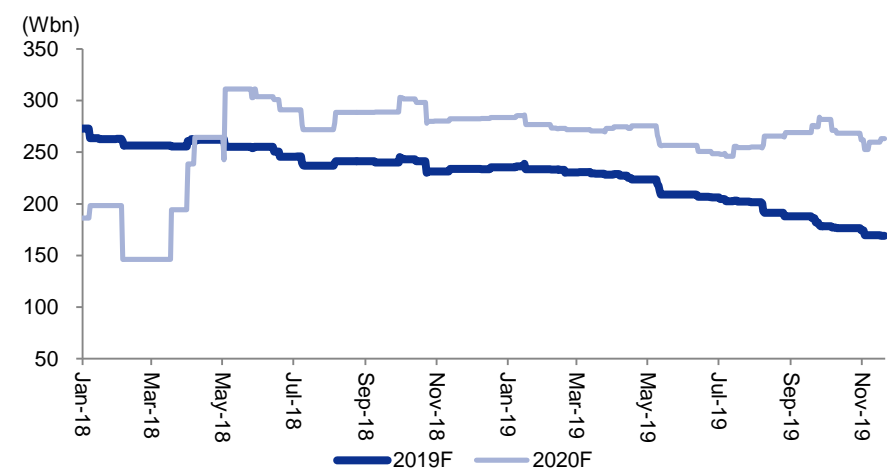
SOURCES: CGS-CIMB RESEARCH, BLOOMBERG

Figure 115: Changes in Bloomberg consensus OP forecasts for Iljin Materials – 2019-20F (Nov 25, 2019)



SOURCES: CGS-CIMB RESEARCH, BLOOMBERG

Figure 116: Changes in Bloomberg consensus OP forecasts for SKC – 2019-20F (Nov 25, 2019)



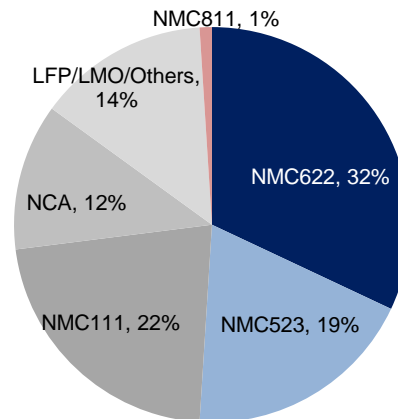
SOURCES: CGS-CIMB RESEARCH, BLOOMBERG

Appendix – battery materials

Cathode ➤

The cathode active material is currently either a lithium metal oxide or lithium iron phosphate. The current R&D focuses on improving the reversibility of the active materials, and developing new active materials with higher voltages/capacity (mAh/g). The current level of reversibility is c.160mAh/g, which is considerably lower than the current anode capacity.

Figure 117: Global EV battery cathode mix (2Q19)



SOURCES: CGS-CIMB RESEARCH, SNE RESEARCH

Figure 118: Cathode material characteristics

Type	Chemical formula	mAh/g	mAh/cc	Average voltage (V)	Features	Main application
NCA	Li[NiCoAl]O ₂ Ni/Co/Al = 80/15/5	175	525	3.8	High density Long life Low stability Low thermal stability	Small (high-end) Power tool
NCM	Li[NiCoMn]O ₂ Ni/Co/Mn = 33/33/33	145	465	3.8	Relatively high structural stability Long battery life Low stability Low thermal stability	Small (low-end) Power tool
	Li[NiCoMn]O ₂ Ni/Co/Mn = 50/20/30	163	500	3.8	High density Relatively high structural stability High thermal stability Low voltage	Small (low-end) Power tool xEV ESS
NMO	LiMn ₂ O ₄	100	263	4	High density Low price Significantly low density Poor heat tolerance	Power tool xEV ESS
LFP	LiFePO ₄	132	254	3.4	High stability Low price Low density and voltage Heavy (contains iron)	Power tool xEV ESS
LCO	LiCoO ₂	145	550	3.9	Industry norm	

SOURCES: CGS-CIMB RESEARCH, SNE RESEARCH

Anode ➤

The most common active material for anode is graphite. The current anode R&D is focusing on developing materials that are safer but also have a higher capacity (charge per unit of weight) than graphite (350mAh/g). We believe that the next-generation anode could adopt a mixture of graphite and silicon.

Figure 119: Anode material characteristics

Type	Pros	Cons	Main application	Manufacturer	
Graphite	Organic	Low price High energy density	High resistance Low stability Short battery life	Small (low-end)	BTR, Mitsubishi Chem, Hitachi Chem, Posco Chemical
	Synthetic	Low resistance High energy density Long battery life	High price Complex manufacturing process	Small (high-end) Large (EV/ESS)	Hitachi Chem, JFE, Nippon Carbon, Posco Chemical
Carbon	Hard	High output Density stability	Low capacity Low stability	Power tool Large (EV/ESS)	Kureha, SK Innovation
	Soft	High output High charging speed	Low capacity	Power tool Large (EV/ESS)	Hitachi Chem, PCT (JV between GS Caltex and JX NOE)
Non-carbon materials	Si/Sn composite	High capacity	High price Poor heat tolerance Short battery life	Large (EV/ESS)	R&D

SOURCES: CGS-CIMB RESEARCH, SNE RESEARCH

Separator ➤

The separator provides a physical separation of the electrodes while being porous to the conducting lithium ions. R&D efforts are directed at improving separator stability for safety, and reducing separator thickness which eats into a battery unit's overall capacity. The separator can be coated with ceramic to improve thermal stability.

Electrolyte ➤

Electrolyte is in a liquid form, most typically a lithium salt dissolved in organic solvents that conduct ions. Electrolyte additives can be used to increase the performance or improve cell life and safety. The challenge for current R&D is to increase the voltage range that an electrolyte can operate over.

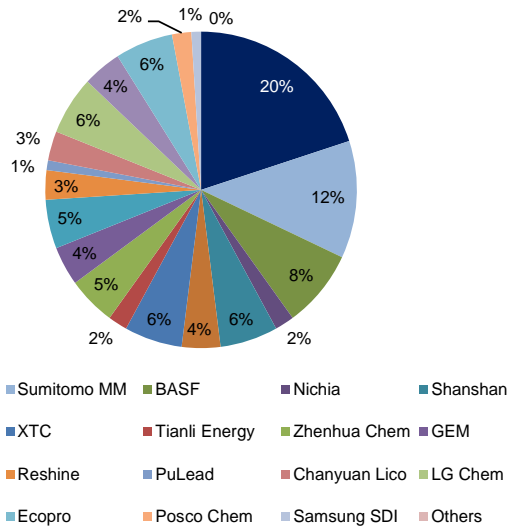
Some solid types of electrolyte may display conductivity as much as liquid types, with the advantage of avoiding leakages. However, one big challenge in using the solid state form is maintaining the surface contact between electrodes and electrolyte over a wide range of temperatures, as the materials in contact have different thermal properties.

Figure 120: Summary of major suppliers for each battery cell component (2Q19)

Component	Cathode	Anode	Separator	Electrolyte
Market share of top three suppliers	61%	65%	78%	65%
Top 3 suppliers	Toda Kogyo Nichia Chemical Umicore	BTR Energy Materials Nippon Carbon Hitachi Chemical	Tonen/Toray Celgard Asahi Kasei	Mitsubishi Chem Ube industries Cheil industries

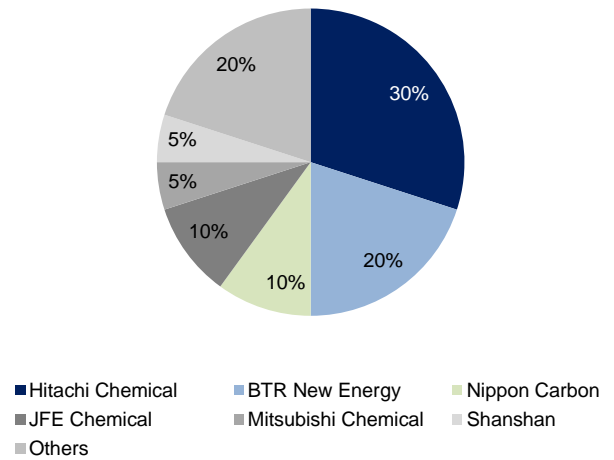
SOURCES: CGS-CIMB RESEARCH, SNE RESEARCH

Figure 121: Global market share of cathode, in terms of sales volume (2018)



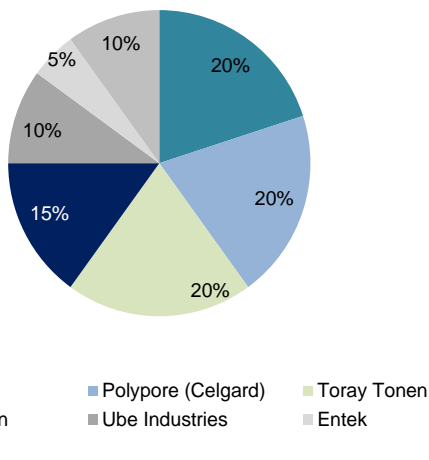
SOURCES: CGS-CIMB RESEARCH, SNE RESEARCH

Figure 122: Global market share of anode, in terms of sales volume (2018)



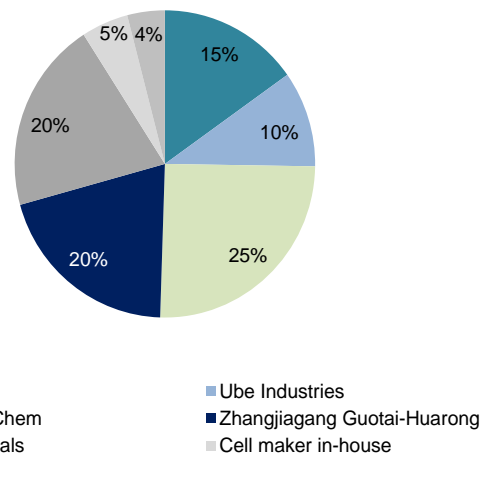
SOURCES: CGS-CIMB RESEARCH, SNE RESEARCH

Figure 123: Global market share of separator, in terms of sales volume (2018)



SOURCES: CGS-CIMB RESEARCH, SNE RESEARCH

Figure 124: Global market share of electrolyte, in terms of sales volume (2018)



SOURCES: CGS-CIMB RESEARCH, SNE RESEARCH

Figure 125: Key EV and battery material plays in Korea (3Q19)

Battery cell

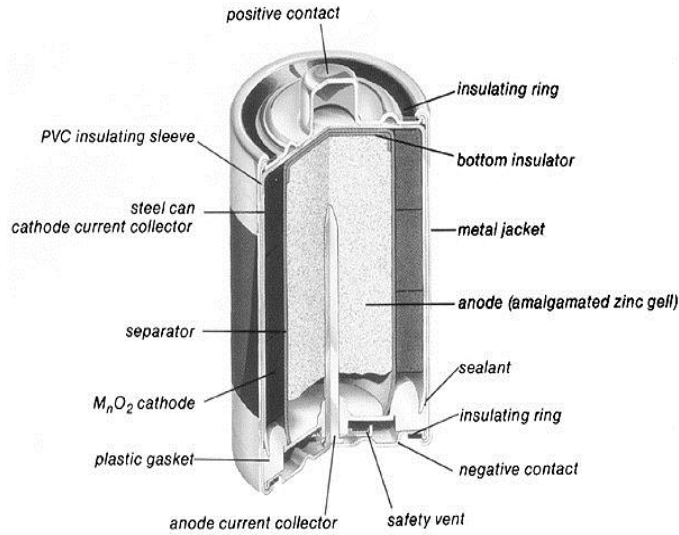
- LG Chem (051910 KS, Mkt Cap: US\$18.3bn)
- Samsung SDI (006400 KS, Mkt Cap: US\$13.7bn)
- SK Innovation (096770 KS, Mkt Cap: US\$12.1bn)

Cathode

- Posco Chemical (003670 KS, Mkt Cap: US\$2.4bn)
- Ecopro BM (247540 KS, Mkt Cap: US\$0.9bn)
- L&F (066970 KS, Mkt Cap: US\$0.4bn)
- Cosmo AM&T (005070 KS, Mkt Cap: US\$0.3bn)

Separator

- SK Innovation (096770 KS, Mkt Cap: US\$2.4bn)
- MS TNS (257370 KS, Mkt Cap: US\$0.1bn)



Anode

- Posco Chemical (003670 KS, Mkt Cap: US\$2.4bn)

Electrolyte

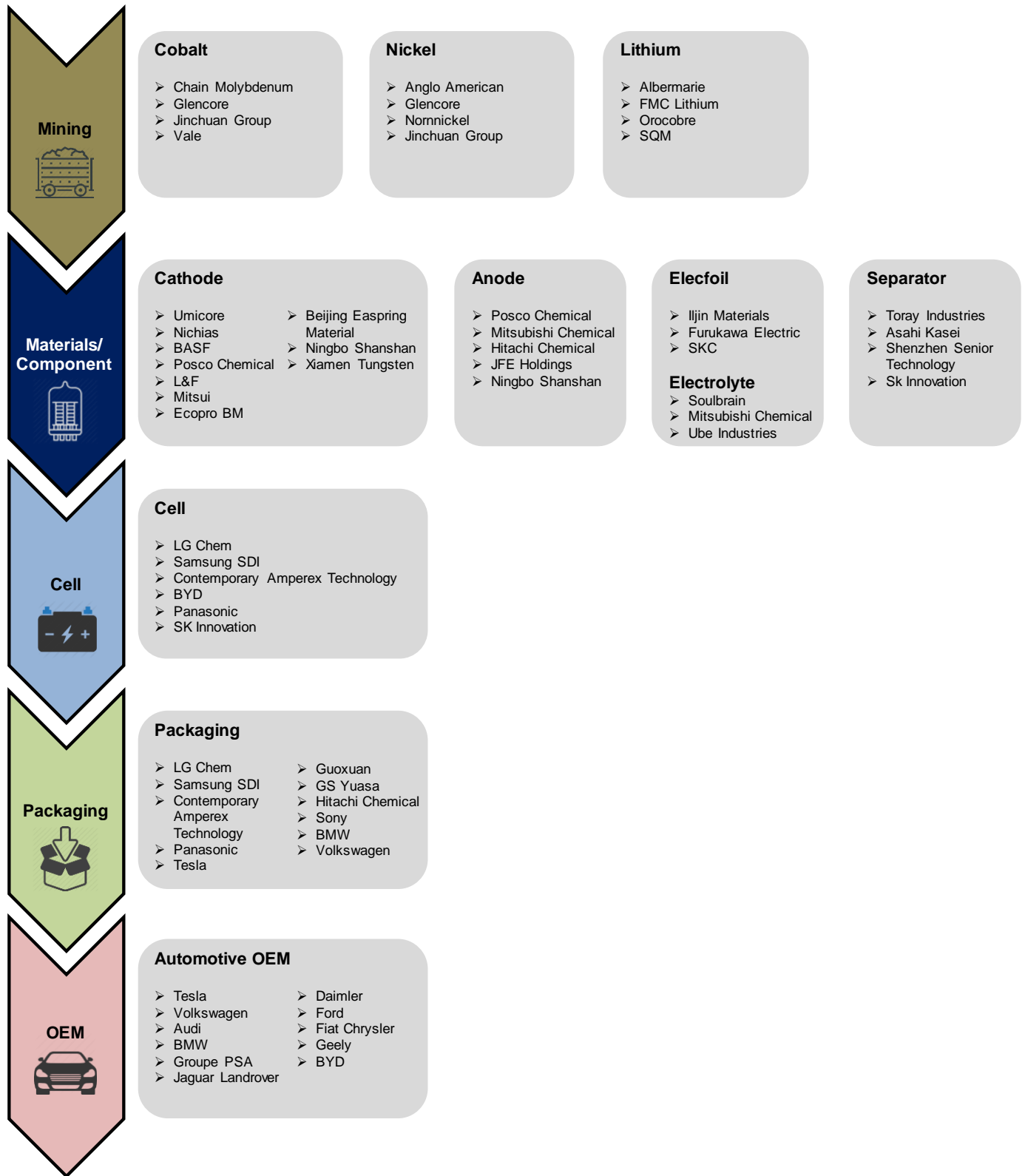
- Iljin Materials (020150 KS, Mkt Cap: US\$1.6bn)
- SKC (011790 KS, Mkt Cap: US\$1.5bn)

Electrolyte

- Soulbrain (036830 KS, Mkt Cap: US\$1.1bn)
- Foosung (093370 KS, Mkt Cap: US\$0.7bn)
- Chunbo (278280 KS, Mkt Cap: US\$0.5bn)

SOURCES: CGS-CIMB RESEARCH, BLOOMBERG, SNE RESEARCH

Figure 126: EV battery and material value chain (3Q19)



SOURCES: CGS-CIMB RESEARCH, BLOOMBERG, SNE RESEARCH

A horizontal line with a red segment on the left and a blue segment on the right.

Company Section

South Korea

ADD (no change)

Consensus ratings*: Buy 36 Hold 1 Sell 1

Current price:	W309,000
Target price:	W380,000
Previous target:	W380,000
Up/downside:	23.0%
CGS-CIMB / Consensus:	-3.9%
Reuters:	051910.KS
Bloomberg:	051910 KS
Market cap:	US\$18,530m
	W21,813,034m
Average daily turnover:	US\$44.63m
	W52,362m
Current shares o/s:	66.27m
Free float:	58.9%

*Source: Bloomberg

Key changes in this note

- ▶ FY20F/21F OP decreased by 5%/3%.
- ▶ FY20F/21F EPS decreased by 9%/3%.



Source: Bloomberg

Price performance	1M	3M	12M
Absolute (%)	2.3	-4.6	-11
Relative (%)	1.1	-13.7	-11.5

Major shareholders

	% held
LG Corp	33.3
National Pension	10.0

Analyst(s)



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LG Chem

Preemptive capacity expansion for new EVs

- LG Chem should benefit from the EU's strong EV market and new EV launches from EU OEMs as LGC has multiple EU OEMs as customers.
- The concerns over battery profitability (EV) should be alleviated as its Poland new battery production yield could improve to 90% in 1H20F.
- We retain our Add call and SOP-based target price of W380k as we forecast strong turnaround for battery division (26% OP contribution) in FY20F.

No. 1 EV battery supplier for EU OEMs

LGC is No. 1 EV battery supplier for EU OEMs (backlog basis) and it should gain momentum with the new model launches by European automakers from 2020 on strong subsidies. Germany plans to increase EV subsidy by 50% over the next five years from 2020 and VW plans to sell 800k new platform EVs in 2021F. Based on its W100tr order backlog, we expect its EV battery revenue to rise from W4.2tr in 2019F to W9tr in 2020F.

To benefit the most from the EU's EV market over next three years

While we expect strong demand for EV batteries (rising from 52GWh in 2019 to 500GWh in 2023F, at a 43% CAGR) on new EV launches, the capacity of battery suppliers looks limited for EU OEMs. Only LGC, SDI, Contemporary Amperex Technology (CATL), SKI can produce high-quality batteries at competitive cost for EU OEM's new EV models scheduled for launch, in our view. LGC should be a prime beneficiary, based on its leading position in terms of capacity, battery flexibility, energy density and safety.

EV battery to turn profitable in 2020F

While LGC is in the process of expanding its EV battery capacity to 100Gwh by 2020 (vs. 30Gwh in 2018), the initial yield for new EV battery operation in Poland is lower than expected on new automotive applications. We expect the new battery plant operations to stabilise from 1Q20F (90% yield). We see its EV battery capacity rising to 55Gwh in the EU (vs. 30Gwh in Asia and 10Gwh in the US) by 2020. We project EV battery OP to rise to W206bn in 2020F with OPM improvement (2.3% in 2020F vs. -3% in 2019F).

Domestic ESS battery concerns could be eased

LGC may book W106bn additional provisions for its energy storage system (ESS) battery in 4Q19 with tighter safety measures. As LGC plans to install fire extinguisher system on its ESS battery, concerns over domestic ESS could be alleviated. Given robust overseas growth of 40% in 2020F (vs. 50% in 2019F), we think its ESS revenue may rise by over 40% to W1.1tr in 2020F with domestic ESS gradual recovery.

Maintain Add with an SOP-based TP of W380,000

While investors remain skeptical on its new EV battery capacity normalisation in the near term, ESS risks should be eased. We cut FY20/21F EPS by 9%/3% given lower chemical margin assumptions. Re-rating catalyst is improved profitability from its Poland new capacity. Downside risks include delays in new EV rollouts by global OEMs.

Financial Summary

	Dec-17A	Dec-18A	Dec-19F	Dec-20F	Dec-21F
Revenue (Wb)	25,698	28,183	28,685	35,097	40,304
Operating EBITDA (Wb)	4,334	3,731	3,053	4,197	4,511
Net Profit (Wb)	1,945	1,473	582	1,315	1,643
Normalised EPS (W)	28,426	20,861	8,249	18,627	23,281
Normalised EPS Growth	47%	(27%)	(60%)	126%	25%
FD Normalised P/E (x)	10.87	14.81	37.46	16.59	13.27
DPS (W)	6,000	6,000	6,000	6,000	5,000
Dividend Yield	1.94%	1.94%	1.94%	1.94%	1.62%
EV/EBITDA (x)	4.92	6.60	9.30	7.10	6.70
P/FCFE (x)	7.78	NA	NA	65.19	NA
Net Gearing	1.6%	16.3%	37.5%	42.8%	42.1%
P/BV (x)	1.35	1.28	1.26	1.20	1.13
ROE	12.9%	8.9%	3.4%	7.4%	8.8%
% Change In Normalised EPS Estimates			(0.33%)	(8.88%)	(3.17%)
Normalised EPS/consensus EPS (x)			1.01	1.08	1.03

SOURCES: CGS-CIMB RESEARCH, COMPANY REPORTS

Figure 1: Earnings forecasts

(Wbn)	1Q18	2Q18	3Q18	4Q18	1Q19	2Q19	3Q19	4Q19F	2015	2016	2017	2018	2019F	2020F	2021F
Revenues	6,554	7,052	7,235	7,343	6,639	7,177	7,347	7,521	20,207	20,659	25,698	28,183	28,685	35,097	40,304
Petrochemical	4,359	4,671	4,649	4,357	3,749	3,936	3,965	3,941	14,633	14,448	17,246	18,036	15,591	16,324	17,047
Advanced Materials	759	765	847	902	1,234	1,254	1,218	1,237	2,765	2,657	3,059	3,273	4,943	5,137	5,453
Energy Solution	1,244	1,494	1,704	2,077	1,650	2,009	2,210	2,348	3,151	3,562	4,561	6,520	8,218	13,617	17,785
Small-sized Batteries	600	623	815	783	705	717	860	822	2,206	2,052	2,351	2,820	3,104	3,698	4,466
Large-sized Batteries	586	793	846	1,140	949	1,213	1,280	1,526	945	1,510	2,210	3,364	4,968	9,918	13,320
EV Batteries	476	603	636	895	869	1,013	1,037	1,261	785	1,240	1,715	2,609	4,180	8,818	11,872
ESS Batteries	110	190	210	245	80	200	243	265	160	270	495	755	788	1,100	1,448
Others	191	122	35	7	6	(22)	(46)	(6)	0	(8)	833	355	(67)	19	19
EBITDA	1,006	1,066	975	684	679	725	879	769	3,070	3,326	4,334	3,731	3,053	4,197	4,511
OP	651	703	602	290	275	268	380	233	1,824	1,992	2,928	2,246	1,156	1,988	2,495
Petrochemical	637	704	548	242	399	382	321	302	1,676	2,138	2,808	2,131	1,404	1,456	1,594
Advanced Materials	(10)	(22)	12	(9)	4	19	33	5	147	(55)	111	(28)	60	57	44
Energy Solution	2	27	84	96	(148)	(128)	71	(35)	1	(49)	29	209	(240)	505	873
Small-sized Batteries	11	28	65	59	7	24	95	68	131	30	82	163	194	229	268
Large-sized Batteries	(9)	3	14	16	(137)	(145)	(23)	(103)	(130)	(79)	(53)	25	(409)	276	605
EV Batteries	(14)	(12)	(3)	2	(17)	(89)	(30)	3	(136)	(101)	(89)	(27)	(134)	206	510
ESS Batteries	6	15	17	15	(120)	(56)	7	(106)	7	22	36	52	(275)	69	94
Others	22	(6)	(41)	(40)	21	(6)	(45)	(40)	0	(42)	(20)	(66)	(69)	(29)	(15)
NP	531	478	343	120	194	68	129	191	1,153	1,281	1,945	1,473	582	1,315	1,643
ROE (%)	13%	12%	8%	3%	5%	2%	3%	4%	9%	10%	13%	9%	3%	7%	9%
OP margin															
Overall	9.9%	10.0%	8.3%	3.9%	4.1%	3.7%	5.2%	3.1%	9.0%	9.6%	11.4%	8.0%	4.0%	5.7%	6.2%
Petrochemical	14.6%	15.1%	11.8%	5.6%	10.6%	9.7%	8.1%	7.7%	11.5%	14.8%	16.3%	11.8%	9.0%	8.9%	9.3%
Advanced Materials	-1.3%	-2.9%	1.4%	-0.9%	0.3%	1.5%	2.7%	0.4%	5.3%	-2.1%	3.6%	-0.9%	1.2%	1.1%	0.8%
Energy Solution	0.2%	1.8%	4.9%	4.6%	-9.0%	-6.4%	3.2%	-1.5%	0.0%	-1.4%	0.6%	3.2%	-2.9%	3.7%	4.9%
Small-sized Batteries	1.8%	4.5%	8.0%	7.5%	1.0%	3.4%	11.0%	8.3%	5.9%	1.5%	3.5%	5.8%	6.3%	6.2%	6.0%
Large-sized Batteries	-1.5%	0.4%	1.7%	1.4%	-14.5%	-12.0%	-1.8%	-6.8%	-13.7%	-5.2%	-2.4%	0.7%	-8.2%	2.8%	4.5%
EV Batteries	-3.0%	-2.0%	-0.4%	0.2%	-2.0%	-8.8%	-2.9%	0.2%	-17.4%	-8.1%	-5.2%	-1.0%	-3.2%	2.3%	4.3%
ESS Batteries	5.0%	8.0%	8.0%	6.0%	-150.0%	-28.0%	3.0%	-40.0%	4.2%	8.0%	7.2%	6.9%	-34.9%	6.3%	6.5%
Others	11.3%	-5.1%	-120.1%	-537.0%	337.6%	26.0%	98.5%	718.9%		549.1%	-2.4%	-18.6%	103.4%	-155.7%	-80.5%
KRW/US\$ (Avg)	1,073	1,077	1,112	1,113	1,126	1,167	1,194	1,188	1,134	1,161	1,126	1,094	1,169	1,167	1,156
Oil Price - Dubai (\$/bbl)	64	72	74	67	63	67	61	65	51	41	53	69	64	65	65

SOURCES: CGS-CIMB RESEARCH ESTIMATES, COMPANY REPORTS

Figure 2: SOP valuation

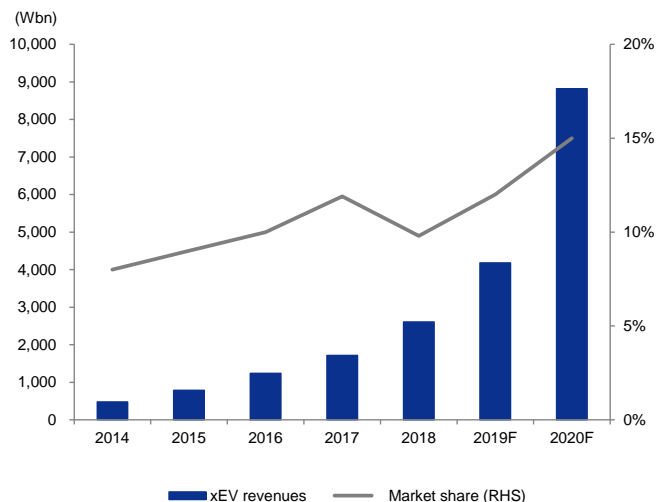
A. Core operating value (Wbn)	EBITDA	EV/EBITDA multiple (x)	EV Note
Petrochemical	2,542.1	5.2	13,219.2 NCC peers multiple
Advanced materials	600.4	5.5	3,326.1 I&E peers multiple
Energy solution	1,082.5	15.3	16,562.3 10% discount to CATL multiple (normalised margin)
Farm Hannong	64.0	7.0	448.0 Domestic peers multiple
Life Sciences	102.0	9.0	922.1 Chemical bio multiple
Sub total	4,391.0		34,477.6
B. Investment asset value (Wbn)			295.5 30% discount to book value
C. Net debt (Wbn)			6,577.4 Based on 2020F
D. Preferred shares (Capitalisation, Wbn)			1,499.3 6 month average on market price
NAV (A+B-C-D, Wbn)			26,696.4
# of shares outstanding (mn)			70.6
Fair value per share (W)			378,179
Target price (W)			380,000
Current price (W)			309,000
Upside (%)			23%

SOURCES: CGS-CIMB RESEARCH ESTIMATES, COMPANY REPORTS

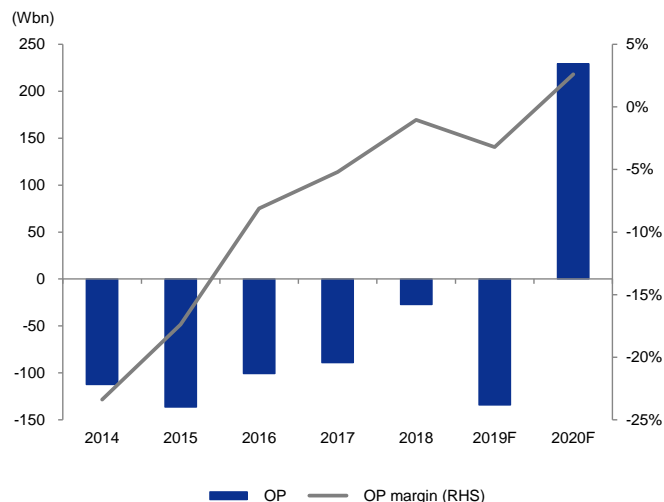
Figure 3: Our assumptions for LGC's EV battery division

	2014	2015	2016	2017	2018	2019F	2020F
Global xEV battery cell market size (US\$m)	3,543	4,132	6,180	7,893	12,913	14,071	19,359
YoY % change	25%	17%	50%	28%	64%	9%	38%
Battery cell ASP (US\$/kwh)	456	410	253	170	156	148	142
YoY % change	-3%	-10%	-38%	-33%	-9%	-5%	-4%
Total xEV vehicles (m)	1.9	1.8	2.4	3.2	4.1	4.2	4.7
YoY % change	6%	-4%	37%	29%	29%	4%	11%
EV penetration rate (%)	0%	0%	1%	1%	2%	2%	3%
LG Chem							
xEV revenues (Wbn)	480	785	1,240	1,715	2,609	4,180	8,818
YoY % change	0%	64%	58%	38%	52%	60%	111%
Total sales volume market share (%)	8%	9%	10%	12%	10%	12%	15%
OP (Wbn)	-112	-136	-101	-89	-27	-134	206
YoY % change	30%	22%	-26%	-11%	-70%	395%	-254%
OP margin (%)	-23%	-17%	-8%	-5%	-1%	-3%	2%

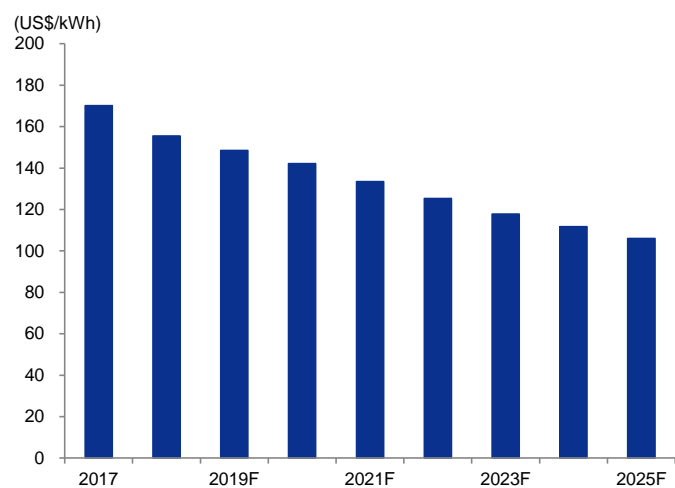
SOURCES: CGS-CIMB RESEARCH ESTIMATES, COMPANY REPORTS, MARKLINES, ICCT

Figure 4: LGC's revenues vs. total sales volume market share


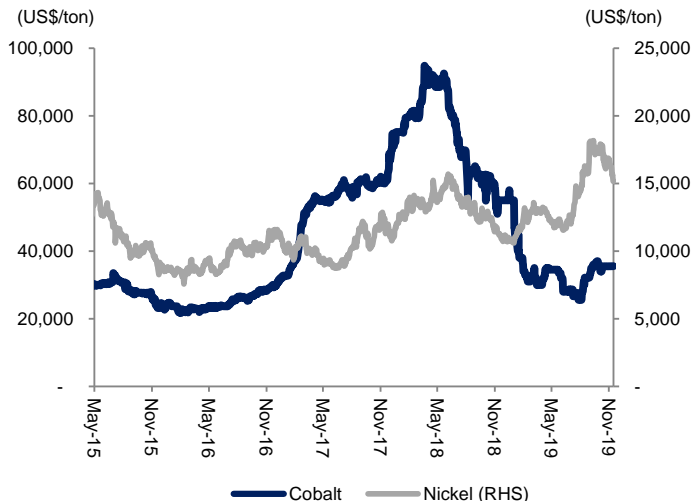
SOURCES: CGS-CIMB RESEARCH ESTIMATES, COMPANY REPORTS, ICCT

Figure 5: LGC's operating profit (OP) vs. OP margin forecasts


SOURCES: CGS-CIMB RESEARCH ESTIMATES, COMPANY REPORTS

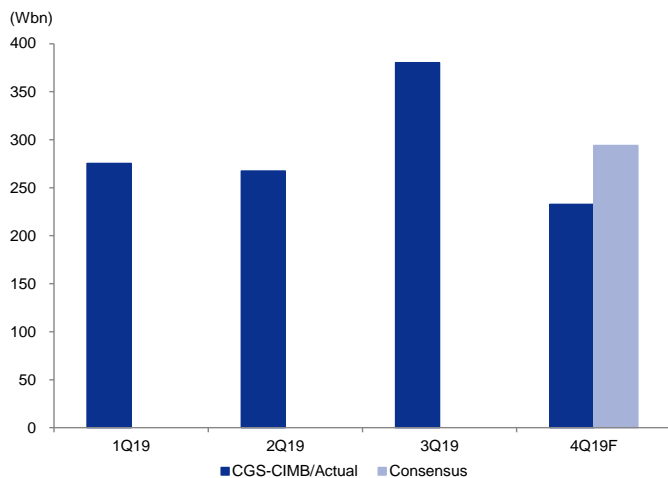
Figure 6: Reduction in the battery module price for LGC


SOURCES: CGS-CIMB RESEARCH ESTIMATES, COMPANY REPORTS

Figure 7: EV battery metal prices trend


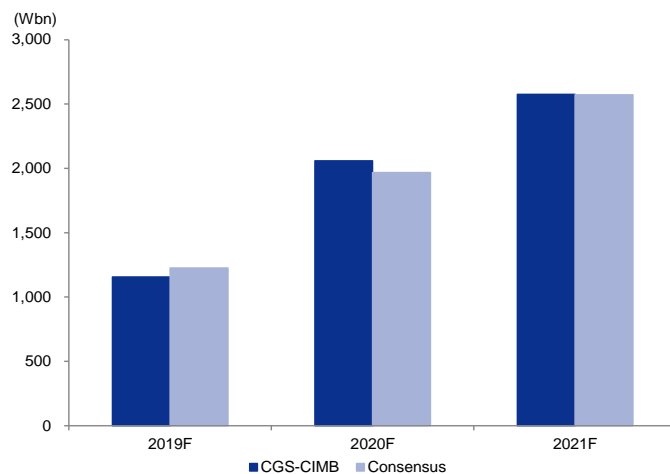
SOURCES: CGS-CIMB RESEARCH, BLOOMBERG

Figure 8: Quarterly OP forecast comparison: CGS-CIMB vs. Bloomberg consensus



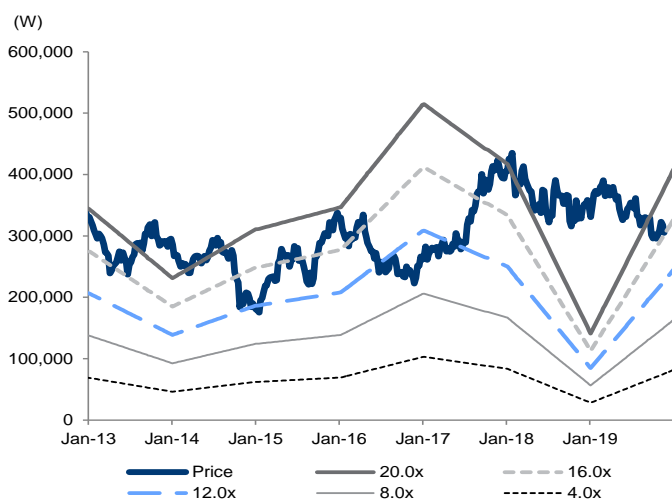
SOURCES: CGS-CIMB RESEARCH ESTIMATES, BLOOMBERG

Figure 9: Annual OP forecast comparison: CGS-CIMB vs. Bloomberg consensus



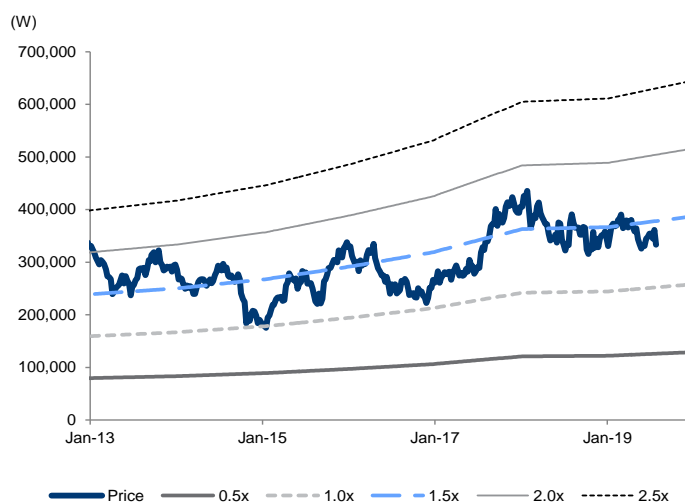
SOURCES: CGS-CIMB RESEARCH ESTIMATES, BLOOMBERG

Figure 10: LGC's 12-month forward P/E band



SOURCES: CGS-CIMB RESEARCH, COMPANY REPORTS, BLOOMBERG

Figure 11: LGC's 12-month forward P/BV band



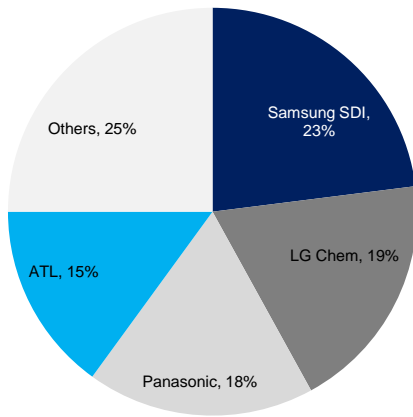
SOURCES: CGS-CIMB RESEARCH, COMPANY REPORTS, BLOOMBERG

Figure 12: Peer comparison

Company	Bloomberg Ticker	Bloomberg Recom.	TP (Lcy)	Price (Lcy)	Mkt cap (US\$m)	P/E (x)		P/BV (x)		ROE		EV/EBITDA (x)		Div yield	
						FY19F	FY20F	FY19F	FY20F	FY19F	FY20F	FY19F	FY20F	FY19F	FY20F
LG Chem	051910 KS	ADD	380,000	309,000	18,498	37.3	15.1	1.3	1.2	3.4%	7.4%	9.3	7.1	1.9%	1.6%
EV Battery															
Contemporary Amperex Technology	300750 CH	NR	na	87.4	27,452	43.4	36.4	5.1	4.6	11.9%	12.5%	24.2	19.4	0.2%	0.2%
Panasonic	6752 JP	NR	na	1,009	22,619	12.6	12.2	1.2	1.1	9.5%	9.2%	4.9	4.7	2.9%	2.9%
Samsung SDI	006400 KS	ADD	320,000	233,000	13,587	13.1	10.4	1.3	1.2	4.4%	7.5%	9.2	5.7	0.4%	0.4%
SK Innovation	096770 KS	ADD	215,000	147,500	11,566	13.7	7.9	0.7	0.7	5.4%	9.0%	6.2	5.1	4.1%	5.4%
BYD	002594 CH	REDUCE	32	43.2	15,593	45.3	37.5	2.3	2.4	5.2%	6.3%	10.4	9.3	0.4%	0.5%
Average						29.4	21.7	2.3	2.1	7.4%	9.1%	12.0	9.6	1.5%	1.6%
Petrochemical															
Nanya Plastic	1303 TT	NR	na	73	18,858	19.4	16.6	1.6	1.5	7.8%	9.4%	20.7	18.2	3.7%	4.5%
Formosa Chemicals	1326 TT	NR	na	88	16,858	14.3	14.8	1.4	1.4	8.9%	8.4%	12.6	12.9	5.1%	5.0%
Formosa Petrochemical	6505 TT	NR	na	97	30,305	21.2	17.2	2.8	2.6	12.6%	15.2%	14.5	11.1	3.6%	4.6%
PTT Global Chemical	PTTGC TB	REDUCE	48	55	8,146	17.2	13.1	0.8	0.8	4.8%	6.1%	6.7	6.1	2.5%	3.1%
Average						18.7	16.0	2.0	1.9	9.7%	11.2%	14.8	12.8	3.9%	4.5%
Total average						24.0	18.9	2.1	2.0	8.5%	10.1%	13.4	11.2	2.7%	3.1%

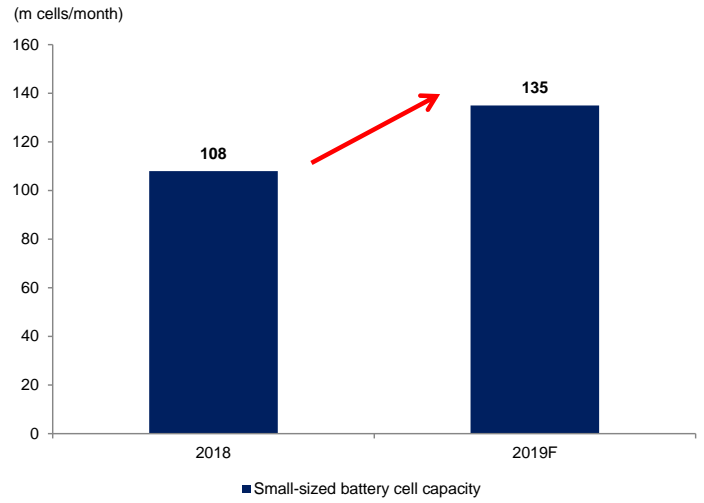
NOTE: DATA FOR NOT RATED COMPANIES IS BASED ON BLOOMBERG CONSENSUS ESTIMATES
 SOURCES: CGS-CIMB RESEARCH ESTIMATES, BLOOMBERG
 *DATA AS AT 28 NOV 2019

Figure 13: Global small-sized battery market share – 2019F



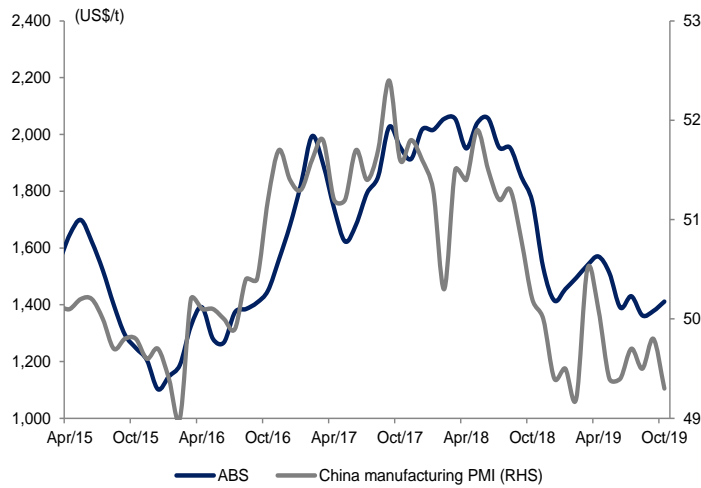
SOURCES: CGS-CIMB RESEARCH ESTIMATES, COMPANY REPORTS

Figure 14: LGC's small-sized battery cell capacity ramp-up in 2019F



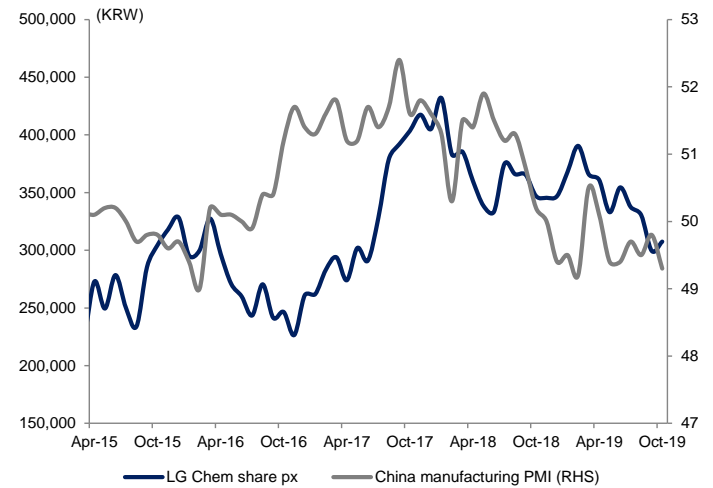
SOURCES: CGS-CIMB RESEARCH ESTIMATES, COMPANY REPORTS

Figure 15: ABS price vs. China manufacturing PMI



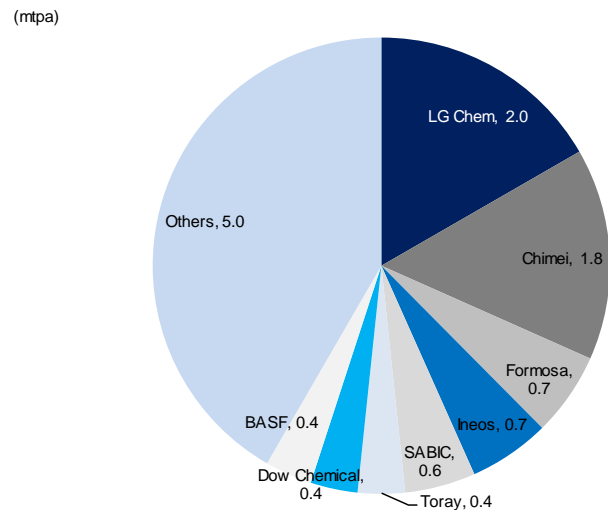
SOURCES: CGS-CIMB RESEARCH, BLOOMBERG, CISCHEM

Figure 16: LG Chem share price vs. China manufacturing PMI



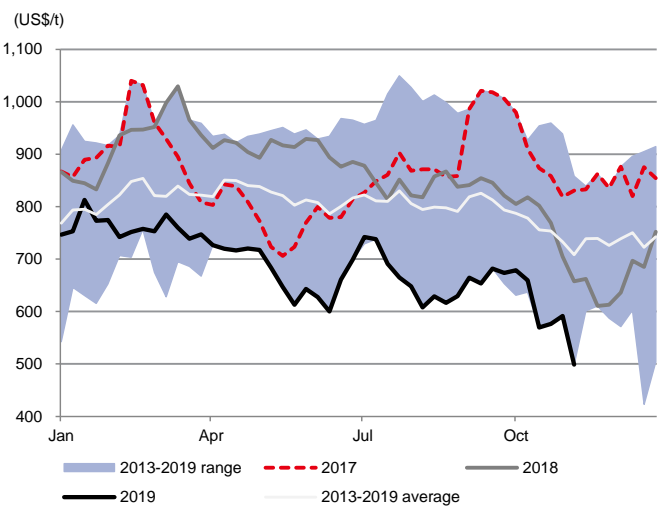
SOURCES: CGS-CIMB RESEARCH, BLOOMBERG

Figure 17: LGC is no.1 in global ABS market share - 2019F



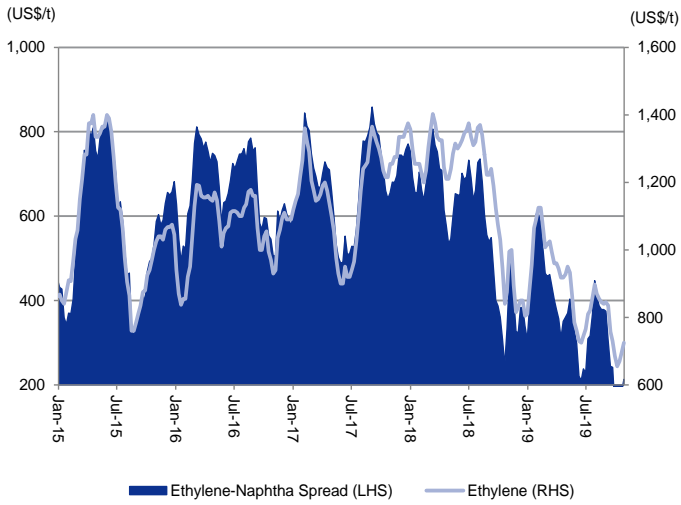
SOURCES: CGS-CIMB RESEARCH ESTIMATES, BLOOMBERG, CISCHEM ESTIMATES

Figure 18: ABS-naphtha spread



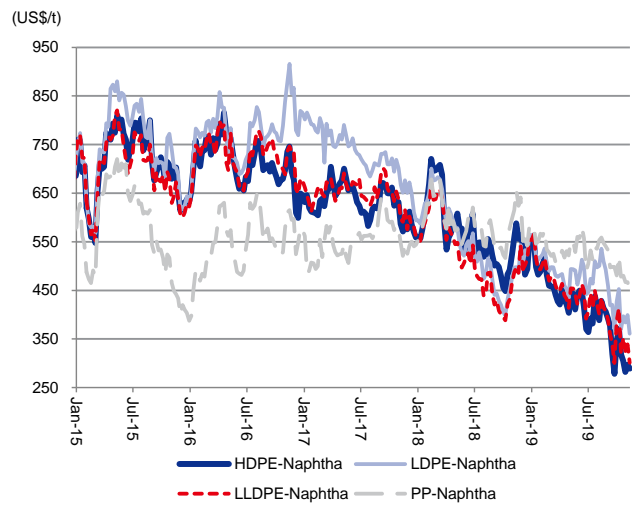
SOURCES: CGS-CIMB RESEARCH, CISCHEM

Figure 19: Ethylene-naphtha spreads



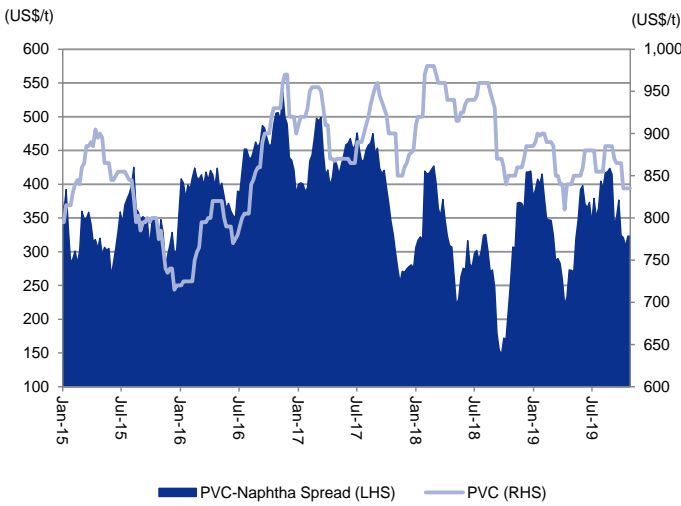
SOURCES: CGS-CIMB RESEARCH, BLOOMBERG, CISCHEM

Figure 20: Polyethylene/polypropylene (PE/PP) spreads



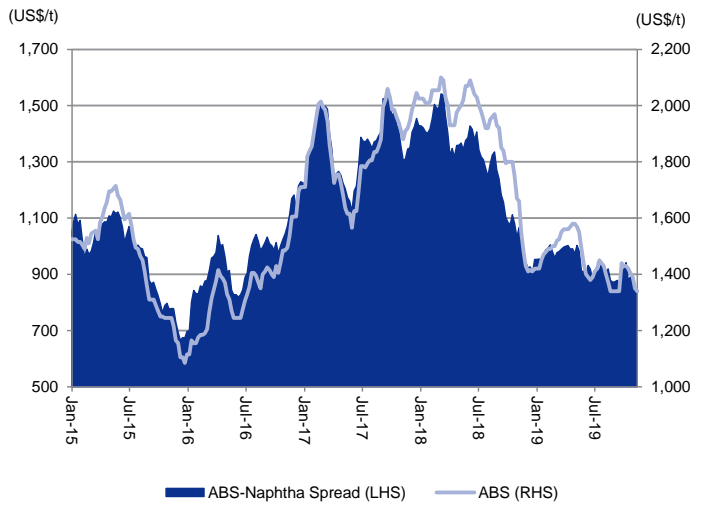
SOURCES: CGS-CIMB RESEARCH, BLOOMBERG, CISCHEM

Figure 21: PVC-naphtha spreads



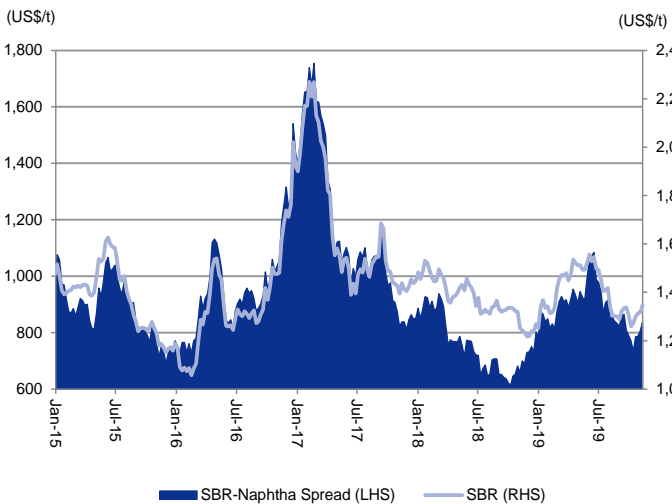
SOURCES: CGS-CIMB RESEARCH, BLOOMBERG, CISCHEM

Figure 22: ABS-naphtha spreads



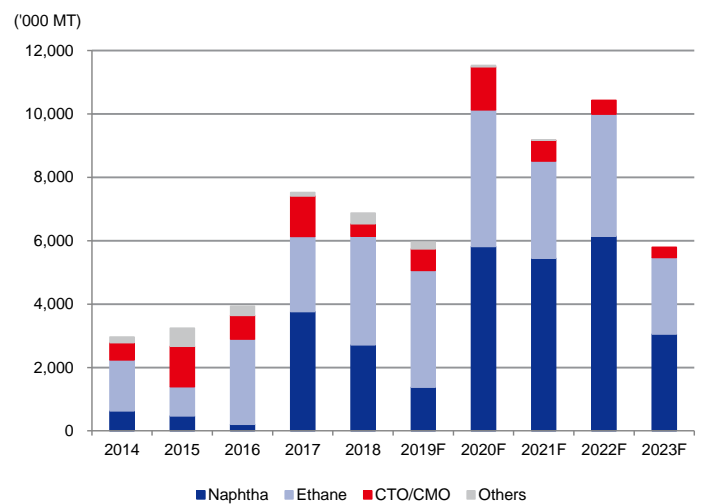
SOURCES: CGS-CIMB RESEARCH, BLOOMBERG, CISCHEM

Figure 23: SBR-naphtha spreads

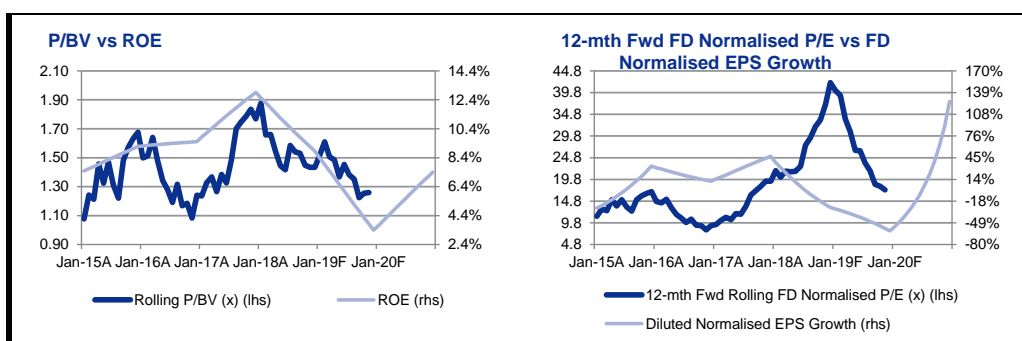


SOURCES: CGS-CIMB RESEARCH, BLOOMBERG, CISCHEM

Figure 24: New ethylene capacity breakdown by feedback



SOURCES: CGS-CIMB RESEARCH, IHS ESTIMATES

BY THE NUMBERS

Profit & Loss

(Wb)	Dec-17A	Dec-18A	Dec-19F	Dec-20F	Dec-21F
Total Net Revenues	25,698	28,183	28,685	35,097	40,304
Gross Profit	5,564	5,346	4,668	5,849	6,727
Operating EBITDA	4,334	3,731	3,053	4,197	4,511
Depreciation And Amortisation	(1,406)	(1,485)	(1,897)	(2,208)	(2,016)
Operating EBIT	2,928	2,246	1,156	1,988	2,495
Financial Income/(Expense)	(79)	(157)	(245)	(305)	(359)
Pretax Income/(Loss) from Assoc.	7	5	13	0	0
Non-Operating Income/(Expense)	(292)	(154)	44	120	92
Profit Before Tax (pre-EI)	2,564	1,940	968	1,804	2,228
Exceptional Items					
Pre-tax Profit	2,564	1,940	968	1,804	2,228
Taxation	(542)	(421)	(334)	(406)	(501)
Exceptional Income - post-tax	0	0	0	0	0
Profit After Tax	2,022	1,519	634	1,398	1,726
Minority Interests	(77)	(47)	(52)	(83)	(83)
Preferred Dividends					
FX Gain/(Loss) - post tax					
Other Adjustments - post-tax					
Preference Dividends (Australia)					
Net Profit	1,945	1,473	582	1,315	1,643
Normalised Net Profit	2,022	1,519	634	1,398	1,726
Fully Diluted Normalised Profit	1,945	1,473	582	1,315	1,643

Cash Flow

(Wb)	Dec-17A	Dec-18A	Dec-19F	Dec-20F	Dec-21F
EBITDA	4,334	3,731	3,053	4,197	4,511
Cash Flow from Inv. & Assoc.	7	5	13	0	0
Change In Working Capital	531	(638)	666	(1,808)	(1,033)
(Incr)/Decr in Total Provisions					
Other Non-Cash (Income)/Expense	1,867	2,212	2,979	3,450	3,150
Other Operating Cashflow	(1,771)	(2,138)	(2,924)	(2,393)	(4,072)
Net Interest (Paid)/Received	(70)	(88)	(189)	(305)	(359)
Tax Paid	(542)	(421)	(334)	(406)	(501)
Cashflow From Operations	4,357	2,663	3,265	2,735	1,696
Capex	(2,937)	(4,113)	(6,385)	(2,400)	(2,400)
Disposals Of FAs/subsidiaries					
Acq. Of Subsidiaries/investments					
Other Investing Cashflow	1,297	474	(373)	0	0
Cash Flow From Investing	(1,640)	(3,639)	(6,759)	(2,400)	(2,400)
Debt Raised/(repaid)					
Proceeds From Issue Of Shares					
Shares Repurchased					
Dividends Paid	(470)	(470)	(470)	(470)	(392)
Preferred Dividends					
Other Financing Cashflow	(266)	2,264	3,406	770	692
Cash Flow From Financing	(737)	1,794	2,936	300	300
Total Cash Generated	1,980	818	(557)	635	(404)
Free Cashflow To Equity	2,717	(976)	(3,493)	335	(704)
Free Cashflow To Firm	2,817	(840)	(3,192)	806	(221)

SOURCES: CGS-CIMB RESEARCH, COMPANY REPORTS

BY THE NUMBERS... cont'd
Balance Sheet

(Wb)	Dec-17A	Dec-18A	Dec-19F	Dec-20F	Dec-21F
Total Cash And Equivalents	2,779	2,557	2,521	1,539	1,493
Total Debtors	4,690	4,664	4,451	6,298	6,920
Inventories	3,352	4,289	4,154	5,623	6,324
Total Other Current Assets	384	578	860	860	899
Total Current Assets	11,206	12,089	11,985	14,321	15,637
Fixed Assets	11,211	13,839	18,327	18,519	18,903
Total Investments	264	266	307	333	360
Intangible Assets	1,823	2,006	2,216	2,398	2,596
Total Other Non-Current Assets	537	744	762	987	1,032
Total Non-current Assets	13,836	16,856	21,612	22,237	22,891
Short-term Debt	1,451	1,613	1,530	1,588	1,647
Current Portion of Long-Term Debt					
Total Creditors	4,213	5,133	5,632	7,141	7,441
Other Current Liabilities	981	527	627	627	656
Total Current Liabilities	6,645	7,274	7,789	9,357	9,744
Total Long-term Debt	1,596	3,775	7,604	7,895	8,187
Hybrid Debt - Debt Component					
Total Other Non-Current Liabilities	462	574	588	761	796
Total Non-current Liabilities	2,058	4,348	8,191	8,657	8,983
Total Provisions	0	0	0	0	0
Total Liabilities	8,703	11,622	15,981	18,013	18,727
Shareholders' Equity	16,169	17,083	17,342	18,186	19,360
Minority Interests	170	239	276	359	442
Total Equity	16,339	17,322	17,617	18,545	19,801

Key Ratios

	Dec-17A	Dec-18A	Dec-19F	Dec-20F	Dec-21F
Revenue Growth	24.4%	9.7%	1.8%	22.4%	14.8%
Operating EBITDA Growth	30.3%	(13.9%)	(18.2%)	37.5%	7.5%
Operating EBITDA Margin	16.9%	13.2%	10.6%	12.0%	11.2%
Net Cash Per Share (W)	(3,805)	(40,106)	(93,675)	(112,550)	(118,160)
BVPS (W)	229,041	241,996	245,658	257,626	274,248
Gross Interest Cover	N/A	N/A	N/A	N/A	N/A
Effective Tax Rate	21.1%	21.7%	34.5%	22.5%	22.5%
Net Dividend Payout Ratio	24.2%	31.9%	80.7%	35.7%	23.8%
Accounts Receivables Days	60.00	60.57	57.99	56.05	59.85
Inventory Days	57.26	61.07	64.16	61.17	64.94
Accounts Payables Days	64.36	74.69	81.80	79.92	79.25
ROIC (%)	19.8%	13.4%	5.6%	8.1%	9.3%
ROCE (%)	16.1%	10.7%	4.7%	7.3%	8.7%
Return On Average Assets	9.23%	6.21%	2.81%	4.85%	5.55%

Key Drivers

	Dec-17A	Dec-18A	Dec-19F	Dec-20F	Dec-21F
Oil Price (US\$/bbl)	53.1	66.0	66.0	66.0	66.0
Volume Growth (%)	N/A	N/A	N/A	N/A	N/A
Ratio Of Up To Downstream (x)	0.4	0.4	0.5	0.5	0.4
Operating Cash Cost (US\$/bbl)	N/A	N/A	N/A	N/A	N/A
Ratio Of High To Low Margin (x)	N/A	N/A	N/A	N/A	N/A

SOURCES: CGS-CIMB RESEARCH, COMPANY REPORTS

South Korea

ADD (no change)

Consensus ratings*: Buy 38 Hold 0 Sell 1

Current price:	W233,000
Target price:	W320,000
Previous target:	W345,000
Up/downside:	37.3%
CGS-CIMB / Consensus:	7.8%
Reuters:	006400.KS
Bloomberg:	006400 KS
Market cap:	US\$13,610m
	W16,022,135m
Average daily turnover:	US\$40.03m
	W47,397m
Current shares o/s:	68.77m
Free float:	79.4%

*Source: Bloomberg

Key changes in this note

- TP decreased by 7% as we transfer coverage.
- FY19F EPS decreased by 56%.
- FY20F EPS decreased by 37%.



Source: Bloomberg

Price performance	1M	3M	12M
Absolute (%)	1.5	-6.2	11.5
Relative (%)	0.3	-15.3	11

Major shareholders	% held
SEC	19.6
National Pension	9.2

Analyst(s)


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Samsung SDI

Profitability strategy

- SDI is now focusing on profitability for battery business while other Korean battery cell makers are expanding EV battery capacity first.
- We think SDI's OP could increase by over 100% to W1tr in 2020F given EV/ESS battery earnings recovery on the back of strong sales growth.
- We transfer SDI coverage to John Park with an Add rating and a lower SOP-based target price of W320,000.

Quiet and strong EV battery business

SDI has secured major OEMs (BMW and VW group) as strong clients for high nickel EV battery. While other EV battery makers have difficulties earning an initial yield from newly expanded EV battery operations, we believe that SDI is able to do so in a calm and orderly way while focusing on high quality orders and profitability. Given the EU's strong EV market and growing battery size for new EVs, we expect SDI to expand its EV battery capacity to 50Gwh by 2020 (vs. 15Gwh in 2018).

Expect EV battery OP to turn around from 3Q20F

Based on strong battery backlog and scheduled battery shipments, we project SDI's EV battery revenues to rise from W2.3tr in 2019F to W3.2tr in 2020F. We expect SDI's EV battery segment to turn around at operating profit level from 3Q20F thanks to 1) relatively high operational utilisation, and 2) a decrease in unit fixed costs on economies of scale. We forecast that its EV battery OP should recover to W6bn in 2020F and W111bn in 2021F with OPM improvement (2.3% in 2021F vs. -7% in 2019F).

Domestic ESS battery should recover in 2020F

SDI is likely to book W200bn provisions for its energy storage system (ESS) battery in 4Q19 with safety measures. As such, we cut FY19F/20F EPS by 56%/37% to reflect ESS battery losses and conservative sales growth. As SDI plans to install fire extinguisher system on its ESS battery, the negative impact from domestic ESS should be eased. We think its ESS revenue may rise by over 27% to W1.3tr in 2020F given overseas growth of 40% in 2020F with gradual recovery for domestic ESS market.

2020F OP could grow by over 100%

We believe its core operating earnings is likely to accelerate, driven by battery. The large sized (EV+ESS) sales should rise by 33% yoy in 2020F on strong EV battery shipment growth of 36% yoy. Its small sized battery sales growth should remain steady at 8% in 2020F given non-IT cylindrical battery and polymer battery sales for new IT products. We expect OP to rise by over 100% in FY20F with 7% battery OPM vs. 2% in 2019F.

Maintain Add with a lower SOP-based TP of W320,000

We maintain our Add rating with a lower SOP-based target price of W320,000. Potential re-rating catalysts are EV sales growth return in 2020F. Downside risks include slow new EV rollouts by global OEMs and tepid EV battery margin improvements.

Financial Summary

	Dec-17A	Dec-18A	Dec-19F	Dec-20F	Dec-21F
Revenue (Wb)	6,347	9,158	10,148	11,676	14,094
Net Profit (Wb)	657	701	533	973	1,200
Normalised EPS (W)	9,558	10,197	7,754	14,146	17,449
Normalised EPS Growth		6.7%	(24.0%)	82.4%	23.3%
FD Normalised P/E (x)	24.38	22.85	30.05	16.47	13.35
Price To Sales (x)	2.52	1.75	1.58	1.37	1.14
DPS (W)	1,000.0	1,000.0	1,000.0	1,000.0	1,000.0
Dividend Yield	0.429%	0.429%	0.429%	0.429%	0.429%
EV/EBITDA (x)	17.46	8.71	8.94	5.56	4.49
P/FCFE (x)	84.8	NA	NA	NA	107.4
Net Gearing	1.1%	13.3%	20.4%	20.5%	17.9%
P/BV (x)	1.42	1.34	1.28	1.19	1.10
ROE	5.98%	6.05%	4.36%	7.49%	8.57%
% Change In Normalised EPS Estimates			(56.3%)	(36.9%)	
Normalised EPS/consensus EPS (x)			0.97	0.94	0.95

SOURCES: CGS-CIMB RESEARCH, COMPANY REPORTS

Figure 1: Earnings forecasts

(Wbn)	1Q18	2Q18	3Q18	4Q18	1Q19	2Q19	3Q19	4Q19F	2015	2016	2017	2018	2019F	2020F	2021F
Revenues	1,909	2,248	2,523	2,479	2,304	2,405	2,568	2,871	4,955	5,201	6,347	9,158	10,148	11,676	14,094
LIB	1,417	1,727	1,922	1,879	1,730	1,821	1,952	2,276	3,310	3,424	4,298	6,946	7,779	9,236	11,549
Small-sized batteries	881	945	1,153	1,143	1,116	1,154	1,068	1,076	2,669	2,451	2,780	4,122	4,414	4,756	5,139
Large-sized batteries	536	782	769	736	614	667	884	1,200	641	973	1,518	2,824	3,365	4,480	6,409
EV battery	278	332	392	384	437	457	555	903	500	786	1,080	1,386	2,352	3,201	4,798
ESS	258	450	377	352	177	210	329	297	141	187	438	1,438	1,013	1,279	1,611
EM	490	502	581	572	558	577	610	595	1,642	1,771	2,017	2,145	2,340	2,440	2,545
Chemical	130	128	130	132	140	143	129	129	390	403	497	520	542	533	524
Display	360	374	451	465	432	419	470	502	1,252	1,368	1,520	1,650	1,822	1,827	1,832
OP	72	153	242	249	119	157	166	35	(268)	(926)	117	715	478	1,014	1,204
LIB	31	95	152	156	57	71	78	(60)	(467)	(457)	(87)	434	146	681	850
Small-sized batteries	90	95	169	187	154	165	123	129	(109)	(113)	119	541	571	585	622
Large-sized batteries	(59)	-	(17)	(31)	(97)	(94)	(45)	(189)	(358)	(344)	(206)	(107)	(425)	96	228
EV battery	(64)	(42)	(55)	(65)	(68)	(64)	(34)	1	(301)	(319)	(319)	(226)	(165)	6	111
ESS	5	42	38	34	(29)	(30)	(11)	(190)	(57)	(25)	113	119	(260)	90	117
EM	41	57	90	92	61	87	88	95	209	157	213	280	331	333	354
Chemical	18	19	22	22	20	20	18	18	110	58	69	81	76	75	73
Display	23	38	68	70	41	40	52	50	99	99	144	199	183	183	191
OP margin	4%	7%	10%	10%	5%	7%	6%	1%	-5%	-18%	2%	8%	5%	9%	9%
LIB	2%	5%	8%	8%	3%	4%	4%	-3%	-14%	-13%	-2%	6%	2%	7%	7%
Small-sized batteries	10%	10%	15%	16%	14%	14%	12%	12%	-4%	-5%	4%	13%	13%	12%	12%
Large-sized batteries	-11%	0%	-2%	-4%	-16%	-14%	-5%	-16%	-56%	-35%	-14%	-4%	-13%	2%	4%
EV battery	-23%	-13%	-14%	-17%	-16%	-14%	-6%	0%	-60%	-41%	-30%	-16%	-7%	0%	2%
ESS	2%	9%	10%	10%	-16%	-14%	-3%	-64%	-40%	-13%	26%	8%	-26%	7%	7%
EM	8%	11%	15%	16%	11%	15%	14%	16%	13%	9%	11%	13%	14%	14%	14%
Chemical	14%	15%	17%	17%	14%	14%	14%	14%	28%	14%	14%	16%	14%	14%	14%
Display	6%	10%	15%	15%	10%	10%	11%	10%	8%	7%	9%	12%	10%	10%	10%
EBITDA	201	269	372	454	308	365	394	266	366	179	578	1,297	1,333	2,090	2,429
NP	125	107	215	254	50	149	208	126	54	219	657	701	533	973	1,200
ROE (%)	4%	4%	7%	9%	2%	5%	7%	4%	0.5%	2.0%	6.0%	6.0%	4.4%	7.5%	8.6%

SOURCES: CGS-CIMB RESEARCH ESTIMATES, COMPANY REPORTS

Figure 2: SOP valuation

A. Core operating value (Wbn)	EBITDA	EV/EBITDA multiple (x)	EV Note
Small-sized batteries	800.2	7.0	5,601.7 Peers multiple (Simplo, NEC, Panasonic, Murata)
Large-sized batteries (EV+ESS)	741.4	13.5	10,009.5 20% discount to CATL EV/EBTIDA
EV battery	490.5		2021F EBITDA on normalisation
ESS	251.0		2021F EBITDA on normalisation
Electronic materials	548.6	6.0	3,291.7 Peers multiple (Nitto Denko, SK materials)
Sub Total	2,090.3		18,902.9
B. Investment asset value (Wbn)			6,142.1
Samsung Display			4,550.4 30% discount to BV
Other affiliates (listed + unlisted)			835.7 30% discount to BV
Treasury share			756.0
C. Net debt (Wbn)			2,822.1
D. Preferred shares (Capitalisation, Wbn)			129.1
NAV (A+B-C-D, Wbn)			22,093.8
# of shares outstanding (mn)			68.8
Fair value per share (W)			321,294
Target price (W)			320,000
Current price (W)			233,000
Upside (%)			37%

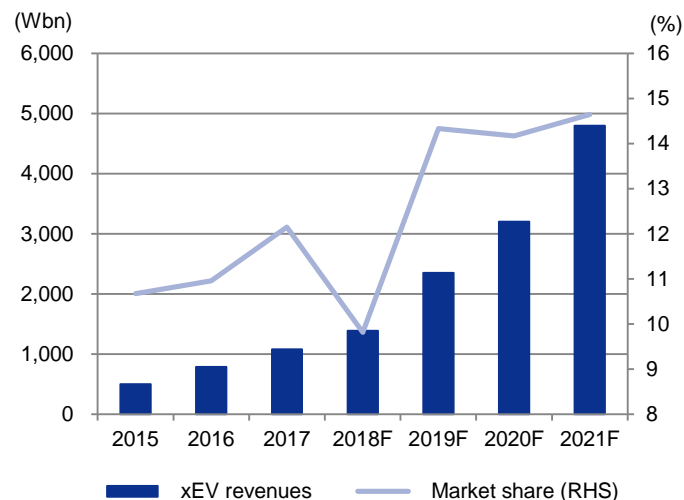
SOURCES: CGS-CIMB RESEARCH ESTIMATES, COMPANY REPORTS

Figure 3: Our assumptions for SDI's EV battery division

	2015	2016	2017	2018	2019F	2020F
Global xEV battery cell market size (US\$m)	4,132	6,180	7,893	12,913	14,071	19,359
YoY % change	17%	50%	28%	64%	9%	38%
Battery cell ASP (US\$/kwh)	410	253	170	156	148	142
YoY % change	-10%	-38%	-33%	-9%	-5%	-4%
Total xEV vehicles (m)	1.8	2.4	3.2	4.1	4.2	4.7
YoY % change	-4%	37%	29%	29%	4%	11%
xEV penetration rate (%)	0.4%	0.8%	1.3%	2.1%	2.1%	2.7%
Samsung SDI						
xEV revenues (Wbn)	500	786	1,080	1,386	2,352	3,201
YoY % change		57%	37%	28%	70%	36%
<i>Market share (%)</i>	11%	11%	12%	10%	14%	14%
OP (Wbn)	(301)	(319)	(319)	(226)	(165)	6
YoY % change		6%	0%	-29%	-27%	-104%
OP margin (%)	-60%	-41%	-30%	-16%	-7%	0%

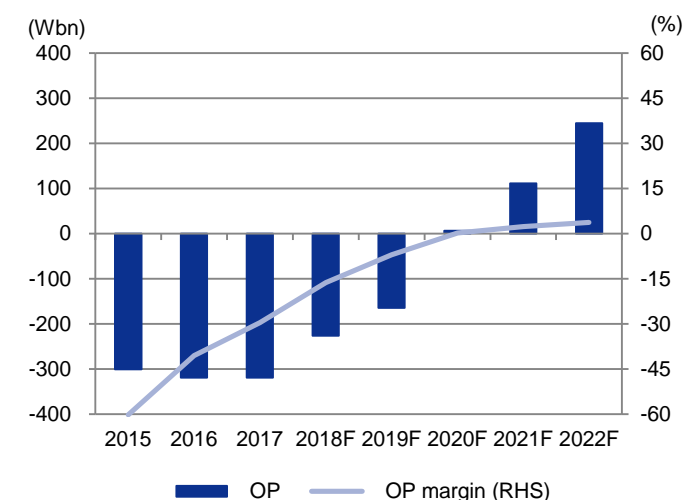
SOURCES: CGS-CIMB RESEARCH ESTIMATES, COMPANY REPORTS, MARKLINES, ICCT

Figure 4: SDI's EV battery revenues vs. total sales volume market share



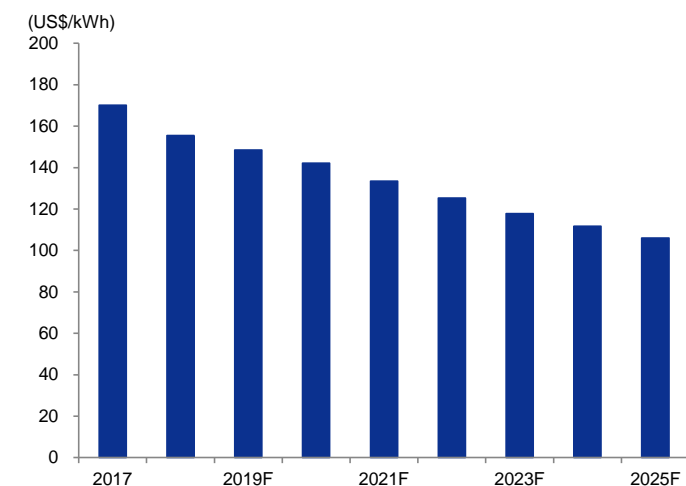
SOURCES: CGS-CIMB RESEARCH ESTIMATES, COMPANY REPORTS, ICCT

Figure 5: SDI's EV battery operating profit (OP) vs. OP margin forecasts



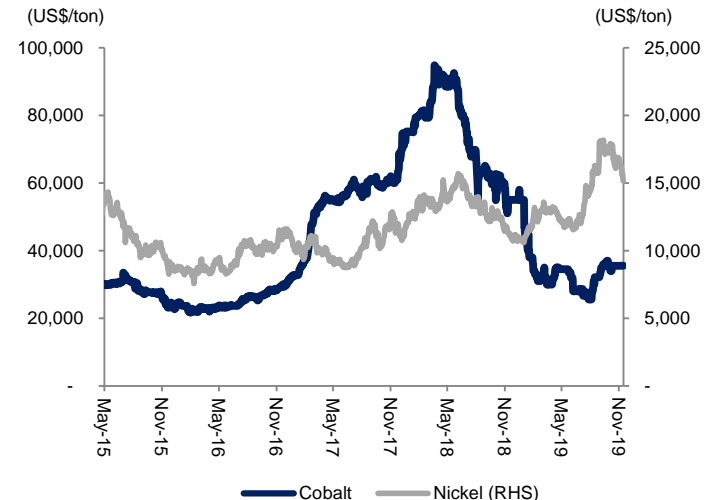
SOURCES: CGS-CIMB RESEARCH ESTIMATES, COMPANY REPORTS

Figure 6: Reduction in the battery module prices



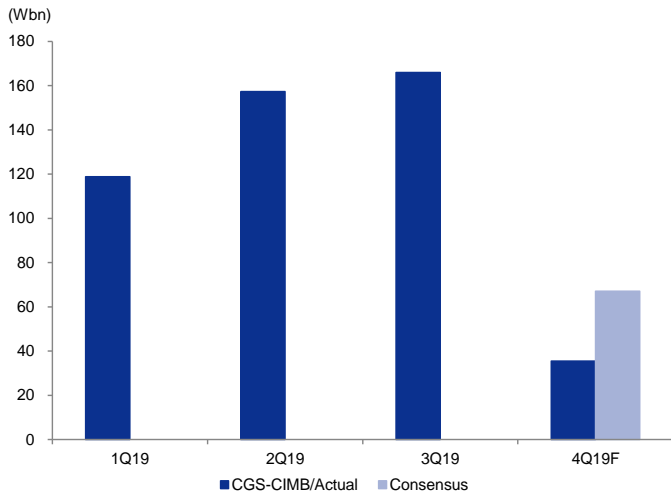
SOURCES: CGS-CIMB RESEARCH ESTIMATES, COMPANY REPORTS

Figure 7: EV battery metal prices trend



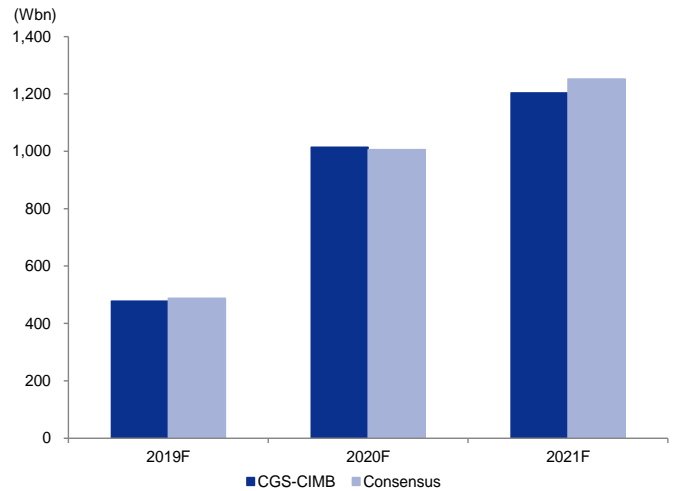
SOURCES: CGS-CIMB RESEARCH, BLOOMBERG

Figure 8: Quarterly OP forecast comparison: CGS-CIMB vs. Bloomberg consensus



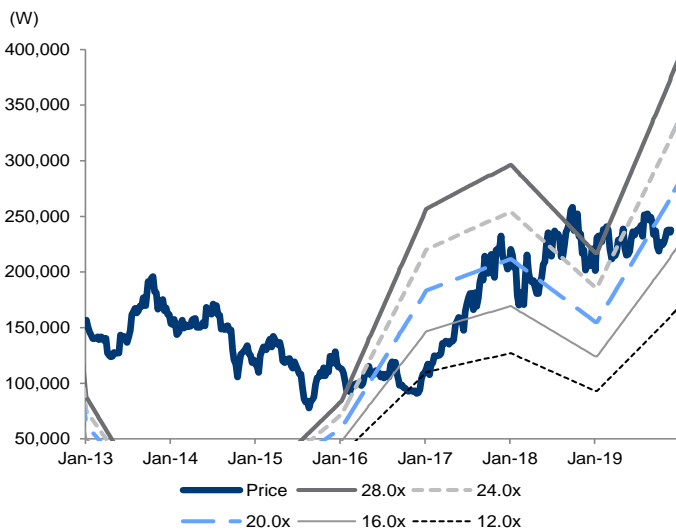
SOURCES: CGS-CIMB RESEARCH ESTIMATES, BLOOMBERG

Figure 9: Annual OP forecast comparison: CGS-CIMB vs. Bloomberg consensus



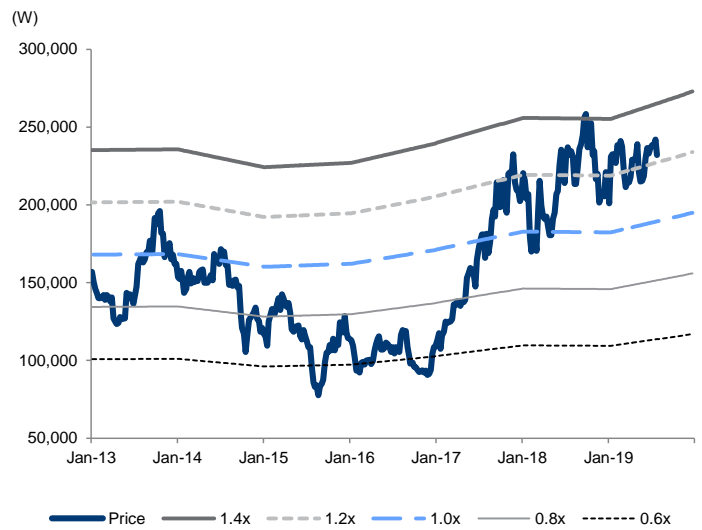
SOURCES: CGS-CIMB RESEARCH ESTIMATES, BLOOMBERG

Figure 10: SDI's 12-month forward P/E band



SOURCES: CGS-CIMB RESEARCH, COMPANY REPORTS, BLOOMBERG

Figure 11: SDI's 12-month forward P/BV band



SOURCES: CGS-CIMB RESEARCH, COMPANY REPORTS, BLOOMBERG

Figure 12: Peer comparison

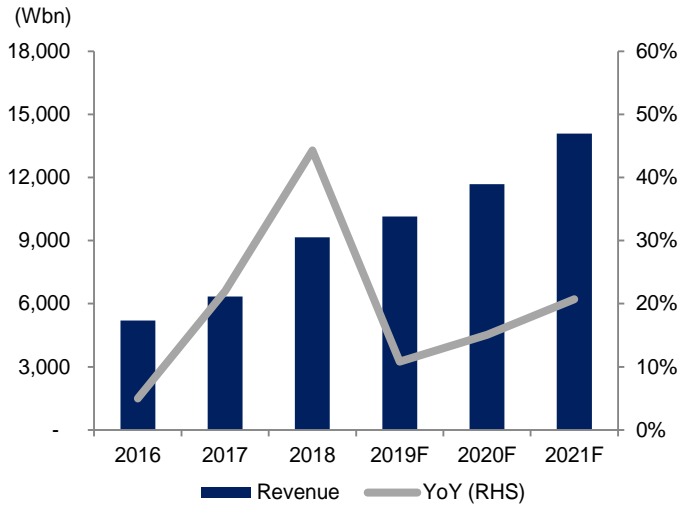
Company	Bloomberg		TP (Lcy)	Price (Lcy)	Mkt cap (US\$m)	P/E (x)		P/BV (x)		ROE		EV/EBITDA (x)		Div yield	
	Ticker	Recom.				FY19F	FY20F	FY19F	FY20F	FY19F	FY20F	FY19F	FY20F	FY19F	FY20F
Samsung SDI	006400 KS	ADD	320,000	233,000	13,587	13.1	10.4	1.3	1.2	4.4%	7.5%	9.2	5.7	0.4%	0.4%
EV Battery															
LG Chem	051910 KS	ADD	380,000	309,000	18,498	37.3	15.1	1.3	1.2	3.4%	7.4%	9.3	7.1	1.9%	1.6%
CATL	300750 CH	NR	na	87.4	27,452	43.4	36.4	5.1	4.6	11.9%	12.5%	24.2	19.4	0.2%	0.2%
Panasonic	6752 JP	NR	na	1,009	22,619	12.6	12.2	1.2	1.1	9.5%	9.2%	4.9	4.7	2.9%	2.9%
SK Innovation	096770 KS	ADD	215,000	147,500	11,566	13.7	7.9	0.7	0.7	5.4%	9.0%	6.2	5.1	4.1%	5.4%
BYD	002594 CH	REDUCE	32	43.2	15,593	45.3	37.5	2.3	2.4	5.2%	6.3%	10.4	9.3	0.4%	0.5%
Total Average						31.7	23.3	2.5	2.3	7.8%	9.3%	12.3	10.2	1.7%	1.8%

NOTE: DATA FOR NOT RATED COMPANIES IS BASED ON BLOOMBERG CONSENSUS ESTIMATES

SOURCES: CGS-CIMB RESEARCH ESTIMATES, BLOOMBERG

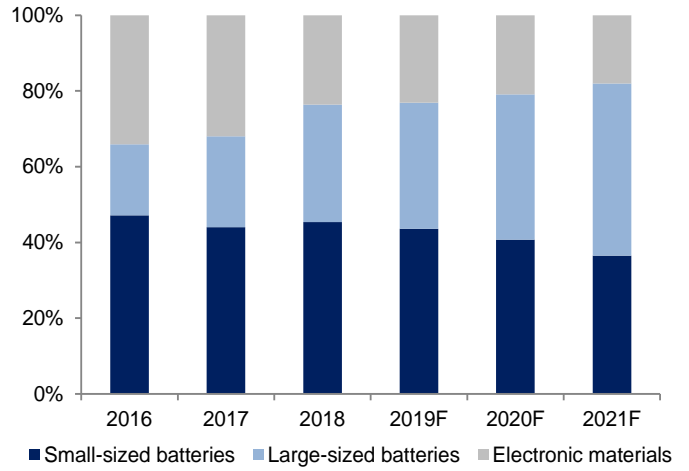
*DATA AS AT 28 NOV 2019

Figure 13: SDI – Sales and yoy growth trend



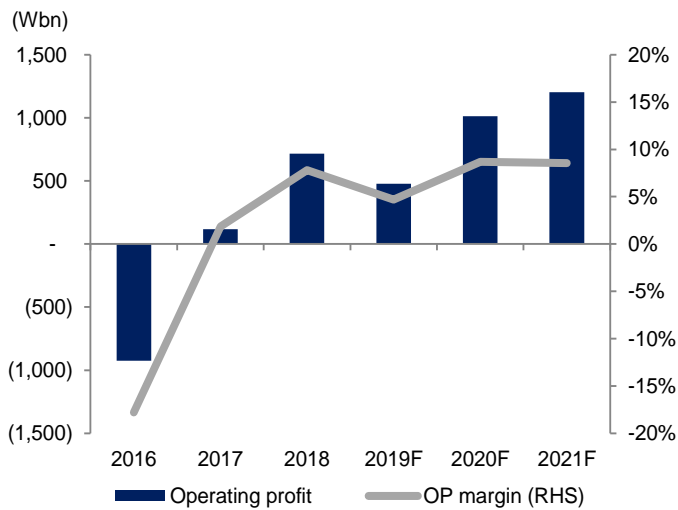
SOURCES: CGS-CIMB RESEARCH ESTIMATES, COMPANY REPORTS

Figure 14: SDI – sales contribution by business



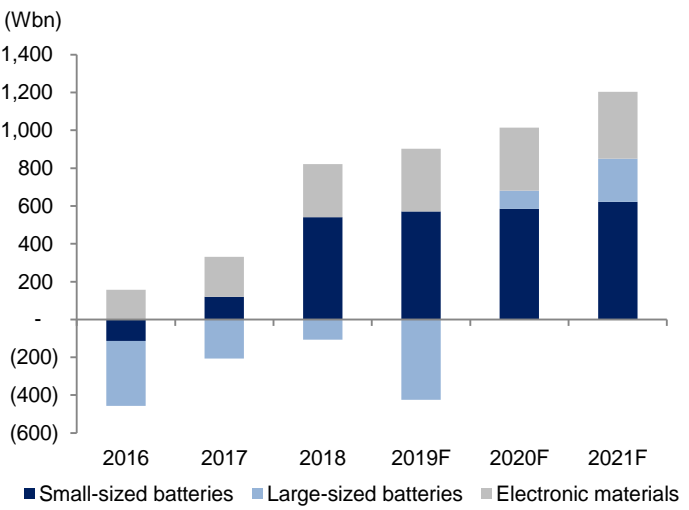
SOURCES: CGS-CIMB RESEARCH ESTIMATES, COMPANY REPORTS

Figure 15: SDI – OP and OPM trend



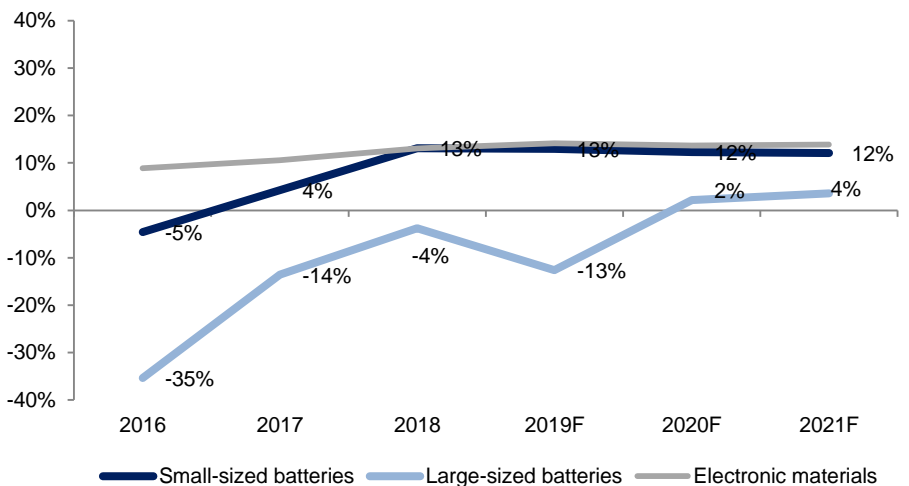
SOURCES: CGS-CIMB RESEARCH ESTIMATES, COMPANY REPORTS

Figure 16: SDI – OP contribution by business



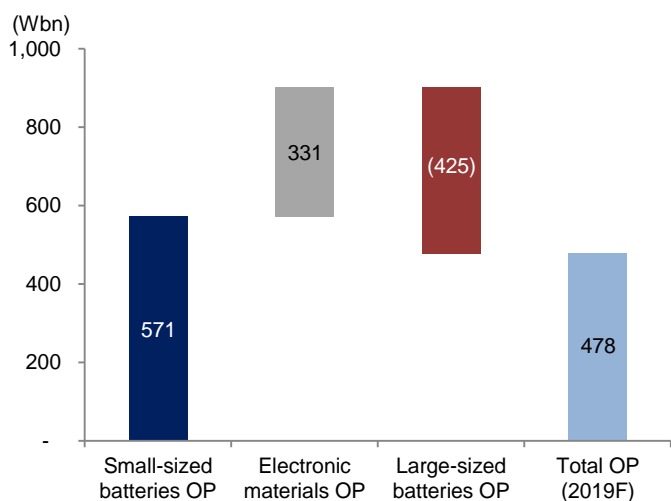
SOURCES: CGS-CIMB RESEARCH ESTIMATES, COMPANY REPORTS

Figure 17: SDI – OP Margin trend by business



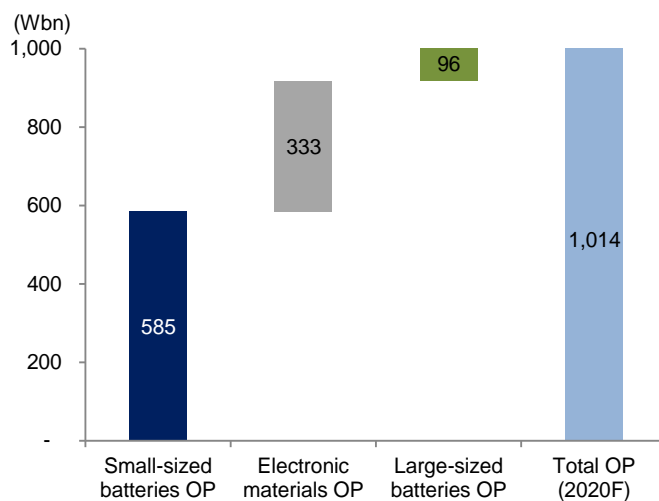
SOURCES: CGS-CIMB RESEARCH ESTIMATES, COMPANY REPORTS

Figure 18: SDI – OP by product segment for 2019F



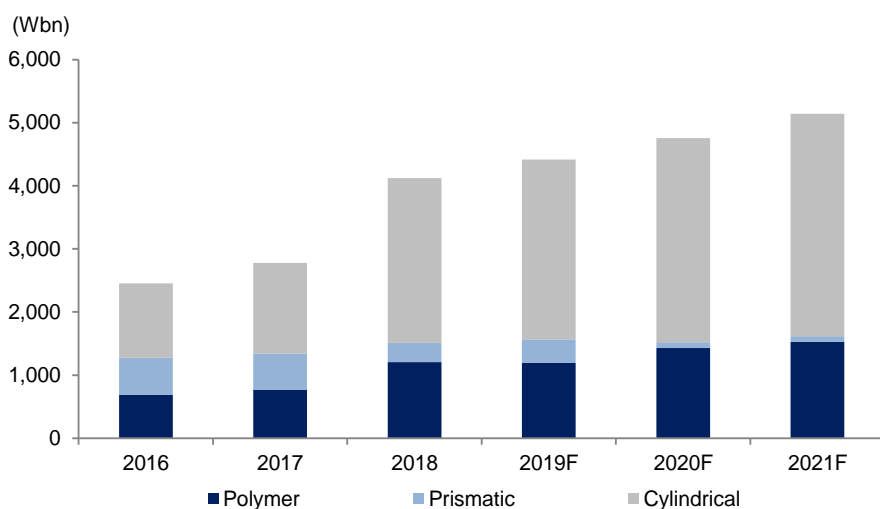
SOURCES: CGS-CIMB RESEARCH ESTIMATES, COMPANY REPORTS

Figure 19: SDI – OP by product segment for 2020F



SOURCES: CGS-CIMB RESEARCH ESTIMATES, COMPANY REPORTS

Figure 20: SDI – Small sized battery sales by battery type

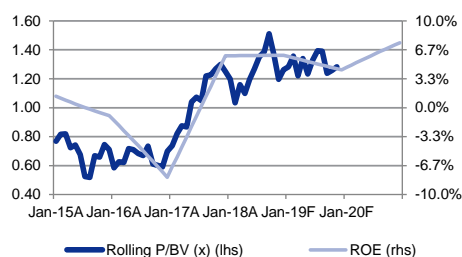
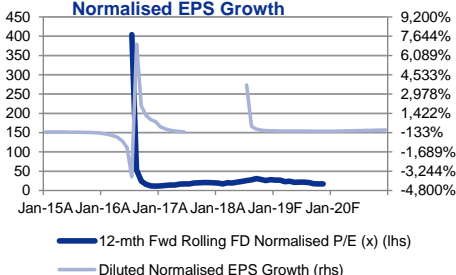


SOURCES: CGS-CIMB RESEARCH ESTIMATES

Figure 21: SDI – Earnings revision summary

(Wbn)	2018	2019F			2020F		
		Old	New	% chg	Old	New	% chg
Revenues	9,158	12,137	10,148	-16%	14,744	11,676	-21%
LIB	6,946	9,803	7,779	-21%	12,415	9,236	-26%
Small-sized batteries	4,122	5,541	4,414	-20%	6,622	4,756	-28%
Large-sized batteries	2,824	4,262	3,365	-21%	5,793	4,480	-23%
EV battery	1,386	2,149	2,352	9%	3,196	3,201	0%
ESS	1,438	2,113	1,013	-52%	2,597	1,279	-51%
EM	2,145	2,327	2,340	1%	2,321	2,440	5%
OP	715	1,352	478	-65%	1,777	1,014	-43%
LIB	434	967	146	-85%	1,379	681	-51%
Small-sized batteries	541	774	571	-26%	957	585	-39%
Large-sized batteries	(107)	193	(425)	-320%	423	96	-77%
EV battery	(226)	(62)	(165)	nmf	98	6	-94%
ESS	119	255	(260)	-202%	325	90	-72%
EM	280	385	331	-14%	398	333	-16%
NP	701	1,221	533	-56%	1,542	973	-37%

SOURCES: CGS-CIMB RESEARCH ESTIMATES, COMPANY REPORTS

BY THE NUMBERS
P/BV vs ROE

12-mth Fwd FD Normalised P/E vs FD Normalised EPS Growth

Profit & Loss

(Wb)	Dec-17A	Dec-18A	Dec-19F	Dec-20F	Dec-21F
Total Net Revenues	6,347	9,158	10,148	11,676	14,094
Gross Profit	1,166	2,040	2,121	2,999	3,600
Operating EBITDA	578	1,297	1,333	2,090	2,429
Depreciation And Amortisation	(461)	(582)	(856)	(1,076)	(1,225)
Operating EBIT	117	715	478	1,014	1,204
Financial Income/(Expense)	(1)	43	(45)	(27)	(26)
Pretax Income/(Loss) from Assoc.	695	342	280	241	367
Non-Operating Income/(Expense)	13	(64)	59	129	129
Profit Before Tax (pre-EI)	824	1,036	771	1,356	1,673
Exceptional Items					
Pre-tax Profit	824	1,036	771	1,356	1,673
Taxation	(181)	(291)	(203)	(332)	(410)
Exceptional Income - post-tax	0	0	0	0	0
Profit After Tax	643	745	568	1,024	1,263
Minority Interests	14	(44)	(35)	(51)	(63)
Preferred Dividends					
FX Gain/(Loss) - post tax					
Other Adjustments - post-tax					
Preference Dividends (Australia)					
Net Profit	657	701	533	973	1,200
Normalised Net Profit	643	745	568	1,024	1,263
Fully Diluted Normalised Profit	657	701	533	973	1,200

Cash Flow

(Wb)	Dec-17A	Dec-18A	Dec-19F	Dec-20F	Dec-21F
EBITDA	577.6	1,297.0	1,333.1	2,090.3	2,429.1
Cash Flow from Inv. & Assoc.	695.4	342.2	280.2	240.9	366.8
Change In Working Capital	(491.6)	(902.4)	(227.2)	(453.1)	(564.4)
(Incr)/Decr in Total Provisions					
Other Non-Cash (Income)/Expense	28.6	629.7	947.1	1,196.7	1,364.5
Other Operating Cashflow	(529.5)	(737.9)	(1,154.6)	(981.5)	(1,056.9)
Net Interest (Paid)/Received	0.0	0.0	0.0	0.0	0.0
Tax Paid	(180.9)	(291.2)	(203.1)	(332.3)	(409.9)
Cashflow From Operations	99.6	337.4	975.5	1,761.0	2,129.2
Capex	(887.3)	(2,260.0)	(2,003.2)	(1,980.0)	(1,980.0)
Disposals Of FAs/subsidiaries					
Acq. Of Subsidiaries/investments					
Other Investing Cashflow	976.6	555.3	130.5	0.0	0.0
Cash Flow From Investing	89.3	(1,704.7)	(1,872.8)	(1,980.0)	(1,980.0)
Debt Raised/(repaid)					
Proceeds From Issue Of Shares					
Shares Repurchased					
Dividends Paid	(70.5)	(70.5)	(70.5)	(70.5)	(70.5)
Preferred Dividends					
Other Financing Cashflow	423.9	1,826.6	282.5	431.6	467.7
Cash Flow From Financing	353.4	1,756.1	212.0	361.1	397.2
Total Cash Generated	542.3	388.8	(685.3)	142.1	546.5
Free Cashflow To Equity	188.9	(1,367.4)	(897.3)	(219.0)	149.2
Free Cashflow To Firm	188.9	(1,367.4)	(897.3)	(219.0)	149.2

SOURCES: CGS-CIMB RESEARCH, COMPANY REPORTS

BY THE NUMBERS... cont'd
Balance Sheet

(Wb)	Dec-17A	Dec-18A	Dec-19F	Dec-20F	Dec-21F
Total Cash And Equivalents	1,324	1,668	1,008	1,150	1,697
Total Debtors	1,129	1,632	1,890	2,327	2,910
Inventories	967	1,746	2,189	2,430	3,053
Total Other Current Assets	165	474	549	676	845
Total Current Assets	3,585	5,519	5,636	6,583	8,505
Fixed Assets	2,930	4,608	5,765	6,668	7,423
Total Investments	6,219	6,555	6,947	7,520	8,140
Intangible Assets	897	866	884	957	1,036
Total Other Non-Current Assets	2,110	1,801	1,796	1,386	971
Total Non-current Assets	12,157	13,830	15,392	16,531	17,569
Short-term Debt	1,079	1,739	1,564	1,721	1,893
Current Portion of Long-Term Debt					
Total Creditors	1,326	1,982	2,485	2,759	3,466
Other Current Liabilities	259	291	338	416	520
Total Current Liabilities	2,664	4,013	4,387	4,896	5,879
Total Long-term Debt	366	1,546	2,047	2,252	2,477
Hybrid Debt - Debt Component					
Total Other Non-Current Liabilities	1,260	1,566	1,814	2,233	2,793
Total Non-current Liabilities	1,626	3,112	3,861	4,484	5,269
Total Provisions	0	0	0	0	0
Total Liabilities	4,290	7,125	8,248	9,380	11,148
Shareholders' Equity	11,257	11,934	12,540	13,442	14,571
Minority Interests	162	206	241	292	355
Total Equity	11,419	12,140	12,780	13,734	14,926

Key Ratios

	Dec-17A	Dec-18A	Dec-19F	Dec-20F	Dec-21F
Revenue Growth	22.0%	44.3%	10.8%	15.1%	20.7%
Operating EBITDA Growth	N/A	125%	3%	57%	16%
Operating EBITDA Margin	9.1%	14.2%	13.1%	17.9%	17.2%
Net Cash Per Share (W)	(1,755)	(23,519)	(37,854)	(41,040)	(38,869)
BVPS (W)	163,707	173,548	182,356	195,478	211,902
Gross Interest Cover	N/A	N/A	N/A	N/A	N/A
Effective Tax Rate	21.9%	28.1%	26.3%	24.5%	24.5%
Net Dividend Payout Ratio	10.7%	10.0%	13.2%	7.2%	5.9%
Accounts Receivables Days	59.20	55.01	63.34	66.09	67.81
Inventory Days	59.73	69.54	89.46	97.41	95.35
Accounts Payables Days	98.7	84.8	101.6	110.6	108.3
ROIC (%)	2.1%	10.8%	5.4%	9.9%	10.7%
ROCE (%)	0.95%	5.05%	3.00%	5.95%	6.51%
Return On Average Assets	4.21%	4.00%	3.04%	4.76%	5.24%

SOURCES: CGS-CIMB RESEARCH, COMPANY REPORTS

South Korea

ADD

Consensus ratings*: Buy 17 Hold 0 Sell 0

Current price:	W46,050
Target price:	W62,000
Previous target:	N/A
Up/downside:	34.6%
CGS-CIMB / Consensus:	6.6%
Reuters:	011790.KS
Bloomberg:	011790 KS
Market cap:	US\$1,468m
	W1,728,466m
Average daily turnover:	US\$7.15m
	W8,397m
Current shares o/s:	37.54m
Free float:	39.7%

*Source: Bloomberg

Key changes in this note

N/A



Source: Bloomberg

Price performance	1M	3M	12M
Absolute (%)	2.8	-1.8	32.9
Relative (%)	1.6	-10.9	32.4

Major shareholders	% held
SK Holdings	41.0
National Pension Service	13.2
Dimensional Fund Advisors LP	2.7

Analyst(s)

John PK PARK

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E johnpk.park@cgs-cimb.com

SKC
Valuation gap narrowing

- SKC is transforming into a battery material player, as suggested by the acquisition of elecfoil supplier KCFT; this could drive a valuation re-rating.
- Given the strong elecfoil demand from new EVs and tight supply, we value KCFT at W1.9tr-2tr in light of its planned capacity expansion.
- Initiate coverage with an Add rating and SOP-based TP of W62,000. We expect SKC to deliver an OP CAGR of 47% over 2019-21F.

Valuation re-rating due to merger effect

SKC expects to complete the acquisition of KCF Technologies (KCFT), Korea's leading elecfoil manufacturer, by end-2019F. In Aug 2019, SKC announced the restructuring of its chemical business, with the disposal of a 49% stake in its chemicals operation. In light of these events, we believe SKC may shift its core business to battery material manufacturing which is likely to impact earnings from 2020F. We expect the stock will re-rate as investors begin to value it as a growth play rather than a chemical sector play.

KCFT: a high-tech elecfoil producer

KCFT manufactures high tech elecfoil and flexible copper clad laminates. KCFT recently developed the world's first ultra-thin foil (less than 4 micrometer copper foil) in Nov 2019. Its advanced technology and a strong market share, has won KCFT major clients such as LG Chem. Given larger battery cell sizes and electric vehicle (EV) penetration, we expect tight global elecfoil supply of only 187k tpa in 2022F (vs. 200k tpa demand).

Ready to expand production capacity

SKC expect KCFT to expand its capacity from 20k tpa in 1H19 to 30k tpa by end-2019F. According to management, KCFT's domestic capacity should rise to 60k tpa by 2022F. SKC could expand its capacity in the US and Europe (Poland), where SK Innovation and LG Chem's battery plants are located, respectively. We expect SKC to further expand its elecfoil capacity, with strong contracts from major battery cell makers.

OP CAGR of 47% over 2019-21F with new growth engines

We expect SKC to reflect earnings from KCFT starting from 1Q20F; management expects the acquisition to be completed by end-2019F. We forecast W100bn OP from KCFT in 2020F, and expect SKC's OP to grow 76% yoy to W296bn in 2020F. We believe KCFT's revenue should continue to rise, as its core operating earnings are likely to accelerate, driven by higher contribution from its battery elecfoil business. As such, we see a stellar EPS CAGR of 53% for SKC over 2019-21F.

Initiate coverage with an Add and target price of W62,000

SKC is now trading at 12x 2020F P/E, while Korean elecfoil makers are trading at 24-25x 2020F P/E. We expect elecfoil OP contribution of above 50% from 2022F; thus, we expect multiple expansion for SKC, and hence, the valuation gap between SKC and Korean elecfoil players to narrow. Key downside risk: delays in capacity expansion.

Financial Summary

	Dec-17A	Dec-18A	Dec-19F	Dec-20F	Dec-21F
Revenue (Wb)	2,654	2,768	2,571	3,220	3,575
Operating EBITDA (Wb)	298.2	328.0	309.1	442.0	507.0
Net Profit (Wb)	110.0	120.6	60.4	143.3	176.0
Normalised EPS (W)	2,931	3,212	1,609	3,817	4,690
Normalised EPS Growth	46%	10%	(50%)	137%	23%
FD Normalised P/E (x)	15.71	14.33	28.61	12.06	9.82
DPS (W)	900.0	1,000.0	1,000.0	1,000.0	1,000.0
Dividend Yield	1.95%	2.17%	2.17%	2.17%	2.17%
EV/EBITDA (x)	8.64	7.91	9.00	8.12	7.26
P/FCFE (x)	NA	267.2	NA	NA	NA
Net Gearing	78%	76%	84%	125%	122%
P/BV (x)	1.19	1.13	1.09	1.02	0.94
ROE	7.71%	8.09%	3.87%	8.73%	9.98%
% Change In Normalised EPS Estimates					
Normalised EPS/consensus EPS (x)			0.74	1.08	1.08

SOURCES: CGS-CIMB RESEARCH, COMPANY REPORTS

VALUATION AND RECOMMENDATION

Initiate coverage with an Add and TP of W62k

We value SKC based on a sum-of-parts (SOP) valuation to reflect different target multiples for its diversified business portfolio. Our valuation combines 1) the value of SKC's operating businesses by divisions, 2) its investment asset value (listed securities and unlisted securities), and subtracts its 3) net debts.

We value SKC's operating business at W4tr, by applying its peers' average FY20F EV/EBITDA multiple to our FY20F EBITDA estimates for each business (chemical, industrial materials, semiconductor materials, KCFT (Unlisted) and others). For its battery material business, we apply Korean electrofoil material players' FY20F EV/EBITDA multiple to KCFT's FY20F EBITDA estimate to reflect market value.

Figure 1: SOP valuation based on CGS-CIMB estimates

A. Core operating value (Wbn)	EBITDA	EV/EBITDA multiple (x)	EV Note
Chemical	124.7	8.0	997.8 Average EV/EBITDA multiple of DowDupont, Lyondell Basell
Industrial materials	104.4	6.0	626.4 Average EV/EBITDA multiple of Nitto Denko and Sumitomo
Semiconductor materials	30.2	6.5	196.4 Average EV/EBITDA multiple of Air Products and Air Liquide
BHC	18.3	7.0	128.4 30% discount to average EV/EBITDA multiple of Cosmax, Korea Kolmar
Others	26.0	6.5	169.0
KCFT	138.3	14.0	1,936.6 Average EV/EBITDA multiple of electrofoil material plays
Sub Total	442.0		4,054.4
B. Investment asset value (Wbn)			420.0 30% discount to book value
C. Net debt (Wbn)			2,290.0 Incl. W700bn debt on KCF Technology acquisition
D. Preferred shares (Capitalisation, Wbn)			0.0
NAV (A+B-C-D, Wbn)			2,184.4
# of shares outstanding (mn)			35.4
Fair value per share (W)			61,669
Target price (W)			62,000
Current price (W)			46,050
Upside (%)			35%

SOURCES: CGS-CIMB RESEARCH ESTIMATES, COMPANY REPORTS, BLOOMBERG
DATA AS AT 28 NOV 2019

In order to cross-check our target price, we utilised a P/E valuation methodology, which leads to an implied FY20F P/E multiple of 16x for SKC. Based on major peers' current FY20F P/E multiples of 24x and an upward trajectory in SKC's EPS growth (based on our estimates), we think our implied FY20F P/E multiple of 16x is justified as we expect KCFT to account for 34% of SKC's operating profit (OP) in 2020F. The stock currently trades at just 12x FY20F P/E.

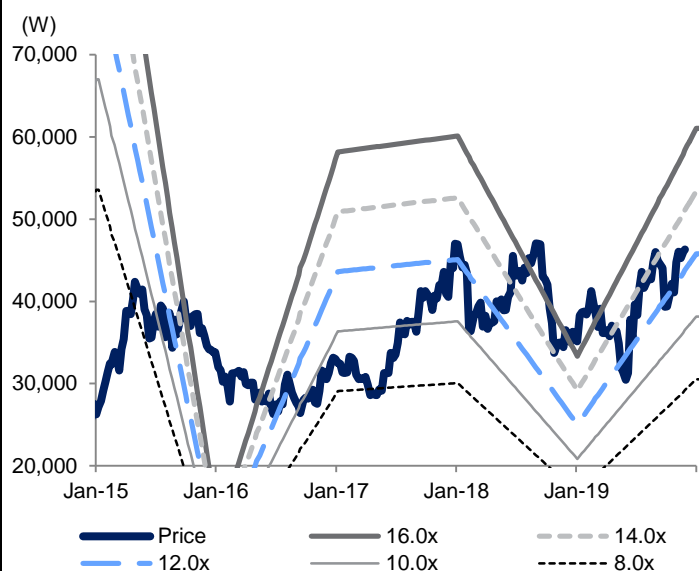
Figure 2: SKC – P/E valuation summary

Recommendation	ADD
Current Price (W/shr)	46,050
SOP-based target Price (W/shr)	62,000
% upside	35%
	FY20F
EPS (W)	3,817
Implied P/E (x)	16
Selected peers	Furukawa Electric, Nanya Plastic, Tongling Noferrous Metals, Shandong Nanshan Aluminium
Selected peers' average P/E (x)	25

SOURCES: CGS-CIMB RESEARCH ESTIMATES, COMPANY REPORTS, BLOOMBERG
DATA AS AT 28 NOV 2019

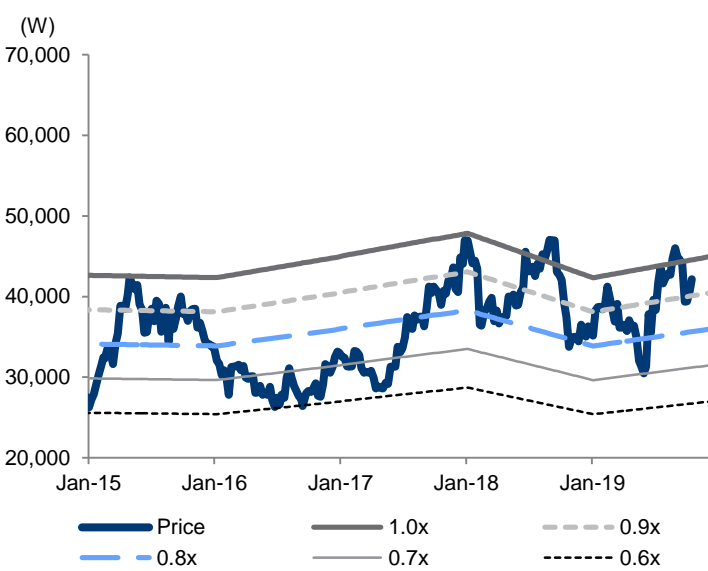
We initiate coverage on SKC with an Add rating and target price of W62,000. SKC's share price has underperformed the KOSPI by 20% over the past six months due to 1) negative sentiment on the chemical industry, and 2) its tepid industrial materials business. However, given the growth potential in the elecfoil business, and stronger earnings visibility over the next three years, we believe SKC's current valuation offers a buying opportunity for long term investment. We expect its OP contribution from elecfoil to increase from 34% in 2020F to over 50% from 2022F.

Figure 3: SKC's 12-month forward P/E band



SOURCES: CGS-CIMB RESEARCH, WISEFEN

Figure 4: SKC's 12-month forward P/BV band



SOURCES: CGS-CIMB RESEARCH, WISEFEN

Downside risks to our rating

Our key downside risks include 1) delays in elecfoil capacity expansion, 2) weaker-than-expected earnings for its chemical business, and 3) slower-than-expected EV penetration in 2020-2022F.

We assume KCFT's elecfoil production capacity from 30k tpa in 2020F to 45k tpa by 2021F. Delays in elecfoil capacity expansion and slow capacity ramp-up pose a key downside risk to our Add rating. The company is scheduled to sell a 49% stake in its chemical assets to Kuwait PIC (Unlisted) for W536bn in early-2020F. If the cash injection is delayed, we believe KCFT's capacity expansion could delay as well.

We expect SKC's chemical OP margin to be solid at 14% in 2020F (vs. 14% in 2019F) given robust specialty product prices. The softer chemical business amid slow global economy could hurt its chemical margins.

Figure 5: SKC SWOT analysis

Strength	Weakness
<ul style="list-style-type: none"> - Stable profitability in its chemicals business. It possesses considerable supplier bargaining power. - Generates stable cash flows from its well-diversified subsidiaries 	<ul style="list-style-type: none"> - High debt ratio burden, which could rise further once it obtains loans to fund the KCFT acquisition, and for its aggressive entry into the battery materials market.
Opportunity	Threat
<ul style="list-style-type: none"> - We expect tight elecfoil supply as the demand for battery materials by EV makers would outweigh global capacity and supply. 	<ul style="list-style-type: none"> - Intensifying competition between global battery materials manufacturers in tandem with aggressive capacity expansion.

SOURCES: CGS-CIMB RESEARCH, COMPANY REPORTS

EARNINGS FORECASTS

Battery materials: the dawn of a new era

We expect SKC to enjoy a strong 47% OP CAGR in 2019-21F, surpassing subsidiary KCFT, Korea's leading elecfoil manufacturer.

We forecast KCFT to increase its elecfoil production capacity from 20k tpa in 1H19 to 45k tpa by 2021F given tight supply for elecfoil (EV use). As such, we expect revenue for its elecfoil business to rise 31% over the next two years, and OP to increase to W100bn in 2020F and W134bn in 2021F, with OPM at just below 20%. We forecast KCFT's contribution to SKC's OP could grow from 34% in 2020F to 38% in 2021F, 44% in 2022F and 51% in 2023F.

OP for the industrial material business could soar by a 34% CAGR in 2019-21F, based on our estimates. SKC is currently producing prototype colorless polyimide (CPI) film; it is scheduled to begin commercial CPI production in 1H20. As commercial production of transparent polyimide (PI) film increases in tandem with foldable smartphone shipments, we see solid industrial material sales growth over the next two years. Also, we expect prices for its key raw materials purified terephthalic acid (PTA) and monoethylene glycol (MEG) to drop further given the supply from Chinese chemical companies, and hence expect its OPM to rise to 5/6% in 2020/21F (vs. -0.2%/3.8% in 2018/2019F). For its growth businesses, we see strong semiconductor material sales for next three years due to increasing demand for 5G communication equipment.

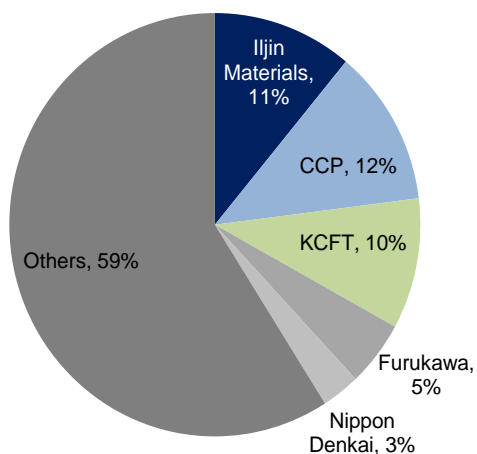
Overall we project OPM to expand from 6.5% in 2019F to 10% in 2021F, which should lead to remarkable EPS CAGR of 53% over 2019-21F. Our FY20/21 OP forecasts are 11%/12% higher than Bloomberg consensus.

Figure 6: Earnings forecasts

(Wbn)	1Q18	2Q18	3Q18	4Q18	1Q19	2Q19	3Q19	4Q19F	2016	2017	2018	2019F	2020F	2021F
Revenues	638.7	726.0	689.4	713.7	604.0	639.0	636.6	691.5	2,359.4	2,653.5	2,767.8	2,571.2	3,219.6	3,575.4
Chemical	210.2	229.3	228.6	202.7	192.0	202.3	188.0	186.5	706.5	785.4	870.8	768.7	760.9	753.3
Industrial materials	273.5	290.5	266.7	253.3	249.4	256.5	271.7	253.3	973.8	1,009.8	1,084.1	1,031.0	1,089.5	1,182.2
New growth businesses	125.0	236.2	194.1	257.7	162.6	180.2	176.9	251.7	679.2	858.3	812.9	771.5	854.2	965.3
Semiconductor materials	70.8	81.5	76.7	87.0	81.0	78.8	79.3	94.8	-	268.1	316.1	334.0	367.4	418.8
BHC	26.8	23.4	24.1	26.3	28.1	29.0	27.0	28.4	-	102.6	100.6	112.5	126.0	142.3
Others	27.3	131.3	93.2	144.4	53.5	72.4	70.6	128.5	679.2	487.7	396.2	325.1	360.8	404.1
KCFT	-	-	-	-	-	-	-	-	-	-	-	-	515.0	674.7
GP	108.6	125.0	121.8	123.3	107.7	120.7	106.7	113.5	410.0	426.2	478.7	448.6	559.4	622.5
OP	41.2	53.1	54.0	52.9	36.2	48.3	40.5	43.3	149.3	175.7	201.1	168.3	295.9	352.1
Chemical	36.8	40.7	39.7	32.2	27.1	29.8	24.8	23.3	120.5	126.3	149.4	105.0	104.3	100.9
Industrial materials	-4.0	2.0	1.6	-1.6	3.6	11.8	13.5	10.1	-17.3	-1.7	-2.0	39.0	51.2	69.7
New growth businesses	8.4	10.4	12.7	22.2	5.6	6.6	2.2	9.9	46.1	51.1	53.7	24.2	39.5	47.8
Semiconductor materials	3.7	4.9	4.4	9.4	1.8	0.7	-3.3	3.3	0.0	19.0	22.4	2.5	12.9	17.6
BHC	4.3	3.7	3.4	4.9	4.2	3.3	2.0	1.4	0.0	16.0	16.4	10.9	12.2	14.1
Others	0.4	1.8	4.8	7.9	-0.5	2.7	3.5	5.1	46.1	16.1	15.0	10.8	14.4	16.2
KCFT	-	-	-	-	-	-	-	-	-	-	-	-	100.9	133.6
NP	41.6	38.5	39.8	0.7	19.1	13.3	21.6	24.2	42.8	110.0	120.6	60.4	143.3	176.0
EPS (W/shr)	1,107	1,027	1,061	18	509	354	575	645	1,991	2,931	3,212	1,609	3,817	4,690
ROE (%)	11.4%	10.4%	10.5%	0.2%	5.0%	3.5%	5.6%	6.1%	3.0%	7.7%	8.1%	4.0%	8.7%	10.0%
Margins														
OP margin	6.4%	7.3%	7.8%	7.4%	6.0%	7.6%	6.4%	6.3%	6.3%	6.6%	7.3%	6.5%	9.2%	9.8%
Chemical	-1.5%	0.7%	0.6%	-0.6%	1.4%	4.6%	5.0%	4.0%	17.1%	16.1%	17.2%	13.7%	13.7%	13.4%
Industrial materials	17.5%	17.7%	17.4%	15.9%	14.1%	14.7%	13.2%	12.5%	-1.8%	-0.2%	-0.2%	3.8%	4.7%	5.9%
New growth businesses	6.7%	4.4%	6.5%	8.6%	3.4%	3.7%	1.2%	3.9%	6.8%	6.0%	6.6%	3.1%	4.6%	5.0%
Semiconductor materials	5.2%	6.0%	5.8%	10.8%	2.3%	0.8%	-4.2%	3.5%	-	7.1%	7.1%	0.8%	3.5%	4.2%
BHC	16.1%	15.9%	14.2%	18.7%	15.0%	11.2%	7.4%	5.0%	-	15.6%	16.3%	9.7%	9.7%	9.9%
Others	1.5%	1.4%	5.2%	5.5%	-0.9%	3.7%	5.0%	4.0%	6.8%	3.3%	3.8%	3.3%	4.0%	4.0%
KCFT	-	-	-	-	-	-	-	-	-	-	-	-	19.6%	19.8%
NP margin	6.5%	5.3%	5.8%	0.1%	3.2%	2.1%	3.4%	3.5%	1.8%	4.1%	4.4%	3.0%	4.5%	4.9%

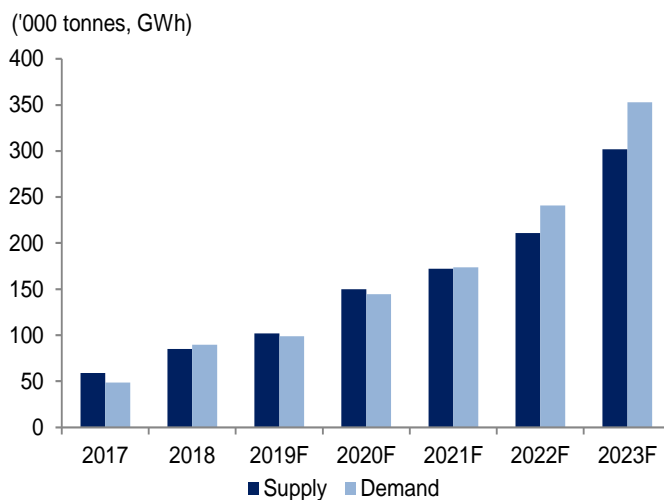
SOURCES: CGS-CIMB RESEARCH ESTIMATES, COMPANY REPORTS

Figure 7: Elecfoil market share in terms of sales volume (2018)



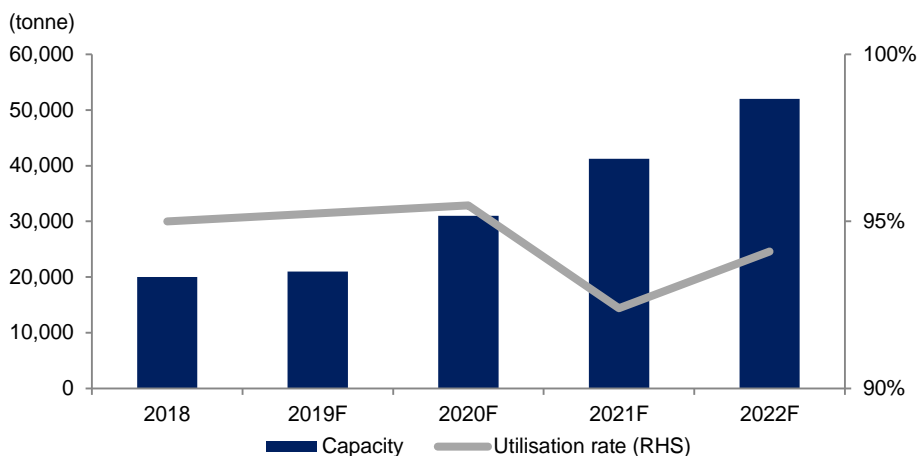
SOURCES: CGS-CIMB RESEARCH

Figure 8: Global elecfoil (copper foil) supply (90% utilisation rate assumption) vs. demand (60% in 2017-2020F and 70-80% in 2021F-2023F utilisation rate battery cell capacity assumption)



SOURCES: CGS-CIMB RESEARCH ESTIMATES

Figure 9: KCFT's capacity and utilisation forecasts



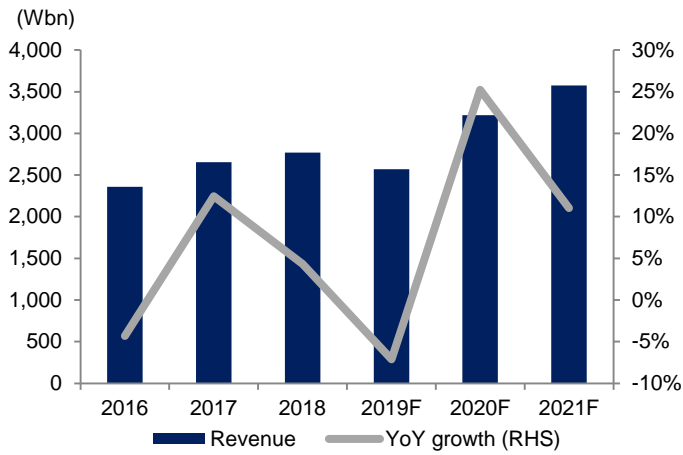
SOURCES: CGS-CIMB RESEARCH ESTIMATES, COMPANY REPORTS

Figure 10: KCFT's capacity and sales forecasts

	2018	2019F	2020F	2021F	2022F
Capacity (average, tonne)	20,000	21,000	31,000	41,250	52,000
Capacity (year end, tonne)	20,000	21,000	31,000	45,500	52,000
Utilisation rate (%)	95%	95%	95%	92%	94%
Production (tonne)	19,000	20,000	29,598	38,116	48,929
ASP (Wm/tonne)	16	17.2	17.4	17.7	16.8
KCFT revenue (Wbn)	304	343	515	675	822

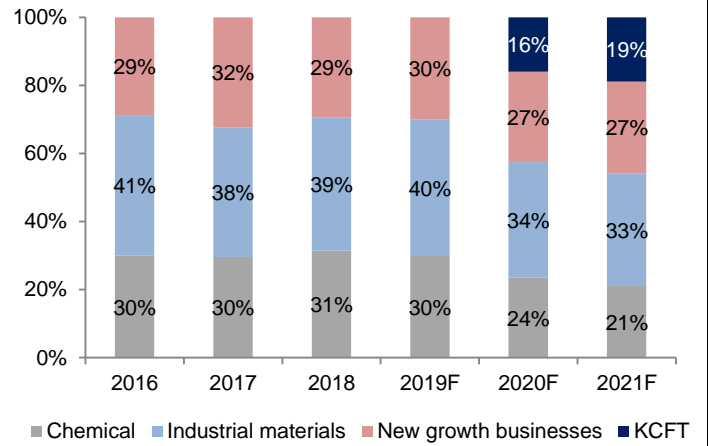
SOURCES: CGS-CIMB RESEARCH ESTIMATES, COMPANY REPORTS

Figure 11: SKC – Sales and yoy growth trend



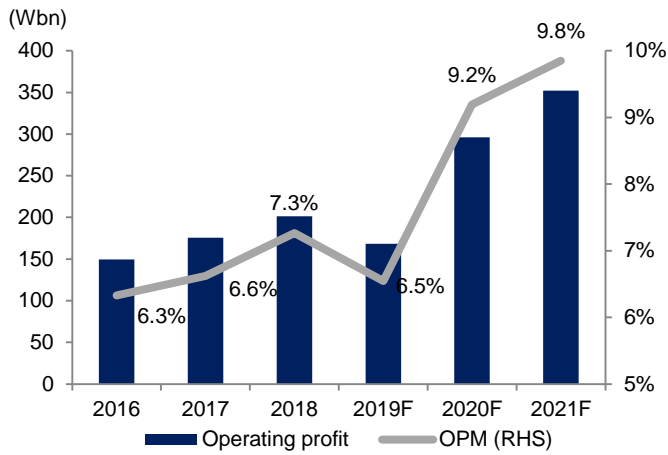
SOURCES: CGS-CIMB RESEARCH ESTIMATES, COMPANY REPORTS

Figure 12: SKC – Sales contribution by business



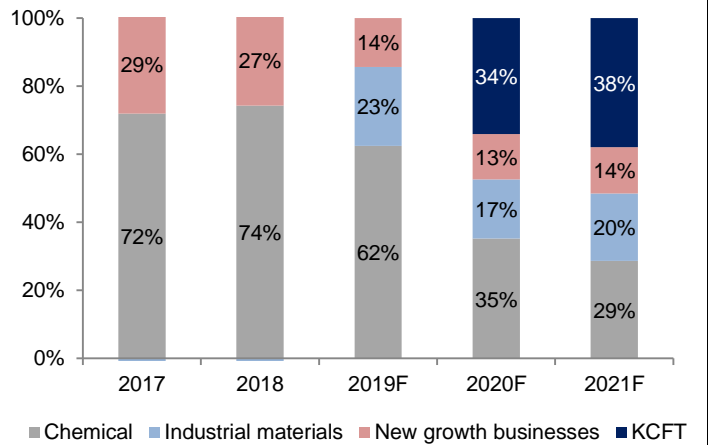
SOURCES: CGS-CIMB RESEARCH ESTIMATES, COMPANY REPORTS

Figure 13: SKC – OP and OPM trend



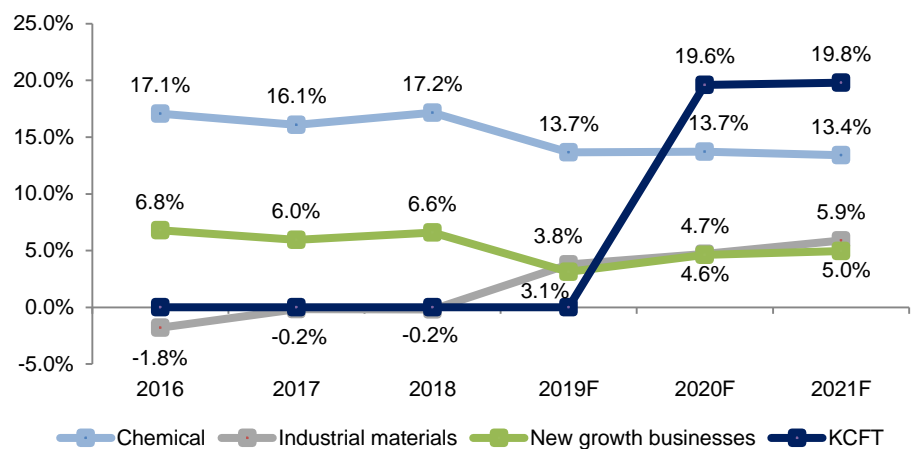
SOURCES: CGS-CIMB RESEARCH ESTIMATES, COMPANY REPORTS

Figure 14: SKC – OP contribution by business



SOURCES: CGS-CIMB RESEARCH ESTIMATES, COMPANY REPORTS

Figure 15: SKC – OP margin trend by business



SOURCES: CGS-CIMB RESEARCH ESTIMATES, COMPANY REPORTS

Figure 16: Global elecfoil (copper foil) supply and demand outlook

	2017	2018	2019F	2020F	2021F	2022F	2023F
EV battery capacity (GWh, on operation basis)							
LG Chem	12	25	41	70	101	115	145
Samsung SDI	6	11	17	26	32	45	59
SK Innovation	1	5	5	17	25	44	56
CATL (passenger EV)	5	9	14	22	42	74	121
Panasonic	19	40	40	40	41	50	65
BYD (passenger EV)	3	8	12	20	30	45	60
Others	30	42	25	31	39	57	124
Total	76	140	154	226	310	430	630
EV battery utilisation (%)							
60%	46	84	93	136	186	258	378
70%	53	98	108	158	217	301	441
80%	61	112	124	181	248	344	504
90%	68	126	139	203	279	387	567
EV battery demand (GWh)	46	83	95	136	212	332	520
EV elecfoil demand (at util. 80%)							
0.6kg/kWh	36	67	74	108	149	206	302
0.7kg/kWh	43	78	86	127	174	241	353
0.8kg/kWh	49	90	99	145	198	275	403
Elecfoil capacity ('000 tonnes/year)							
Iijin Materials	15	20	24	35	45	50	60
KCFT (SKC)	13	18	21	30	40	50	60
Lingbao Wason Copper Foil	10	20	25	40	55	65	75
Chang Chun Petrochemical	15	20	25	35	45	55	65
Doosan	0	4	7	12	15	20	25
Others	5	5	5	5	10	20	35
Total	58	87	107	157	210	260	320
Utilisation (%)							
70%	46	66	79	117	134	164	235
80%	53	75	90	134	153	187	265
90%	59	85	102	150	172	211	302

SOURCES: CGS-CIMB RESEARCH ESTIMATES, SNE RESEARCH ESTIMATES

* CGS-CIMB estimates used for LG Chem, Samsung SDI, SK Innovation and Iijin Materials

* SNE Research estimates used for CATL (300750 CH, Not Rated), Guoxuan (002074 CH, Not Rated), Lishen (Not Listed), Panasonic (6752 JP, Not Rated), KCFT (Not Listed), Lingbao Wason Copper Foil (Not Listed), Chang Chun Petrochemical (Not Listed) and Doosan (000150 KS, Not Rated)

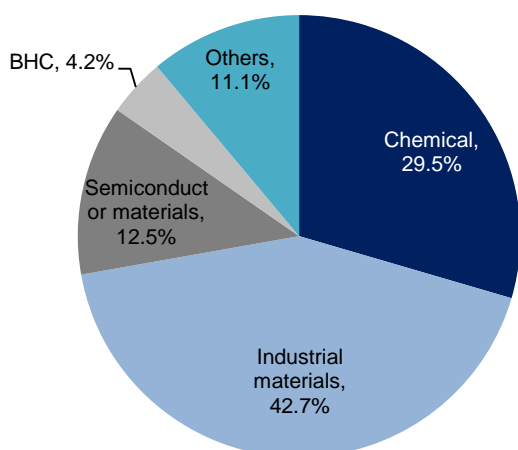
COMPANY BACKGROUND

SKC (011790 KS) is mainly engaged in the production and sale of a variety of film including polyester films, be it silicone-coated films or inkjet films. The company and its subsidiaries' businesses are divided into four main segments: 1) chemicals, 2) industrial materials, 3) semiconductor materials, 4) beauty & healthcare (BHC), and 5) others.

There are currently two major changes to look out for by year-end, in our view. First, SKC has announced plans to spin off its chemical business segment and sell a 49% stake to SKC PIC (joint venture between SKC and Kuwait Petroleum Corporation) for W536bn (1Q20F). Second, SKC is in the process of acquiring KCFT, which manufactures copper foils and flexible copper clad laminates used in lithium-ion batteries for electric vehicles. These changes in SKC's business portfolio will turn SKC into a company that specialises in manufacturing rechargeable battery elecfoil.

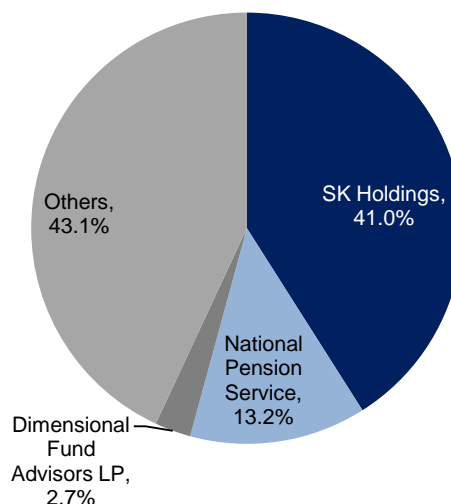
SK Holdings is the company's largest shareholder with a 41% stake, followed by National Pension service with 13.2%, and Dimensional Fund Advisors LP with 2.7% as at Nov 2019.

Figure 17: Revenue breakdown by segment (3Q19)



SOURCES: CGS-CIMB RESEARCH, COMPANY REPORTS

Figure 18: SKC's major shareholders (Nov 2019)



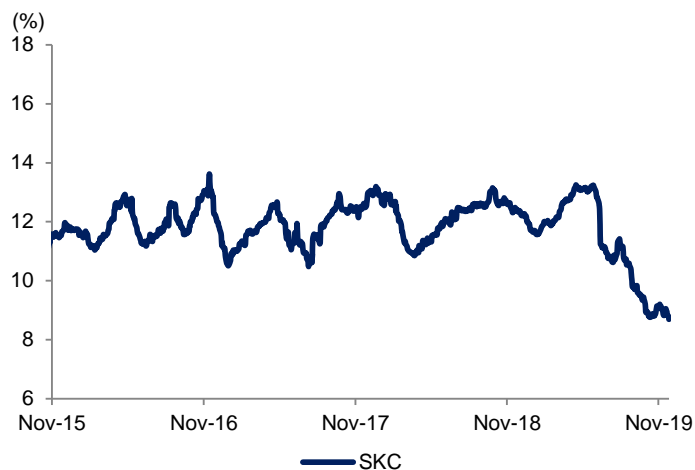
SOURCES: CGS-CIMB RESEARCH, COMPANY REPORTS

Figure 19: Business model innovation target (by 2020F)

EV Material	Semiconductor Material
- Battery/circuit material (PCT film, MLCC release film)	- Front-end process material (CMP pad, Slurry, Ceramic parts, Wet chemical)
- Wind shield (PVB, Window film)	- Back-end process material (Parts for test equipment)
- Anti-shock/noise (In/exterior material, Jounce bumper)	
Industrial Material	Ecofriendly material
- IT/Display material (Specialty PET film)	- Ecofriendly packaging (Bio-degradable, heat-shrinking film)
- Chemical material (PO, PG, Polyol)	- Energy saving (Heat saving material)
- Telecommunication equipment (5G repeater)	- Non-toxic (Nextyol, Beauty & Healthcare materials)

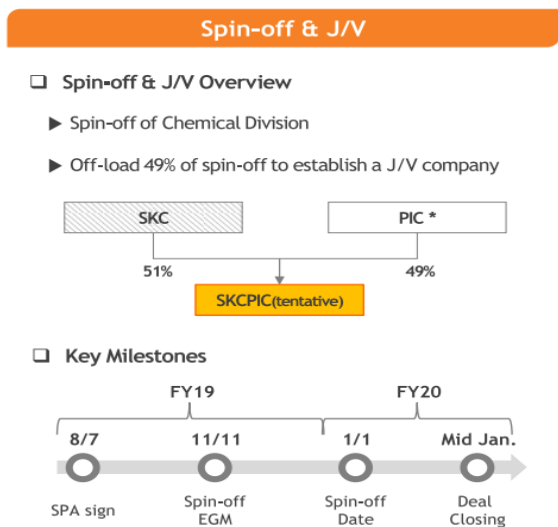
SOURCES: CGS-CIMB RESEARCH, COMPANY PRESENTATION (NOV 1, 2019)

Figure 20: Foreign shareholding ratio (Nov 2019)



SOURCES: CGS-CIMB RESEARCH, WISE FN

Figure 21: Chemical business segment spin-off



SOURCES: CGS-CIMB RESEARCH, COMPANY PRESENTATION (NOV 1, 2019)

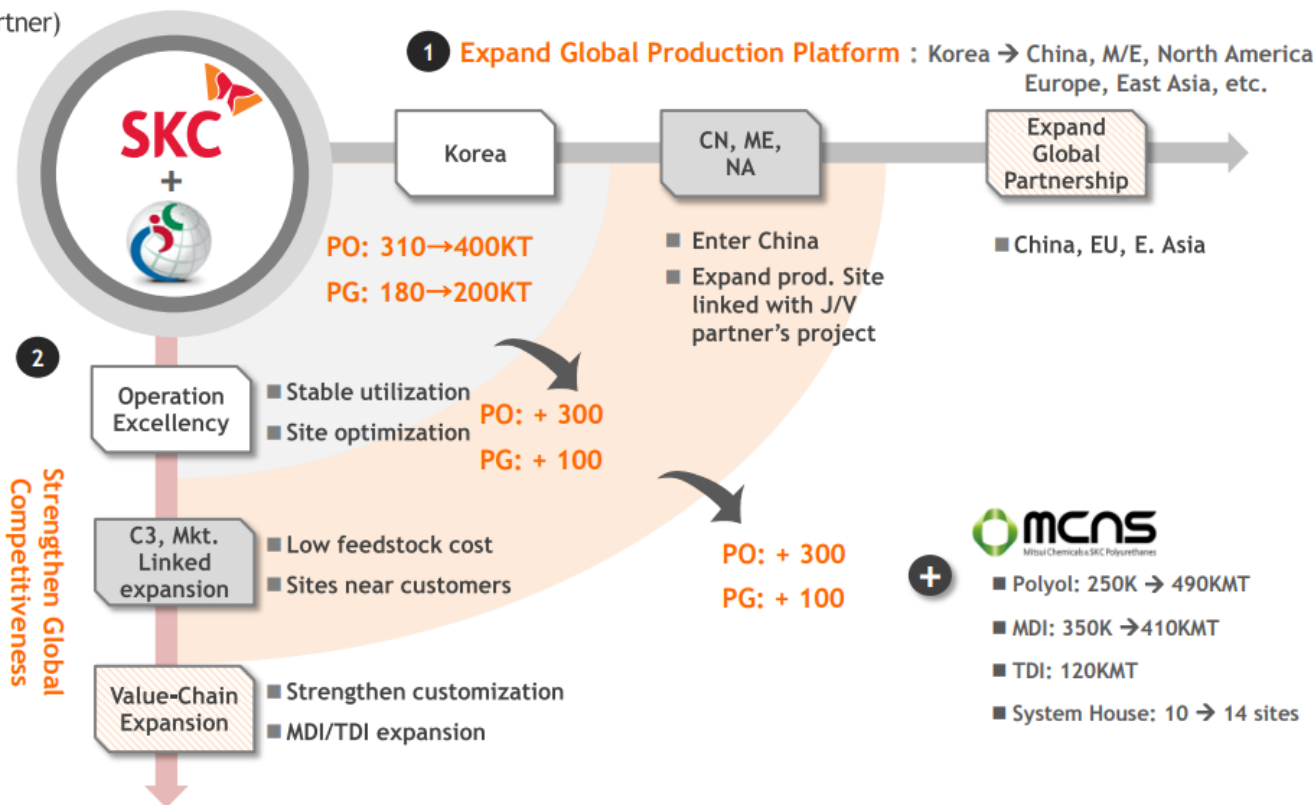
Figure 22: Entry into copper foil market through KCFT acquisition



SOURCES: CGS-CIMB RESEARCH, COMPANY PRESENTATION (NOV 1, 2019)

Figure 23: Growth roadmap for SKC's chemical joint venture

Build 1,000 KT PO capacity through Global J/V (in areas competitive feedstock sourcing is viable through J/V partner)



SOURCES: CGS-CIMB RESEARCH, COMPANY PRESENTATION (NOV 1, 2019)

Figure 24: SKC's target business model

Leap toward a Global Specialty MARKETER through Biz. Model Change



**Evolve in to Global Major : “Cash Cow based on stable profit base
→ Global expansion focused on high-value-add products”**

- Execute J/V strategy for global expansion
- Expand customized/high-profit downstream biz such as PG USP, DPG, etc.



Earnings expansion trend : “FY19 Turnaround → Specialty product expansion from FY20”

- Value Chain Redesign through strengthening coating biz. competitiveness
- Expand specialty/high-profit product portfolio



Accelerate growth : “Expand Semi./BHC/Comm. Equip. materials certification/production”

- Semi. Mat. : Expand virtuous cycle of certification/expansion/ramp-up of CMP Pad, Slurry, Wet Chem., Ceramic Parts
- BHC Mat. : Expand China production(3rd gen. mask pack, cosmetic ingredients), strengthen bio-medical biz.
- Comm. Equip. : Respond to 5G CAPEX expansion



Strengthen Global No.1 position : “KCFT competitive advantage + SKC Synergy”

- KCFT Core Competency : ① R&D/production technology, ② Major focused customer base ③ Edge in sourcing/expansion
- SKC Synergy : ① Timely expansion decision, ② Global production platform(US, Poland), ③ Sharing of film mfg. Know-how

11

SOURCES: CGS-CIMB RESEARCH, COMPANY PRESENTATION (NOV 1, 2019)

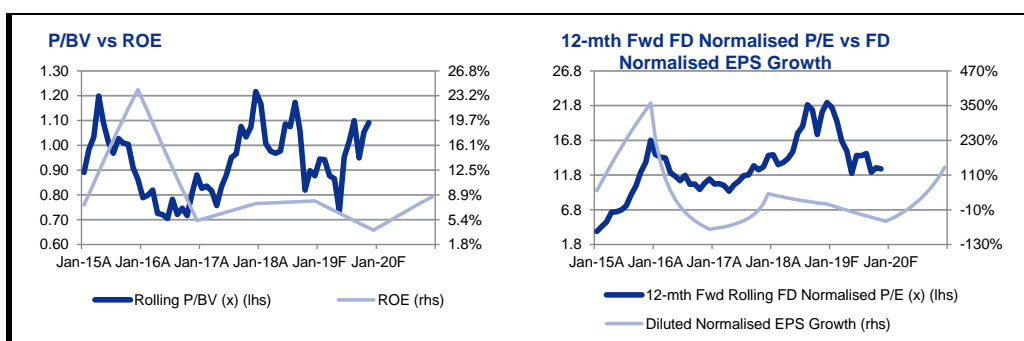
Figure 25: Peer comparison

Company	Bloomberg		TP (Lcy)	Price (Lcy)	Mkt cap (US\$m)	P/E (x)		P/BV (x)		ROE		EV/EBITDA (x)		Div yield	
	Ticker	Recom.				FY19F	FY20F	FY19F	FY20F	FY19F	FY20F	FY19F	FY20F	FY19F	FY20F
Elecfoil															
SKC	011790 KS	ADD	62,000	46,050	1,466	28.0	11.8	1.1	1.0	4%	9%	8.9	8.0	2.2%	2.2%
Iijin Materials	020150 KS	ADD	49,000	39,500	1,545	39.3	23.6	3.0	2.8	8%	12%	18.7	12.9	1.7%	1.7%
Furukawa Electric	5801 JP	NR	na	3,030	1,957	13.7	11.4	0.8	0.8	6%	8%	7.2	6.5	2.7%	2.7%
Mitsui & Co.	8031 JP	NR	na	1,950	31,046	7.5	7.5	0.8	0.7	10%	10%	15.5	15.5	4.2%	4.3%
UACJ Corp	5741 JP	NR	na	2,471	1,091	402.1	15.9	0.6	0.6	0%	4%	12.0	9.2	2.1%	2.4%
Nanya Plastic	1303 TT	NR	na	73	18,858	19.4	16.6	1.6	1.5	8%	9%	20.7	18.2	3.7%	4.5%
Tongling Nonferrous Metals	000630 CH	NR	na	2	3,189	25.7	22.0	1.3	1.3	5%	5%	7.7	7.2	1.4%	1.9%
Shandong Nanshan Aluminium	600219 CH	NR	na	2	3,688	15.8	13.2	0.7	0.7	4%	5%	6.4	5.5	1.8%	2.1%
Total average						20.6	12.1	1.1	1.0	9%	9%	15.9	14.8	3.6%	4.0%

NOTE: DATA FOR NOT RATED COMPANIES IS BASED ON BLOOMBERG CONSENSUS ESTIMATES

SOURCES: CGS-CIMB RESEARCH, BLOOMBERG

*DATA AS AT 28 NOV 2019

BY THE NUMBERS

Profit & Loss

(Wb)	Dec-17A	Dec-18A	Dec-19F	Dec-20F	Dec-21F
Total Net Revenues	2,654	2,768	2,571	3,220	3,575
Gross Profit	426	479	449	559	623
Operating EBITDA	298	328	309	442	507
Depreciation And Amortisation	(122)	(127)	(141)	(146)	(155)
Operating EBIT	176	201	168	296	352
Financial Income/(Expense)	(50)	(54)	(48)	(50)	(69)
Pretax Income/(Loss) from Assoc.	68	63	3	0	0
Non-Operating Income/(Expense)	(13)	(28)	(25)	(51)	(46)
Profit Before Tax (pre-EI)	181	182	99	195	237
Exceptional Items					
Pre-tax Profit	181	182	99	195	237
Taxation	(44)	(41)	(30)	(43)	(52)
Exceptional Income - post-tax	0	0	0	0	0
Profit After Tax	136	141	69	152	185
Minority Interests	(26)	(20)	(9)	(9)	(9)
Preferred Dividends					
FX Gain/(Loss) - post tax					
Other Adjustments - post-tax					
Preference Dividends (Australia)					
Net Profit	110	121	60	143	176
Normalised Net Profit	136	141	69	152	185
Fully Diluted Normalised Profit	110	121	60	143	176

Cash Flow

(Wb)	Dec-17A	Dec-18A	Dec-19F	Dec-20F	Dec-21F
EBITDA	298.2	328.0	309.1	442.0	507.0
Cash Flow from Inv. & Assoc.	68.1	62.9	3.0	0.0	0.0
Change In Working Capital	(18.3)	(17.4)	(107.5)	(88.4)	(52.0)
(Incr)/Decr in Total Provisions					
Other Non-Cash (Income)/Expense	171.1	200.5	266.8	276.5	293.0
Other Operating Cashflow	(270.0)	(287.7)	(348.6)	(464.9)	(586.9)
Net Interest (Paid)/Received	(33.7)	(26.0)	(21.1)	(50.3)	(69.4)
Tax Paid	(44.4)	(41.1)	(30.1)	(42.8)	(52.1)
Cashflow From Operations	171.0	219.3	71.4	72.1	39.8
Capex	(159.6)	(202.2)	(251.6)	(300.0)	(248.0)
Disposals Of FAs/subsidiaries					
Acq. Of Subsidiaries/investments					
Other Investing Cashflow	(16.1)	(10.6)	26.9	0.0	0.0
Cash Flow From Investing	(175.7)	(212.8)	(224.7)	(300.0)	(248.0)
Debt Raised/(repaid)					
Proceeds From Issue Of Shares					
Shares Repurchased					
Dividends Paid	(33.8)	(37.5)	(37.5)	(37.5)	(37.5)
Preferred Dividends					
Other Financing Cashflow	(141.9)	(175.2)	(187.2)	(262.5)	(210.5)
Cash Flow From Financing	(175.7)	(212.8)	(224.7)	(300.0)	(248.0)
Total Cash Generated	(180.4)	(206.3)	(378.0)	(527.9)	(456.2)
Free Cashflow To Equity	(4.7)	6.5	(153.3)	(227.9)	(208.2)
Free Cashflow To Firm	29.9	33.1	(129.2)	(171.9)	(131.4)

SOURCES: CGS-CIMB RESEARCH, COMPANY REPORTS

BY THE NUMBERS... cont'd
Balance Sheet

(Wb)	Dec-17A	Dec-18A	Dec-19F	Dec-20F	Dec-21F
Total Cash And Equivalents	176	162	126	39	91
Total Debtors	368	346	406	508	566
Inventories	299	353	445	547	612
Total Other Current Assets	54	49	59	59	59
Total Current Assets	897	910	1,036	1,153	1,328
Fixed Assets	1,903	1,979	2,089	2,243	2,336
Total Investments	536	590	598	648	701
Intangible Assets	209	233	256	277	300
Total Other Non-Current Assets	122	122	118	816	910
Total Non-current Assets	2,770	2,923	3,062	3,983	4,247
Short-term Debt	739	610	686	1,010	1,091
Current Portion of Long-Term Debt					
Total Creditors	428	440	486	602	673
Other Current Liabilities	34	32	40	40	40
Total Current Liabilities	1,201	1,082	1,212	1,652	1,804
Total Long-term Debt	677	846	924	1,359	1,469
Hybrid Debt - Debt Component					
Total Other Non-Current Liabilities	196	211	205	254	283
Total Non-current Liabilities	873	1,057	1,128	1,613	1,752
Total Provisions	0	0	0	0	0
Total Liabilities	2,074	2,138	2,340	3,265	3,556
Shareholders' Equity	1,450	1,533	1,589	1,695	1,833
Minority Interests	144	162	168	177	186
Total Equity	1,594	1,695	1,757	1,872	2,019

Key Ratios

	Dec-17A	Dec-18A	Dec-19F	Dec-20F	Dec-21F
Revenue Growth	12.5%	4.3%	(7.1%)	25.2%	11.0%
Operating EBITDA Growth	8.8%	10.0%	(5.8%)	43.0%	14.7%
Operating EBITDA Margin	11.2%	11.9%	12.0%	13.7%	14.2%
Net Cash Per Share (W)	(33,033)	(34,461)	(39,530)	(62,085)	(65,785)
BVPS (W)	38,631	40,835	42,330	45,147	48,836
Gross Interest Cover	N/A	N/A	N/A	N/A	N/A
Effective Tax Rate	24.5%	22.5%	30.4%	22.0%	22.0%
Net Dividend Payout Ratio	30.7%	31.1%	62.1%	26.2%	21.3%
Accounts Receivables Days	51.24	47.04	53.32	51.91	54.81
Inventory Days	45.30	52.02	68.61	68.24	71.64
Accounts Payables Days	68.65	69.16	79.56	74.83	78.80
ROIC (%)	7.3%	8.1%	6.4%	10.4%	9.2%
ROCE (%)	5.97%	6.53%	5.16%	7.78%	7.98%
Return On Average Assets	5.18%	5.19%	2.94%	4.38%	4.74%

SOURCES: CGS-CIMB RESEARCH, COMPANY REPORTS

South Korea

ADD (previously NOT RATED)

Consensus ratings*: Buy 16 Hold 0 Sell 0

Current price:	W39,500
Target price:	W49,000
Previous target:	N/A
Up/downside:	24.1%
CGS-CIMB / Consensus:	-3.5%
Reuters:	020150.KS
Bloomberg:	020150 KS
Market cap:	US\$1,547m
	W1,821,378m
Average daily turnover:	US\$11.84m
	W13,901m
Current shares o/s:	39.20m
Free float:	39.5%

*Source: Bloomberg

Key changes in this note

N/A



Source: Bloomberg

Price performance	1M	3M	12M
Absolute (%)	2.9	-8.9	4.4
Relative (%)	1.7	-18	3.9

Major shareholders

	% held
Huh, Jae-Myung	53.3
National Pension Service	7.2

Analyst(s)


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Iljin Materials

High beta battery material play

- Iljin Materials is a global leading producer of elecfoil for EV battery. It has SDI as a major customer, and is winning over other major battery cell makers.
- We project EPS CAGR of 45% over 2019-21F on 1) solid sales growth, and 2) margin expansion from cost savings, thanks to its new Malaysian capacity.
- Initiate coverage with an Add rating and target price of W49,000, based on CY20F P/E of 30x (2-year historical upcycle)

Global leading supplier of elecfoil for battery cells

Iljin Materials makes high-end elecfoil (mainly for rechargeable anode current collectors) and has global battery cell makers (Samsung SDI, BYD, LG Chem) as its key customers. We believe it should benefit from growing passenger electric vehicle (EV) penetration given the positive supply-demand dynamics for the elecfoil market.

Tight supply for elecfoil

We expect demand for elecfoil from EV batteries to rise from 64k tpa in 2018 to 200k tpa in 2022F (43% CAGR), driven by new EV launches, and the production capacity of elecfoil to rise from 75k tpa in 2018 to 187k tpa in 2022F (34% CAGR). We see only six companies capable of producing high-quality elecfoil at a competitive cost for the new EV models scheduled. EV battery cell makers are trying to procure sufficient elecfoil supply with long-term contracts; this should lead to strong margins for the elecfoil business.

Malaysian capacity ramp-up

Iljin Materials completed the first phase (10k tpa in 1Q19) of its Malaysia production facility for elecfoil at W158bn. It plans to add another 10k tpa capacity every year up to 50k tpa, the plant's design capacity, in 2023F. Given Malaysia's lower labour costs (30% below China's (as at 3Q19) and cheaper electric rate (50% below Korea's (as at 3Q19)), we expect margin expansion from its elecfoil business. Samsung SDI has a small battery plant in Malaysia, implying stable utilisation for Iljin Materials's capacity, in our view.

Robust EPS CAGR of 45% over 2019-21F

We believe its core operating profit (OP) growth is likely to accelerate, driven by increasing contribution from its battery elecfoil. We project elecfoil sales to rise at a 51% CAGR for the next two years and elecfoil's OP margin (OPM) to expand from 15% in 2019F to 18% in 2021F, resulting in OP contribution from the high-margin elecfoil business to rise to 82% in 2021F from 68% in 2019F. As such, we think the overall OPM is likely to expand from 10% in 2019F to 13% in 2021F.

Initiating coverage with an Add and target price of W49,000

We initiate coverage with an Add rating. Our target price is based on a target P/E of 30x (2-year historical upcycle average) on its 2020F EPS. Potential re-rating catalysts include large contracts with major Chinese OEMs. Risks to our call include lower utilisation on slower-than-expected EV penetration.

Financial Summary

	Dec-17A	Dec-18A	Dec-19F	Dec-20F	Dec-21F
Revenue (Wb)	454.0	502.0	575.8	767.0	969.7
Operating EBITDA (Wb)	73.1	73.5	95.3	147.0	195.8
Net Profit (Wb)	42.18	41.33	47.81	75.58	99.14
Normalised EPS (W)	991	898	983	1,639	2,150
Normalised EPS Growth	114%	(9%)	9%	67%	31%
FD Normalised P/E (x)	39.85	43.99	40.20	24.10	18.37
DPS (W)	650.0	0.0	650.0	650.0	650.0
Dividend Yield	1.65%	0.00%	1.65%	1.65%	1.65%
EV/EBITDA (x)	19.75	24.01	19.16	13.21	10.26
P/FCFE (x)	NA	NA	NA	NA	NA
Net Gearing	(45.0%)	(10.5%)	0.8%	19.2%	26.9%
P/BV (x)	3.43	3.45	3.11	2.89	2.60
ROE	10.3%	7.8%	8.1%	12.4%	14.9%
% Change In Normalised EPS Estimates					
Normalised EPS/consensus EPS (x)			0.87	0.97	0.89

SOURCES: CGS-CIMB RESEARCH, COMPANY REPORTS

VALUATION AND RECOMMENDATION

Initiate coverage with an Add rating and TP of W49k

We initiate coverage on Iijin Materials with an Add rating and 12-month target price of W49,000, based on a target P/E of 30x applied to its 2020F EPS. We use a P/E valuation as a primary methodology to deriving Iijin Materials' target price as we believe its EPS should rise at a CAGR of 45% over 2019-21F. We expect solid market conditions and organic business improvement to drive robust EPS growth for the next three years.

Based on major peers' normalised EPS growth and historical P/E multiples during periods of an upward trajectory in earnings, we think the 30x P/E target multiple is justified. Iijin Materials traded at 35x 1-year forward P/E in 2017-2018 (peak of over 45x).

To cross check our target price, we performed a PEG analysis on peers [Nan Ya Plastics (1303 TT, Not Rated), Tongling Nonferrous Metals (000630 CH, Not Rated), UACJ Corp (5741 JP, Not Rated)] earnings growth and P/E multiples for the next two years, which we think will see an industry recovery cycle. We applied Iijin Materials's EPS growth forecasts of 45% for 2019-2021F on peers' average PEG ratio of 0.8x based on Bloomberg consensus. Given the implied P/E of 35x through the PEG analysis, we think a target P/E multiple of 30x on 2020F EPS is reasonable for Iijin Materials's valuation.

We expect Iijin Materials's 2019-21F EPS growth to outpace those of its peers during the comparable period, and the company should continue to maintain leading market share, in our view.

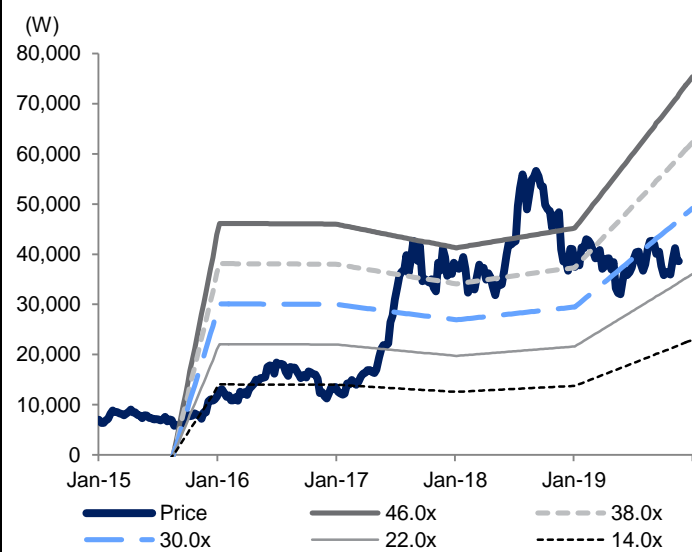
There are potential elecfoil order opportunities from Chinese OEMs [Contemporary Amperex Technology (CATL; 300750 CH, Not Rated, CP; CNY88), BYD (002594 CH, Reduce, TP; CNY32, CP; CNY44)] for the China market. If Iijin Materials take advantage of these opportunities, we think Iijin Materials' forward P/E multiple could expand to as high as 35x, leading to further share price upside going forward. These opportunities are not in our estimates for now.

Figure 1: Iijin Materials – valuation summary

Recommendation	ADD
EPS (W)	FY20F 1,639
Target P/E (x)	30
Equity Value Per Share (W)	49,170
Target Price (W/shr, rounded)	49,000
Current Price (W/shr)	39,500
% upside	24%
Target P/E criteria	FY20F selected peers' average
Peers selected (Global)	Nanya Plastic, Tongling Nonferrous Metals, UACJ Corp
Peers' qualification	High tech copper foil manufacturers

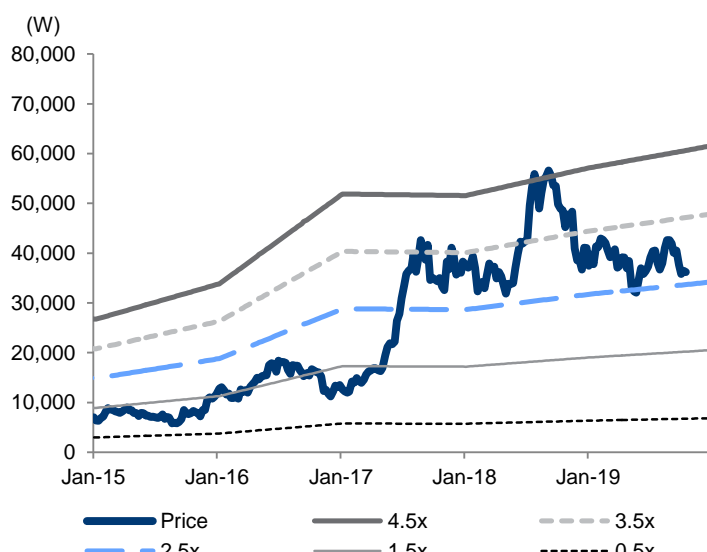
SOURCES: CGS-CIMB RESEARCH ESTIMATES, COMPANY REPORTS, BLOOMBERG
DATA AS AT 28 NOV 2019

Figure 2: Iljin Materials – 12-month forward P/E band



SOURCES: CGS-CIMB RESEARCH, WISEFN

Figure 3: Iljin Materials – 12-month forward P/BV band



SOURCES: CGS-CIMB RESEARCH, WISEFN

Downside risks to our call

Our key downside risks include 1) competitors increasing their capacity expansions. e.g. KCFT (Unlisted) and Doosan Solus (336370 KS, Not Rated, CP; W19,900) could raise their capacity aggressively to gain market share; and 2) reduced operating margins from lower utilisation of its new capacity.

As growing EV penetration should lift demand for electrofoil, we assume the electrofoil production capacity from 87k tpa in 2018 to 260k tpa in 2022F. If late comers aggressively expand their capacity, the electrofoil capacity could outrun the actual demand for electrofoil, which could be a key downside risk to our Add call for long-term.

Iljin Materials is now expanding its capacity in Malaysia. It plans to add 10k tpa capacity every year up to 50k tpa, the plant's design capacity, in 2023F. The initial yield for new electrofoil operations are lower than expected on potential shortage for engineers and sourcing problem for its raw materials. Delays in electrofoil capacity expansion and slow capacity ramp-up pose a key downside risk to our Add call.

Figure 4: Iljin Materials – SWOT analysis

Strength	Weakness
<ul style="list-style-type: none"> - Unchallenged technological gap between Iljin Materials and other electrofoil competitors in producing very thin copper foil with adequate mechanical strength and smooth surface - Stable market share in global electrofoil (I2B & ICS) market, while maintaining long-term strategic partnership with its key customers 	<ul style="list-style-type: none"> - Vulnerable to short-term volatility in earnings due to the impact of absolute copper price fluctuation, occurring quarterly with the existence of difference between procurement and shipping
Opportunity	Threat
<ul style="list-style-type: none"> - Strong growth forecast in global electrofoil market with an increasing demand of EVs worldwide and with an increasing battery capacity - Increasing share of copper foil in global battery material market mix due to strong demand from autos and storage batteries 	<ul style="list-style-type: none"> - Increasing capacity expansion plan, coming from both local and Chinese local manufacturers in line with an expectation that EV makers' copper foil demand would soar in 2020-21F

SOURCES: CGS-CIMB RESEARCH, COMPANY REPORTS

EARNINGS FORECASTS

Strong topline growth and margin expansion

We expect Iljin Materials to report 49% OP CAGR in 2020-21F on the back of stronger sales contribution from its high-margin battery materials (elecfoil for anode) business.

We forecast Iljin Secondary Battery (I2B) revenue to grow 62% yoy in 2020F and 40% yoy in 2021F, on the back of sequential capacity expansion primarily at its Malaysian plant (+10k tonne p.a.). We forecast blended ASP to increase 4% yoy in 2021F given elecfoil supply shortages and cost pass through contracts.

For printed circuit boards (PCBs), we estimate Iljin Copper Standard (ICS) to report -2%/10% revenue growth in 2020F/2021F, given management's strategy to focus on high-end value elecfoil, which could be as thin as 9 micrometer (vs. 35 micrometer traditional products).

Based on its economies of scale and long-term contracts with battery cell makers, we forecast Iljin's OP to rise from W58bn in 2019F to W93bn in 2020F and W129bn in 2021F on OP margin expansions (from 10.2% in 2019F to 12% in 2020F and 13% in 2021F). Given the tight supply of elecfoil for electric vehicles (EVs), we estimate Iljin Materials's normalised OP margin at between high teens and the 20% level.

As we expect its I2B's OP contribution to increase from 67% in 2019F to 77% in 2020F and to 82% in 2021F, we project net profit growth of 58% in 2020F and 31% in 2021F.

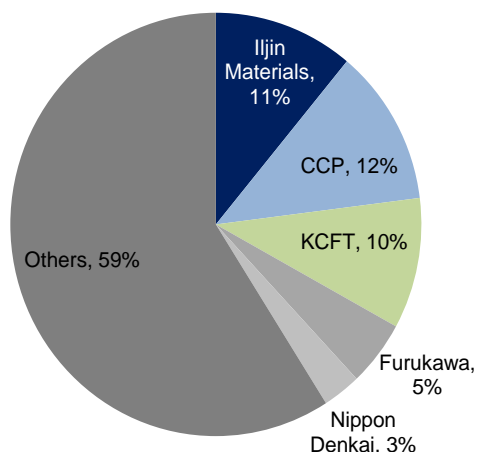
Our FY20-21F EPS forecasts are slightly below current Bloomberg consensus forecasts (as at Nov 2019) as we believe that we have a conservative view on its new elecfoil capacity normalisation in the medium term. We expect Iljin Materials to report soft near-term earnings due to lower-than-expected anode sales from weak energy storage system (ESS) battery and EV battery shipments.

Figure 5: Earnings forecasts

(Wbn)	1Q18	2Q18	3Q18	4Q18	1Q19	2Q19	3Q19	4Q19F	2016	2017	2018	2019F	2020F	2021F
Revenues	116	120	130	137	121	152	150	152	399	454	502	576	767	970
Elecfoil	71	72	75	75	64	76	94	90	227	271	294	324	486	661
I2B	50	54	57	58	49	60	78	76	150	172	219	263	426	595
ICS	21	18	18	17	15	16	16	14	77	100	75	61	60	66
Others	6	7	8	5	5	7	8	8	23	24	25	29	32	32
Subsidiaries	39	41	47	57	51	68	49	55	148	159	183	223	250	277
EBITDA	14	20	24	16	19	26	25	25	52	73	73	95	147	196
OP	8	14	17	9	12	17	16	14	29	50	49	58	93	129
Elecfoil	6	10	14	7	10	13	13	11	-	-	38	47	79	114
I2B	5	8	10	6	8	11	11	10	-	-	29	39	71	106
ICS	2	2	4	1	2	2	2	1	-	-	9	8	7	8
Others	1	2	1	1	(0)	1	0	0	-	-	5	1	1	1
Subsidiaries	1	1	3	2	3	4	2	2	-	3	6	11	12	14
NP	7	14	12	8	12	12	13	10	39	42	41	48	76	99
EPS (W/shr)	143	312	267	174	208	270	293	212	463	918	897	983	1,639	2,150
ROE (%)	5%	11%	9%	6%	9%	9%	9%	7%	15%	10%	8%	9%	12%	15%
OP margin														
Overall	6.9%	11.6%	13.4%	6.9%	9.8%	11.4%	10.4%	8.9%	7.3%	10.9%	9.7%	10.2%	12.1%	13.3%
Elecfoil	8.9%	14.4%	18.5%	9.5%	15.4%	16.9%	14.0%	12.4%	-	-	12.8%	14.5%	16.3%	17.2%
I2B	9.3%	15.5%	18.0%	9.9%	15.5%	17.6%	14.6%	13.0%	-	-	13.3%	15.0%	16.8%	17.8%
ICS	7.8%	11.1%	20.0%	7.9%	15.0%	14.0%	11.0%	9.0%	-	-	11.6%	12.3%	12.5%	12.5%
Others	10.4%	37.6%	12.9%	18.0%	-9.1%	11.0%	3.5%	3.5%	-	-	19.8%	3.0%	3.5%	3.5%
Subsidiaries	2.6%	2.5%	5.4%	2.6%	5.4%	5.4%	4.7%	4.0%	-	1.9%	3.3%	4.9%	5.0%	5.0%
KRW/US\$ (Avg)	1,073	1,077	1,112	1,113	1,126	1,167	1,194	1,175	1,161	1,126	1,094	1,169	1,167	1,156

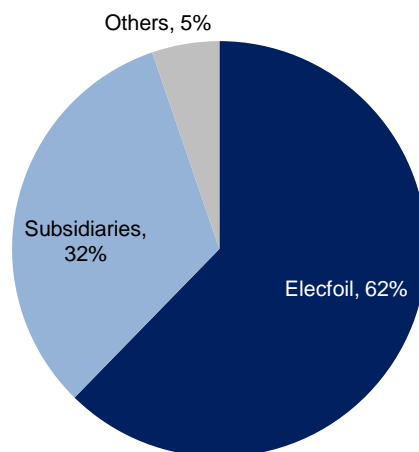
SOURCES: CGS-CIMB RESEARCH ESTIMATES, COMPANY REPORTS

Figure 6: Elecfoil market share in terms of sales volume (2018)



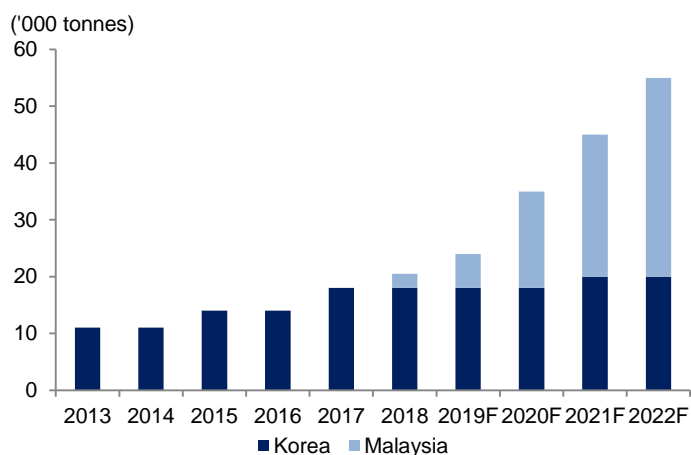
SOURCES: CGS-CIMB RESEARCH

Figure 7: Iljin Materials – customer breakdown (2019F)



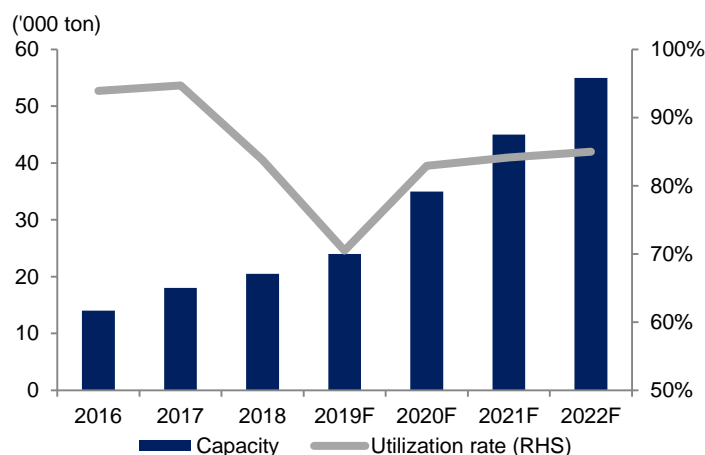
SOURCES: CGS-CIMB RESEARCH ESTIMATES

Figure 8: Iljin Materials – capacity expansion plans



SOURCES: CGS-CIMB RESEARCH ESTIMATES

Figure 9: Iljin Materials – overall capacity and utilisation trend



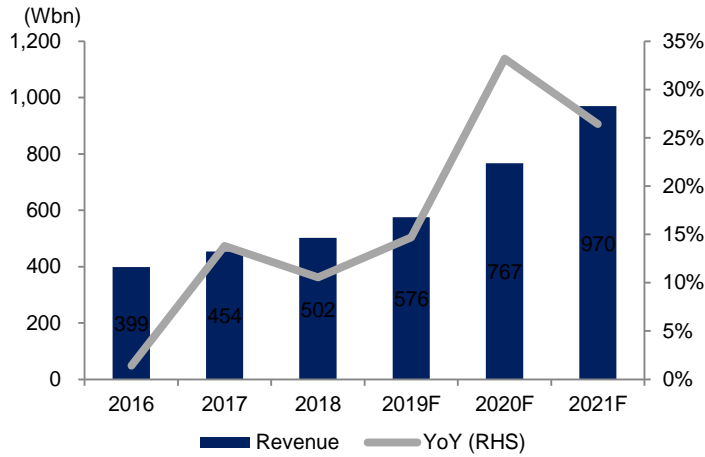
SOURCES: CGS-CIMB RESEARCH ESTIMATES

Figure 10: Iljin Materials – elecfoil capacity and sales forecasts

	2018	2019F	2020F	2021F	2022F
Capacity (year end, tonne)	20,500	24,000	35,000	45,000	55,000
Utilisation rate (%)	84%	71%	83%	84%	85%
Production (tonne)	17,260	21,908	32,975	42,600	51,850
ASP (Wm/tonne)	15.5	13.0	12.5	13.4	14.0
Electrofoil Revenue (Wbn)	294	324	486	661	841

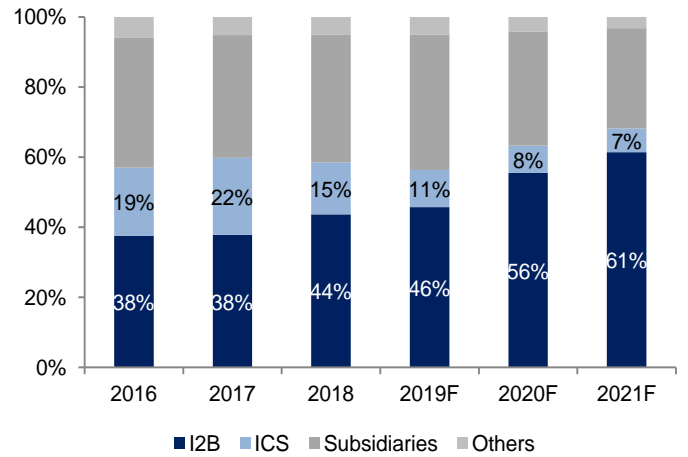
SOURCES: CGS-CIMB RESEARCH ESTIMATES

Figure 11: Iljin Materials – sales and yoy growth trend



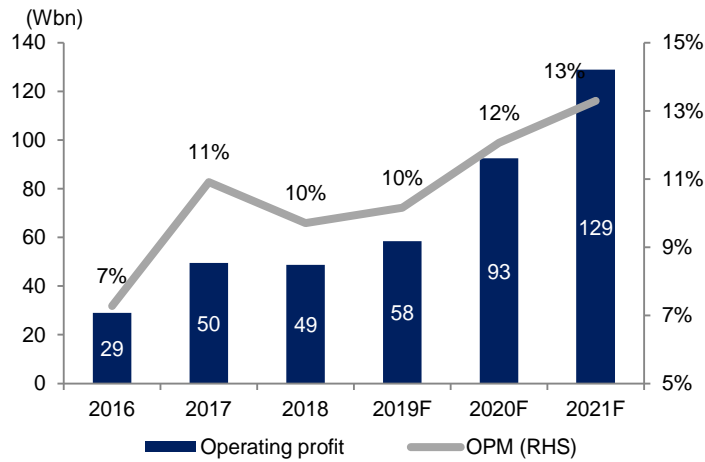
SOURCES: CGS-CIMB RESEARCH ESTIMATES, COMPANY REPORTS

Figure 12: Iljin Materials – sales contribution by business



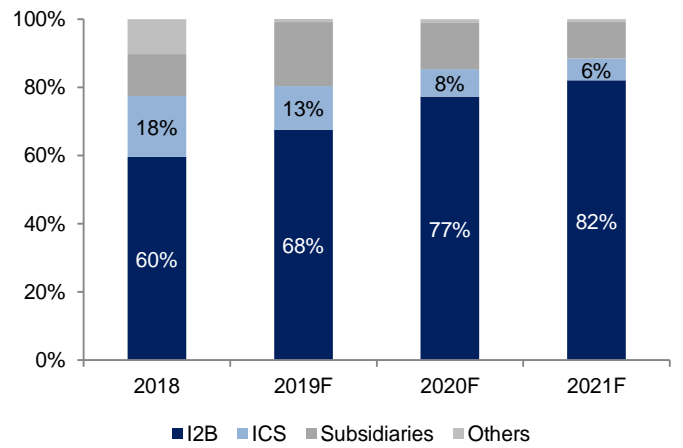
SOURCES: CGS-CIMB RESEARCH ESTIMATES, COMPANY REPORTS

Figure 13: Iljin Materials – OP and OPM trends



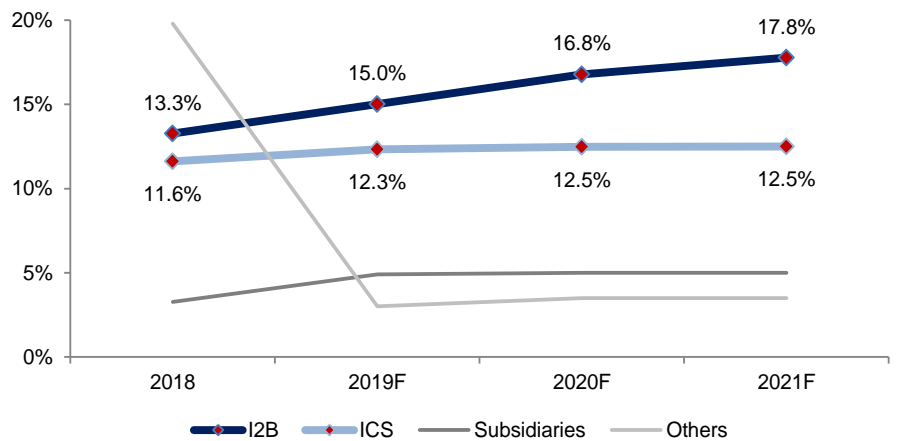
SOURCES: CGS-CIMB RESEARCH ESTIMATES, COMPANY REPORTS

Figure 14: Iljin Materials – OP contribution by business



SOURCES: CGS-CIMB RESEARCH ESTIMATES, COMPANY REPORTS

Figure 15: Iljin Materials – OP margin trend by business



SOURCES: CGS-CIMB RESEARCH ESTIMATES, COMPANY REPORTS

Figure 16: Global elecfoil (copper foil) supply and demand outlook

	2017	2018	2019F	2020F	2021F	2022F	2023F
EV battery capacity (GWh, on operation basis)							
LG Chem	12	25	41	70	101	115	145
Samsung SDI	6	11	17	26	32	45	59
SK Innovation	1	5	5	17	25	44	56
CATL (passenger EV)	5	9	14	22	42	74	121
Panasonic	19	40	40	40	41	50	65
BYD (passenger EV)	3	8	12	20	30	45	60
Others	30	42	25	31	39	57	124
Total	76	140	154	226	310	430	630
EV battery utilisation (%)							
60%	46	84	93	136	186	258	378
70%	53	98	108	158	217	301	441
80%	61	112	124	181	248	344	504
90%	68	126	139	203	279	387	567
EV battery demand (GWh)	46	83	95	136	212	332	520
EV elecfoil demand (at util. 80%)							
0.6kg/kWh	36	67	74	108	149	206	302
0.7kg/kWh	43	78	86	127	174	241	353
0.8kg/kWh	49	90	99	145	198	275	403
Elecfoil capacity ('000 tonnes/year)							
Iljin Materials	15	20	24	35	45	50	60
KCFT (SKC)	13	18	21	30	40	50	60
Lingbao Wason Copper Foil	10	20	25	40	55	65	75
Chang Chun Petrochemical	15	20	25	35	45	55	65
Doosan	0	4	7	12	15	20	25
Others	5	5	5	5	10	20	35
Total	58	87	107	157	210	260	320
Utilisation (%)							
70%	46	66	79	117	134	164	235
80%	53	75	90	134	153	187	265
90%	59	85	102	150	172	211	302

SOURCES: CGS-CIMB RESEARCH ESTIMATES, SNE RESEARCH ESTIMATES

* CGS-CIMB estimates used for LG Chem, Samsung SDI, SK Innovation and Iljin Materials

* SNE Research estimates used for CATL (300750 CH, Not Rated), Guoxuan (002074 CH, Not Rated), Lishen (Not Listed), Panasonic (6752 JP, Not Rated), KCFT (Not Listed), Lingbao Wason Copper Foil (Not Listed), Chang Chun Petrochemical (Not Listed) and Doosan (000150 KS, Not Rated)

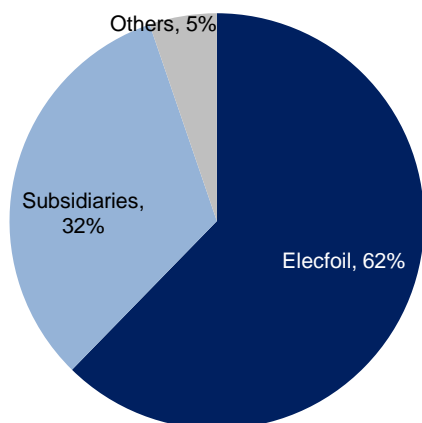
COMPANY BACKGROUND

Iljin Materials (020150 KS), established in 1987, is a company mainly engaged in the production and sale of elecfoils used for secondary lithium batteries, mobile phones and televisions. The company has two main operating divisions: elecfoil business division and energy business division. The company's two major product categories are Iljin Secondary Battery (I2B: low surface profile elecfoil for anode current collector in rechargeable lithium batteries) and Iljin Copper Standard (ICS: general use elecfoil for all electronics).

Iljin Material's elecfoil business division generated 62% of the total revenue (consolidated) as of 3Q19 and specifically, the company's I2B segment for secondary batteries contributed around 68% of the total revenue. Moreover, Iljin Materials enjoys a significant market share of nearly 11%, in terms of sales volume, in the global secondary battery elecfoil market. Huh Jae Myung, the president of the company, is the company's largest shareholder with a 53.3% stake, followed by National Pension Service with 7.2%, respectively, as of Oct 2019.

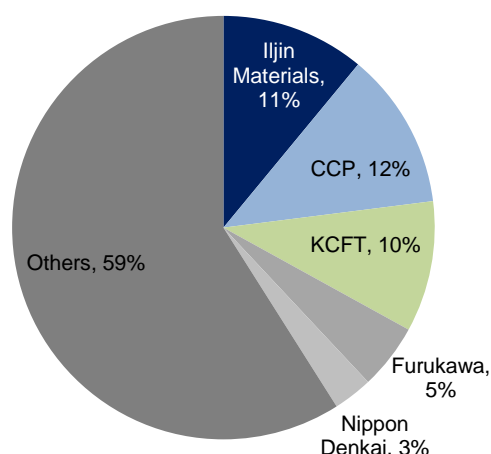
Iljin Materials currently possesses a certain level of technological gap with other competitors in manufacturing very thin copper foil with adequate mechanical strength and smooth surface.

Figure 17: Revenue breakdown by product segments (3Q19)



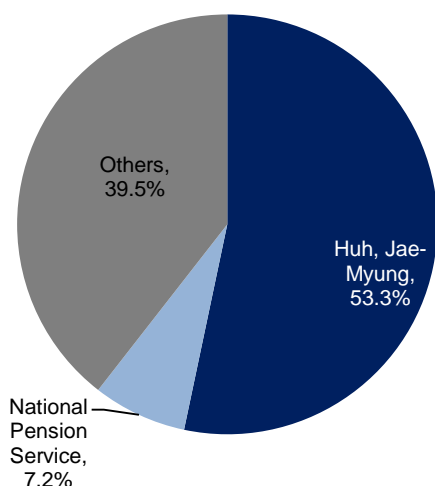
SOURCES: CGS-CIMB RESEARCH, COMPANY REPORTS

Figure 18: I2B market share breakdown (2018)



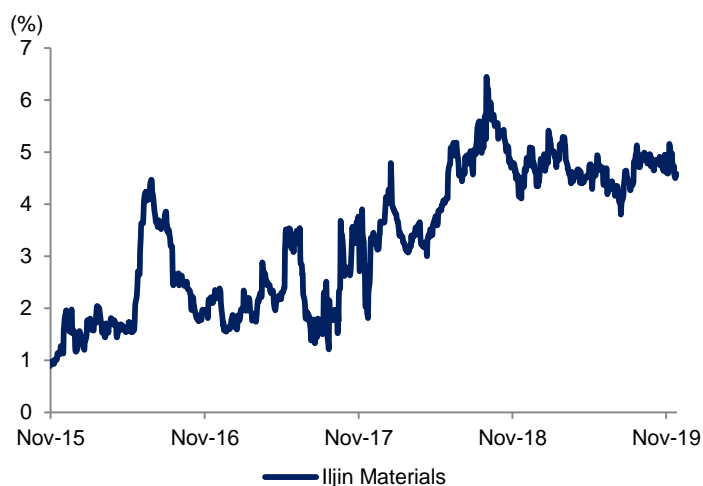
SOURCES: CGS-CIMB RESEARCH, COMPANY REPORTS

Figure 19: Major shareholders of Iljin Materials (Nov 2019)



SOURCES: CGS-CIMB RESEARCH, COMPANY REPORTS

Figure 20: Foreign shareholding ratio (Nov 2019)



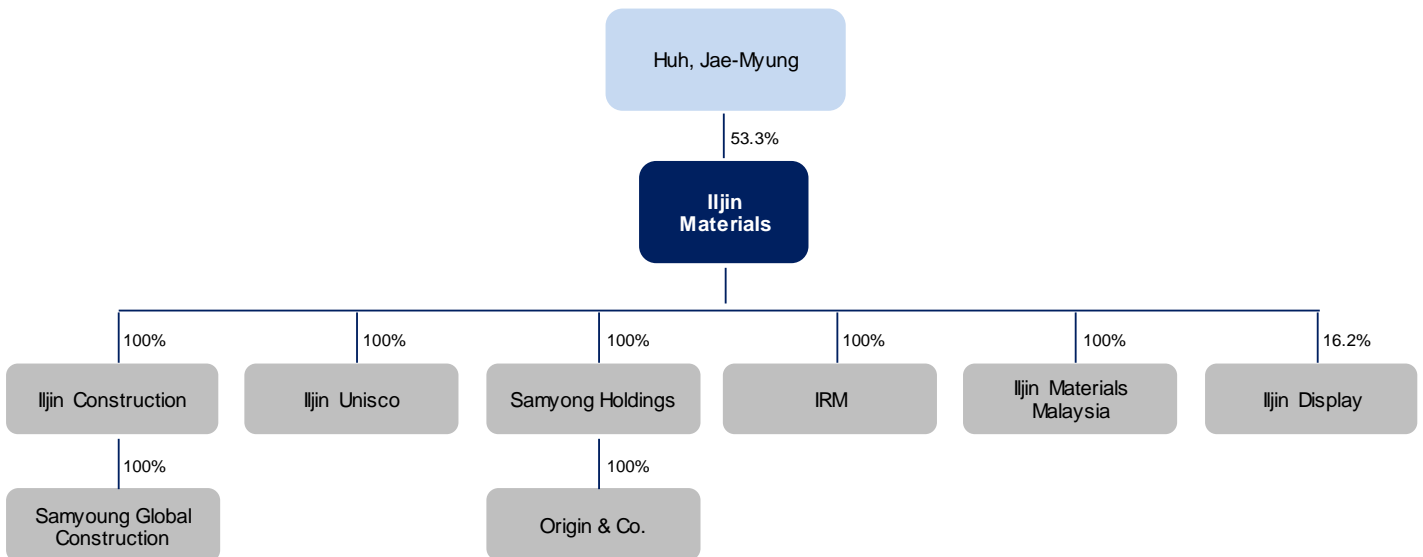
SOURCES: CGS-CIMB RESEARCH, WISE FN

Figure 21: Product category (3Q19)

Business field	Standard	Application
Secondary Battery Materials	I2B (Iljin Secondary Battery)	6, 8, 10, 20 μ m
	LMO (Lithium Manganese Oxide)	Cathode Materials (Dry/Wet Process)
IT Materials	IHT (Iljin High-Temp. Elongation)	High Curve, 12,18 μ m
	ICS (Iljin Copper Standard)	9, 12, 18, 35 μ m
Technology Convergence	Thermal Cu/AL, EMI Shielding, Heat-Responsive, Direct foam Metallized Fabric, Absorber, Masking Tape, Bonding Sheet, Carrier Tape	For Customer's Specification
Raw Materials	NdFeB Bonded Magnet Powder, Compound	B Grade, 14-12, 15-7, 15-9, IM3 & For customer's specification

SOURCES: CGS-CIMB RESEARCH, COMPANY REPORTS

Figure 22: Organisational structure of Iljin Materials (3Q19)



SOURCES: CGS-CIMB RESEARCH, COMPANY REPORTS

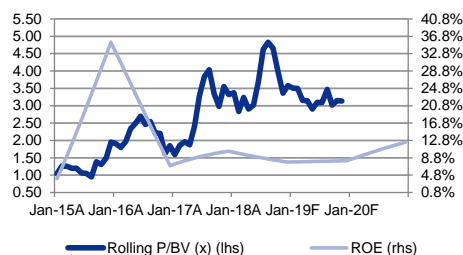
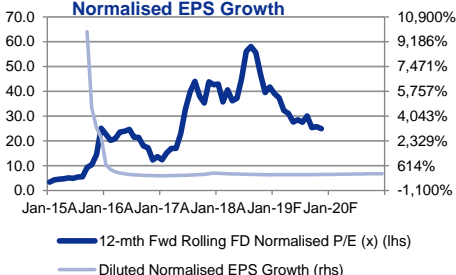
Figure 23: Peer comparison

Company	Bloomberg		TP (Lcy)	Price (Lcy)	Mkt cap (US\$m)	P/E (x)		P/BV (x)		ROE		EV/EBITDA (x)		Div yield		
	Ticker	Recom.				FY19F	FY20F	FY19F	FY20F	FY19F	FY20F	FY19F	FY20F	FY19F	FY20F	
Elecfoil																
Iljin materials	020150	KS	ADD	49,000	39,500	1,545	39.3	23.6	3.0	2.8	8%	12%	18.7	12.9	1.7%	1.7%
SKC	011790	KS	ADD	62,000	46,050	1,466	28.0	11.8	1.1	1.0	4%	9%	8.9	8.0	2.2%	2.2%
Furukawa Electric	5801	JP	NR	na	3,030	1,957	13.7	11.4	0.8	0.8	6%	8%	7.2	6.5	2.7%	2.7%
Mitsui & Co.	8031	JP	NR	na	1,950	31,046	7.5	7.5	0.8	0.7	10%	10%	15.5	15.5	4.2%	4.3%
UACJ Corp	5741	JP	NR	na	2,471	1,091	402.1	15.9	0.6	0.6	0%	4%	12.0	9.2	2.1%	2.4%
Nanya Plastic	1303	TT	NR	na	73	18,858	19.4	16.6	1.6	1.5	8%	9%	20.7	18.2	3.7%	4.5%
Tongling Nonferrous Metals	000630	CH	NR	na	2	3,189	25.7	22.0	1.3	1.3	5%	5%	7.7	7.2	1.4%	1.9%
Shandong Nanshan Aluminium	600219	CH	NR	na	2	3,688	15.8	13.2	0.7	0.7	4%	5%	6.4	5.5	1.8%	2.1%
Total average							20.8	12.1	1.1	1.0	8%	9%	15.8	14.7	3.6%	3.9%

NOTE: DATA FOR NOT RATED COMPANIES IS BASED ON BLOOMBERG CONSENSUS ESTIMATES

SOURCES: CGS-CIMB RESEARCH, BLOOMBERG

*DATA AS AT 28 NOV 2019

BY THE NUMBERS
P/BV vs ROE

12-mth Fwd FD Normalised P/E vs FD Normalised EPS Growth

Profit & Loss

(Wb)	Dec-17A	Dec-18A	Dec-19F	Dec-20F	Dec-21F
Total Net Revenues	454.0	502.0	575.8	767.0	969.7
Gross Profit	81.0	79.5	91.3	138.3	185.4
Operating EBITDA	73.1	73.5	95.3	147.0	195.8
Depreciation And Amortisation	(23.6)	(24.7)	(36.8)	(54.5)	(66.9)
Operating EBIT	49.5	48.7	58.5	92.5	128.9
Financial Income/(Expense)	(0.7)	4.9	3.7	(1.4)	(3.5)
Pretax Income/(Loss) from Assoc.	0.0	0.0	0.0	0.0	0.0
Non-Operating Income/(Expense)	(7.2)	0.1	(0.1)	6.4	2.5
Profit Before Tax (pre-EI)	41.6	53.7	62.0	97.5	127.9
Exceptional Items					
Pre-tax Profit	41.6	53.7	62.0	97.5	127.9
Taxation	0.7	(12.4)	(16.7)	(21.9)	(28.8)
Exceptional Income - post-tax	(0.1)	(0.0)	2.5	0.0	0.0
Profit After Tax	42.2	41.3	47.8	75.6	99.1
Minority Interests	0.0	0.0	0.0	0.0	0.0
Preferred Dividends					
FX Gain/(Loss) - post tax					
Other Adjustments - post-tax					
Preference Dividends (Australia)					
Net Profit	42.2	41.3	47.8	75.6	99.1
Normalised Net Profit	42.2	41.4	45.3	75.6	99.1
Fully Diluted Normalised Profit	42.2	41.4	45.3	75.6	99.1

Cash Flow

(Wb)	Dec-17A	Dec-18A	Dec-19F	Dec-20F	Dec-21F
EBITDA	73.1	73.5	95.3	147.0	195.8
Cash Flow from Inv. & Assoc.	0.0	0.0	0.0	0.0	0.0
Change In Working Capital	(3.4)	(124.3)	17.2	(51.4)	(41.2)
(Incr)/Decr in Total Provisions					
Other Non-Cash (Income)/Expense	30.5	38.5	59.8	88.1	107.9
Other Operating Cashflow	(32.0)	(19.7)	(49.3)	(49.5)	(141.0)
Net Interest (Paid)/Received	1.1	0.9	(0.0)	(1.4)	(3.5)
Tax Paid	0.7	(12.4)	(16.7)	(21.9)	(28.8)
Cashflow From Operations	70.0	(43.5)	106.3	110.8	89.3
Capex	(23.1)	(120.5)	(168.5)	(160.0)	(160.0)
Disposals Of FAs/subsidiaries					
Acq. Of Subsidiaries/investments					
Other Investing Cashflow	(196.4)	58.6	43.0	0.0	0.0
Cash Flow From Investing	(219.5)	(61.9)	(125.5)	(160.0)	(160.0)
Debt Raised/(repaid)					
Proceeds From Issue Of Shares					
Shares Repurchased					
Dividends Paid	(29.9)	0.0	(30.0)	(30.0)	(30.0)
Preferred Dividends					
Other Financing Cashflow	210.1	(18.1)	112.6	169.2	80.0
Cash Flow From Financing	180.2	(18.1)	82.7	139.3	50.0
Total Cash Generated	30.7	(123.5)	63.4	90.1	(20.7)
Free Cashflow To Equity	(149.5)	(105.4)	(19.3)	(49.2)	(70.7)
Free Cashflow To Firm	(149.1)	(104.0)	(17.9)	(45.7)	(64.7)

SOURCES: CGS-CIMB RESEARCH, COMPANY REPORTS

BY THE NUMBERS... cont'd
Balance Sheet

(Wb)	Dec-17A	Dec-18A	Dec-19F	Dec-20F	Dec-21F
Total Cash And Equivalents	250.1	75.8	106.3	128.6	111.5
Total Debtors	70.3	81.4	90.2	146.6	169.0
Inventories	58.5	51.2	82.3	127.1	148.1
Total Other Current Assets	15.6	149.1	130.1	130.1	142.7
Total Current Assets	394.5	357.5	408.8	532.4	571.3
Fixed Assets	175.8	271.5	403.1	508.6	601.7
Total Investments	0.0	0.0	0.0	0.0	0.0
Intangible Assets	4.4	4.3	5.9	6.3	6.9
Total Other Non-Current Assets	75.6	59.0	65.5	97.5	106.9
Total Non-current Assets	255.8	334.7	474.5	612.4	715.4
Short-term Debt	7.9	14.9	51.1	115.4	138.5
Current Portion of Long-Term Debt					
Total Creditors	69.3	79.4	111.6	161.3	174.2
Other Current Liabilities	11.9	14.8	20.7	20.7	22.7
Total Current Liabilities	89.0	109.0	183.4	297.4	335.4
Total Long-term Debt	3.8	5.3	59.6	134.6	161.5
Hybrid Debt - Debt Component					
Total Other Non-Current Liabilities	27.0	49.5	55.0	81.8	89.7
Total Non-current Liabilities	30.8	54.8	114.6	216.4	251.2
Total Provisions	0.0	0.0	0.0	0.0	0.0
Total Liabilities	119.9	163.8	298.0	513.8	586.6
Shareholders' Equity	530.4	528.4	585.3	630.9	700.1
Minority Interests	0.0	0.0	0.0	0.0	0.0
Total Equity	530.4	528.4	585.3	630.9	700.1

Key Ratios

	Dec-17A	Dec-18A	Dec-19F	Dec-20F	Dec-21F
Revenue Growth	13.8%	10.6%	14.7%	33.2%	26.4%
Operating EBITDA Growth	41.5%	0.5%	29.7%	54.3%	33.2%
Operating EBITDA Margin	16.1%	14.6%	16.6%	19.2%	20.2%
Net Cash Per Share (W)	5,184	1,208	(97)	(2,632)	(4,088)
BVPS (W)	11,531	11,460	12,694	13,683	15,183
Gross Interest Cover	N/A	N/A	N/A	N/A	N/A
Effective Tax Rate	0.0%	23.0%	27.0%	22.5%	22.5%
Net Dividend Payout Ratio	70.8%	NA	66.2%	39.7%	30.2%
Accounts Receivables Days	51.46	55.13	54.38	56.49	59.40
Inventory Days	53.82	47.38	50.28	60.94	64.02
Accounts Payables Days	61.46	64.22	71.94	79.45	78.08
ROIC (%)	16.4%	15.3%	11.2%	14.3%	15.5%
ROCE (%)	11.7%	8.9%	9.4%	11.7%	13.7%
Return On Average Assets	8.25%	5.43%	5.29%	7.59%	8.45%

SOURCES: CGS-CIMB RESEARCH, COMPANY REPORTS

South Korea

ADD (previously NOT RATED)

Consensus ratings*: Buy 20 Hold 2 Sell 0

Current price:	W49,000
Target price:	W56,000
Previous target:	N/A
Up/downside:	14.3%
CGS-CIMB / Consensus:	-4.5%
Reuters:	003670.KS
Bloomberg:	003670 KS
Market cap:	US\$2,539m
	W2,988,423m
Average daily turnover:	US\$10.64m
	W12,501m
Current shares o/s:	5.91m
Free float:	34.4%

*Source: Bloomberg

Key changes in this note

N/A



Source: Bloomberg

Price performance	1M	3M	12M
Absolute (%)	2.4	-4.9	-29
Relative (%)	1.2	-14	-29.5

Major shareholders	% held
POSCO	61.3
POSTECH	4.1
Artemis Investment Management LP	4.0

Analyst(s)

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Posco Chemical

All-in-one cathode and anode maker

- Posco Chemical is the sole manufacturer of both cathode and anode components in Korea, and counts LG Chem as a key customer.
- We believe its aggressive expansion of cathode and anode capacity could lead to an operating profit CAGR of 45% over 2020-21F.
- We initiate coverage with an Add rating and SOP-based TP of W56,000. We see over 50% net profit contribution from its battery business in 2021F.

Supplier of both cathode and anode to diversified customers

Posco Chemical is the only producer of both cathode and anode battery materials in Korea. For anode, we expect the company's global market share to be 9% (sales) as at end-2019F as it has a wide range of customers such as major battery makers (LG Chem, Samsung SDI, SK Innovation, and BYD) in electric vehicles (EV)/energy storage system (ESS)/IT. For cathode, we believe its market share could rise rapidly due to aggressive capacity expansion on the back of orders from LG Chem and SDI for EV/ESS use.

Aggressive capacity expansion due to robust financial status

Posco Chemical has been aggressively investing in anode and cathode capacities starting in 2019. It plans to expand anode capacity from 24ktpa in 2018 to 74ktpa by 2021F, and cathode capacity from 8ktpa in 2018 to 50ktpa by 2021F. Given 1) its cashflow from the Posco business, 2) solid balance sheet, and 3) credit leverage from the Posco (group), we believe the company can successfully complete its expansion plans, which should provide it with a competitive edge, in our view.

Transitioning to a high beta battery play from 2021F

We expect Posco Chemical to be a high beta play on the EV battery growth theme as we believe revenue contribution from battery materials (anode/cathode) should rise from 7% in 2018 to 50% in 2021F. Also, we estimate operating profit (OP) contribution from its battery materials business to increase from 21% in 2019F to 47% in 2021F. In the longer term, we think investors should look to Posco Chemical as a high beta battery play.

Robust operating profit CAGR of 45% over 2020-21F

We expect it to deliver an operating profit (OP) CAGR of 45% over 2020-21F on strong sales CAGR of 147% for the EV battery materials (anode/cathode) business over 2020-21F due to capacity expansion. While equity method gains could decrease given PMC Tech's weak earnings (POSCO Chemical holds a 60% stake (as at 3Q19), downside risks should be limited, in our view, given solid needle coke sales volumes.

Initiating coverage with an Add rating and target price of W56,000

We initiate coverage of POSCO Chemical with an Add rating. Our SOP-based target price implies a FY20F P/E of 28x (2017-18 average multiples on market upcycle). Potential re-rating catalysts include new contracts with major battery cell makers. Risks to our call include further deterioration in needle coke prices.

Financial Summary	Dec-17A	Dec-18A	Dec-19F	Dec-20F	Dec-21F
Revenue (Wb)	1,197	1,384	1,493	2,007	2,661
Operating EBITDA (Wb)	118.2	122.7	155.1	235.6	290.7
Net Profit (Wb)	103.6	132.2	110.8	120.0	154.1
Normalised EPS (W)	1,753	2,237	1,877	2,031	2,609
Normalised EPS Growth	137%	28%	(16%)	8%	28%
FD Normalised P/E (x)	27.95	21.90	26.11	24.12	18.78
DPS (W)	350.0	400.0	380.0	450.0	500.0
Dividend Yield	0.71%	0.82%	0.78%	0.92%	1.02%
EV/EBITDA (x)	22.22	21.18	17.57	12.60	10.45
P/FCFE (x)	127.1	49.8	606.2	NA	NA
Net Gearing	(24.3%)	(15.5%)	1.9%	25.2%	29.5%
P/BV (x)	4.49	3.86	2.89	2.63	2.36
ROE	17.2%	19.0%	12.6%	11.4%	13.2%
% Change In Normalised EPS Estimates					
Normalised EPS/consensus EPS (x)			1.01	0.96	0.99

SOURCES: CGS-CIMB RESEARCH, COMPANY REPORTS

VALUATION AND RECOMMENDATION

Initiate coverage with Add and target price of W56k

We value Posco Chemical based on a sum-of-parts (SOP) valuation to reflect different target multiples for its diversified business portfolio. Our valuation combines 1) the value of Posco Chemical's operating business by division, 2) its investment asset value (listed securities and unlisted securities), and subtracts its 3) net debts.

We calculate the value of Posco Chemical's operating business at W3.3tr, derived by applying global peers' average FY20F EV/EBITDA multiple to our FY20F EBITDA estimates for each business (Posco-related business, anode, cathode). For the battery material business, we apply an FY20F EV/EBITDA multiple to Posco Chemical's FY20F EBITDA estimate to reflect its historical two-year average upcycle multiple.

Figure 1: SOP valuation based on CGS-CIMB estimates

A. Core operating value (Wbn)	EBITDA	EV/EBITDA multiple (x)	EV	Note
Posco related business			804.8	
Refractories	22.3	8.5	189.5	10 years mid cycle multiple
Construction	23.0	5.5	126.3	Domestic peers' multiple
Quicklime	34.1	8.0	273.0	10 years mid cycle multiple
Chemicals	39.3	5.5	216.0	Domestic peers' multiple
Anode materials	58.3	20.5	1,195.4	2017-2018 upcycle multiple
Cathode materials	55.6	20.5	1,139.5	2017-2018 upcycle multiple
Others	3.1	8.0	24.4	
Sub Total	235.6		3,164.1	
B. Investment asset value (Wbn)			350.0	60% stake for PMC Tech (needle coke)
C. Net debt (Wbn)			229.5	
D. Preferred shares (Capitalisation, Wbn)			0.0	
NAV (A+B-C-D, Wbn)			3,284.7	
# of shares outstanding (mn)			59.1	
Fair value per share (W)			55,606	
Target price (W)			56,000	
Current price (W)			49,000	
Upside (%)			14%	

SOURCES: CGS-CIMB RESEARCH ESTIMATES, COMPANY REPORTS, BLOOMBERG
DATA AS AT 28 NOV 2019

We cross-checked our target price, a P/E valuation methodology, and derived an implied FY20F P/E multiple of 28x for Posco Chemical. Based on major global peers' normalised EPS growth and historical P/E multiples (2017-18 average) during periods of an upward trajectory in earnings, we think the 28x P/E multiple is justified. The stock currently trades at 23x CY20F P/E.

Figure 2: Posco Chemical – valuation summary

Recommendation	ADD
Current Price (W/shr)	49,000
SOP-based target price (W/shr)	56,000
% upside	14%
	FY20F
EPS (W)	2,031
Implied P/E (x)	28
Selected peers	Umicore, L&F, Xamen Tungsten, Hitachi Chemical
Selected peers' average P/E (x)	30

SOURCES: CGS-CIMB RESEARCH ESTIMATES, COMPANY REPORTS, BLOOMBERG
DATA AS AT 28 NOV 2019

We initiate coverage on Posco Chemical with an Add rating and target price of W56,000. We believe Posco Chemical's share price has underperformed the KOSPI by 20% in the past six months due to 1) negative sentiment on battery materials players due to ESS fire issues, 2) its tepid steel-related business, and 3) declining needle coke price. However, given the potential for growth in its anode and cathode business and earnings visibility over the next three years, we believe its current share price offers a buying opportunity over the long term.

Figure 3: Posco Chemical's 12-month forward P/E band

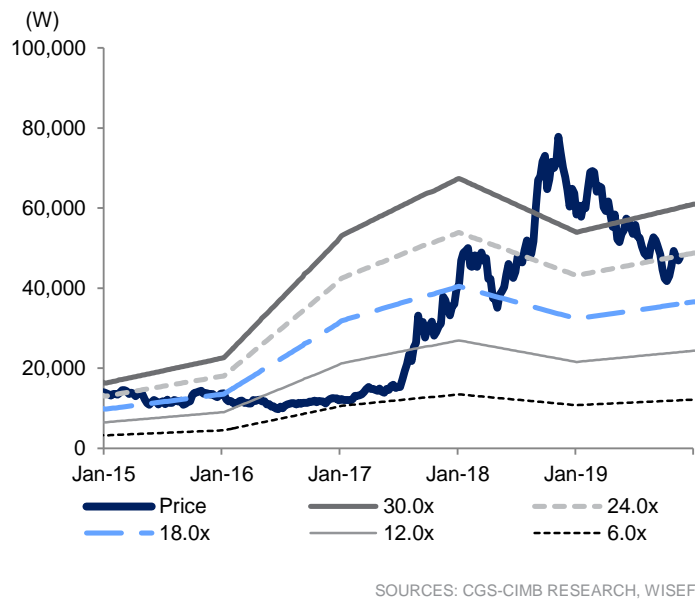
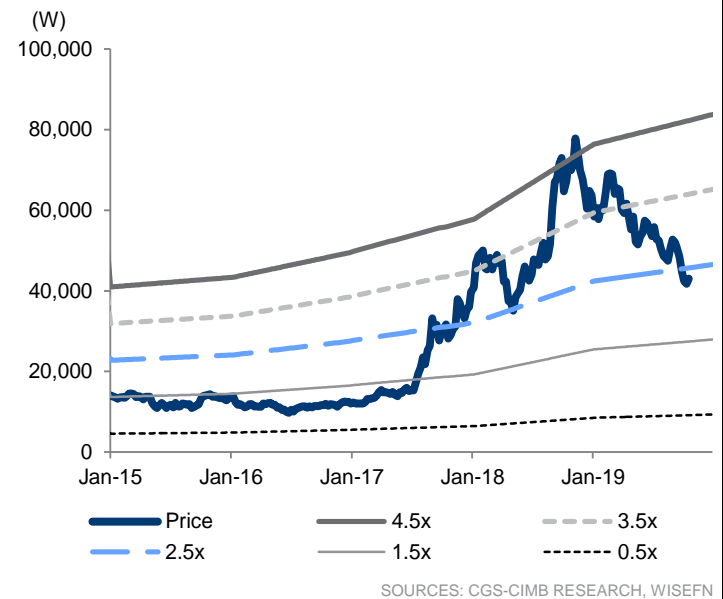


Figure 4: Posco Chemical's 12-month forward P/BV band



Downside risks to our call

Key downside risks include 1) slower-than-expected ramp-up in earnings for its anode and cathode business, 2) weaker-than-expected earnings for its Posco-related business and 3) lower-than-expected needle coke prices due to an increase in supply from China.

We assume Posco Chemical to expand anode capacity from 24ktpa in 2018 to 74ktpa by 2021F, and cathode capacity from 8ktpa in 2018 to 50ktpa by 2021F. The initial yield for new cathode and anode operations are lower than expected on new automotive applications and fast expansion. As such, slower than expected sales recognition could be a key down side risk to our Add rating.

A recovery in its Posco-related business has been slower than expected given the sluggish global economy in 9M19. As contract terms for some orders with captive customers are yet to be finalised, we think it could take a while for earnings to recover, which could pressure the earnings recovery.

Figure 5: Posco Chemical SWOT analysis

Strength	Weakness
- Generation of steady cash flows from refractory and chemical businesses, maintaining high productivity levels	- Posco-related earnings are lower than expected due to a sluggish global economy and yet-to-be fully finalised contract terms with its captive customers.
Opportunity	Threat
- Strong growth potential for the EV battery materials market, due to continuous increase in EV demand, further supported by the rise in battery capacity per EV unit.	- Intensifying competition between global cathode and anode manufacturers could lead to a sharp decrease in the prices of battery materials.

SOURCES: CGS-CIMB RESEARCH, COMPANY REPORTS

EARNINGS FORECASTS

Secured earnings growth due to strong capacity expansion

We expect Posco Chemical to deliver a 45% OP CAGR in 2020-21F on the back of capacity expansion in its battery materials (anode/cathode) business. While we estimate revenue from the anode business should grow from W119bn in 2019F to W338bn in 2021F (+59% yoy p.a. during 2019-21F), cathode revenue could expand from W98bn in 2019F to W978bn in 2021F (+242% yoy p.a. during 2019-21F). As such, we expect OP contribution from its battery materials business to rise from 21% in 2019F (when it started the cathode business) to 36% in 2020F and 47% in 2021F. As we factor in conservative earnings for PMC Tech (Unlisted; 60% stake, equity method gains) stemming from weaker needle coke prices, we believe POSCO Chemical's net profit could grow by 13% in 2020F and 28% in 2021F.

Our FY20-21F EPS forecasts are broadly in line with Bloomberg consensus while we believe that we have a more bullish view on its battery material assumptions in the longer term.

We expect Posco Chemical to report weak near-term earnings due to slower-than-expected anode/cathode sales for ESS /EV battery.

Figure 6: Earnings forecasts

(Wbn)	1Q18	2Q18	3Q18	4Q18	1Q19	2Q19	3Q19	4Q19F	2016	2017	2018	2019F	2020F	2021F
Revenues	337	335	346	366	355	370	372	396	1,118	1,197	1,384	1,493	2,007	2,661
Posco related business	312	302	309	327	311	296	300	319	1,053	1,126	1,250	1,226	1,233	1,274
Refractories	77	64	73	70	74	68	67	64	214	239	284	272	268	287
Construction	62	55	48	56	48	54	52	61	194	213	221	216	236	262
Quicklime	80	84	85	86	88	83	87	88	358	317	335	345	364	389
Chemicals	94	98	103	116	101	91	95	107	287	356	410	394	364	336
Anode materials	17	22	26	26	32	31	27	29	23	38	91	119	252	338
Cathode materials	-	-	-	-	-	31	32	35	-	-	-	98	461	978
Others	8	10	11	12	12	12	13	13	41	33	43	50	61	70
EBITDA	27	25	37	34	31	29	49	41	100	118	123	150	236	291
OP	23	21	33	29	22	17	28	23	85	104	106	90	145	183
Posco related business	22	20	32	28	21	16	27	23	79	101	102	88	90	94
Refractories	8	4	8	5	6	4	3	4	27	25	26	17	16	18
Construction	5	5	4	5	4	3	4	4	20	24	19	14	18	20
Quicklime	4	5	6	8	6	2	7	7	21	22	23	22	24	26
Chemicals	5	6	13	10	6	6	14	8	11	30	35	35	32	30
Anode materials	2	3	4	4	4	4	3	4	2	3	14	14	34	45
Cathode materials	-	-	-	-	-	1	2	1	-	-	-	5	18	41
Others	(1)	(2)	(3)	(3)	(3)	(4)	(5)	(5)	5	(0)	(9)	(17)	3	3
NP	31	32	37	32	33	23	30	25	44	104	132	111	120	154
ROE (%)	19%	19%	21%	17%	17%	11%	12%	8%	8%	17%	19%	13%	11%	13%
OP margin														
Overall	6.8%	6.3%	9.6%	8.0%	6.2%	4.5%	7.5%	5.9%	7.6%	8.7%	7.7%	6.0%	7.2%	6.9%
Posco related business	7.1%	6.6%	10.3%	8.5%	6.9%	5.5%	9.1%	7.2%	7.5%	9.0%	8.1%	7.2%	7.3%	7.3%
Refractories	10.6%	6.9%	11.5%	6.5%	7.9%	6.3%	3.9%	6.5%	12.7%	10.5%	9.0%	6.2%	6.1%	6.1%
Construction	7.4%	8.3%	9.0%	9.6%	7.3%	5.6%	7.4%	6.6%	10.4%	11.1%	8.5%	6.7%	7.4%	7.8%
Quicklime	5.1%	5.5%	7.3%	9.1%	6.7%	3.0%	7.8%	8.0%	5.8%	6.9%	6.8%	6.4%	6.7%	6.7%
Chemicals	5.9%	6.4%	12.5%	8.7%	6.0%	7.0%	14.9%	7.5%	3.8%	8.4%	8.5%	8.8%	8.8%	8.8%
Anode materials	13.0%	14.0%	16.0%	16.0%	11.3%	12.0%	12.0%	13.0%	6.9%	8.4%	15.0%	12.1%	13.3%	13.3%
Cathode materials	-	-	-	-	-	4.0%	7.0%	4.0%	-	-	-	5.0%	4.0%	4.2%
Others	-16.0%	-20.4%	-25.5%	-22.2%	-24.4%	-38.3%	-38.5%	-38.0%	12.0%	-0.2%	-21.4%	-34.8%	5.0%	5.0%
KRW/US\$ (Avg)	1,073	1,077	1,112	1,113	1,126	1,167	1,194	1,188	1,161	1,126	1,094	1,169	1,167	1,156

SOURCES: CGS-CIMB RESEARCH ESTIMATES, COMPANY REPORTS

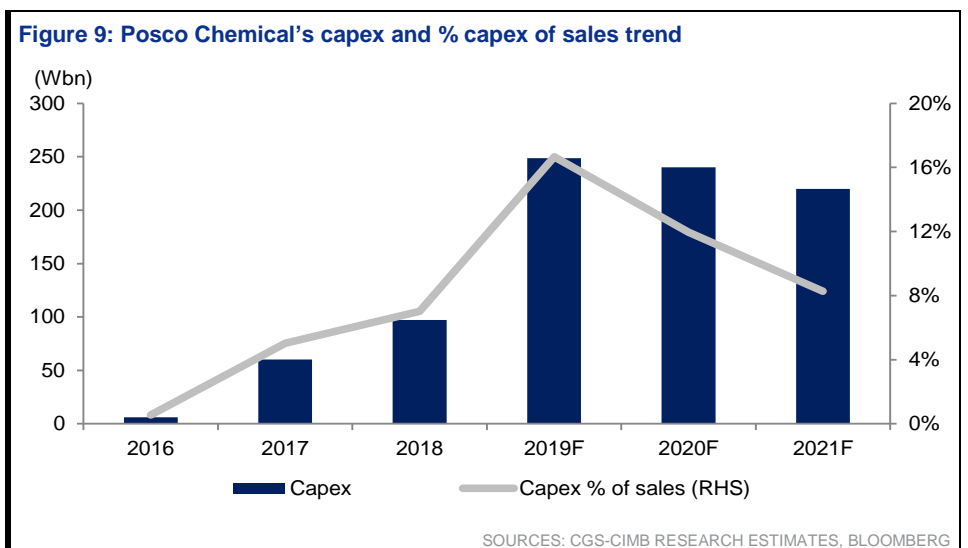
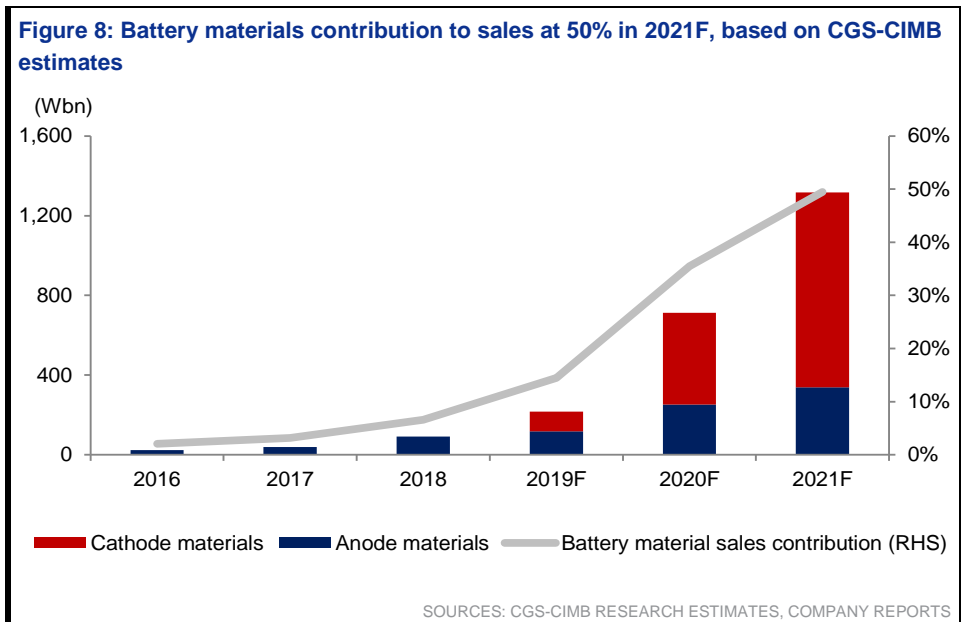
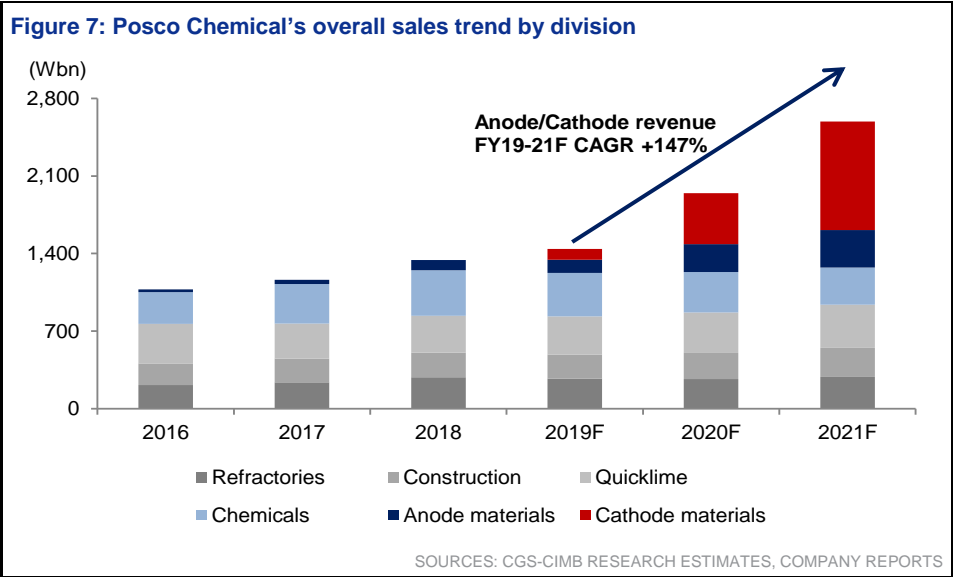
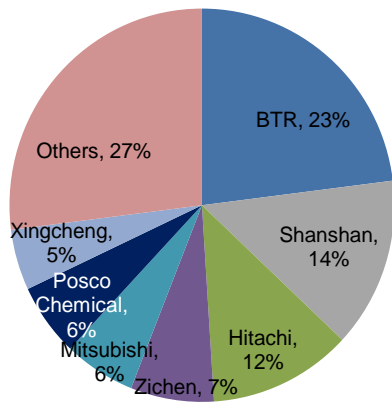
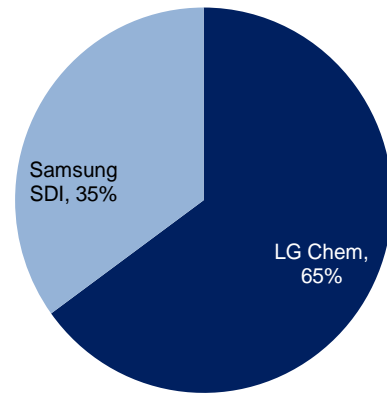


Figure 10: Anode market share in terms of sales volume (2019F) **Figure 11: Posco Chemical's anode customer breakdown (2019F)**

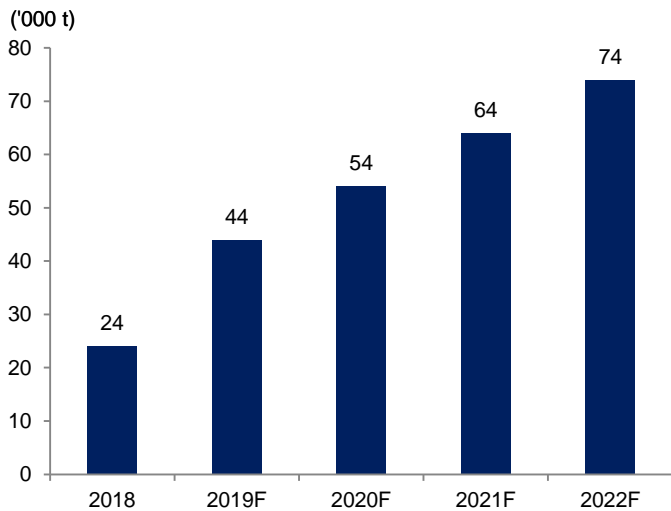


SOURCES: CGS-CIMB RESEARCH ESTIMATES



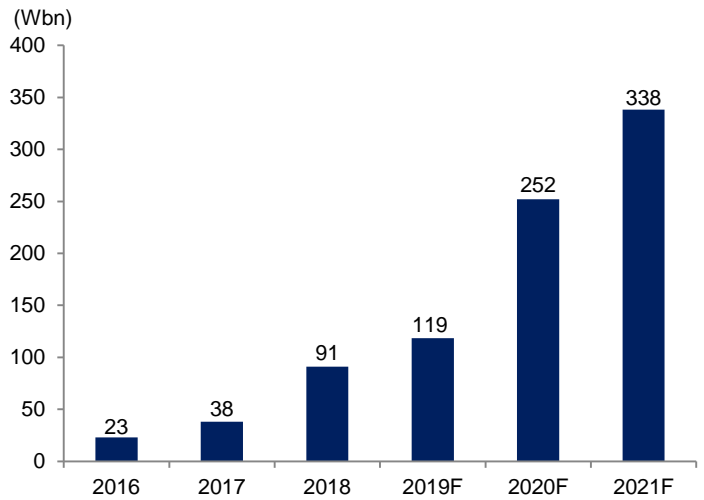
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Figure 12: Anode capacity expansion plan (2019-22F)



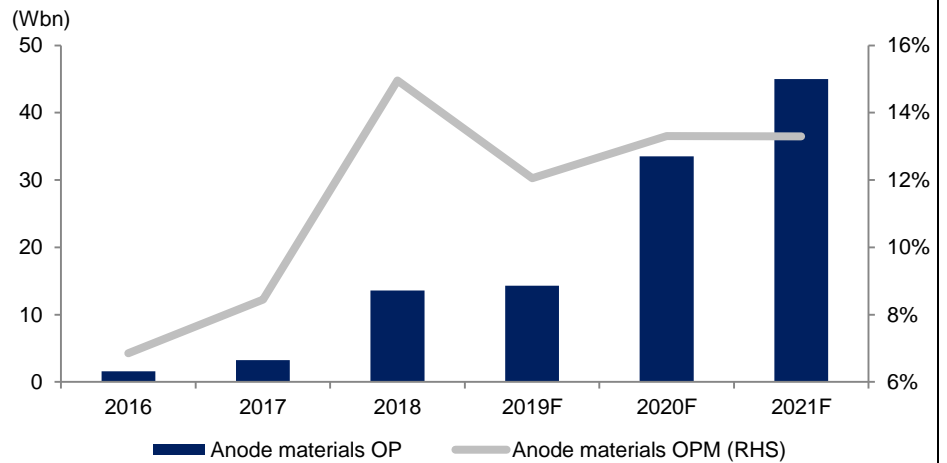
SOURCES: CGS-CIMB RESEARCH ESTIMATES, COMPANY REPORTS

Figure 13: Posco Chemical's anode revenue forecast



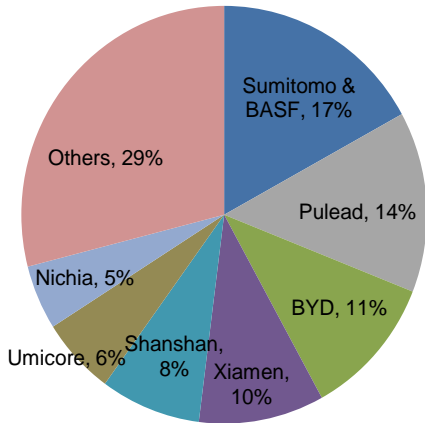
SOURCES: CGS-CIMB RESEARCH ESTIMATES, COMPANY REPORTS

Figure 14: Anode materials OP and OPM trend



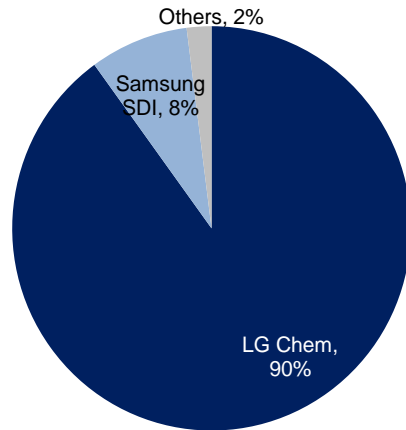
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Figure 15: Cathode market share (2019F) (in terms of sales volume)



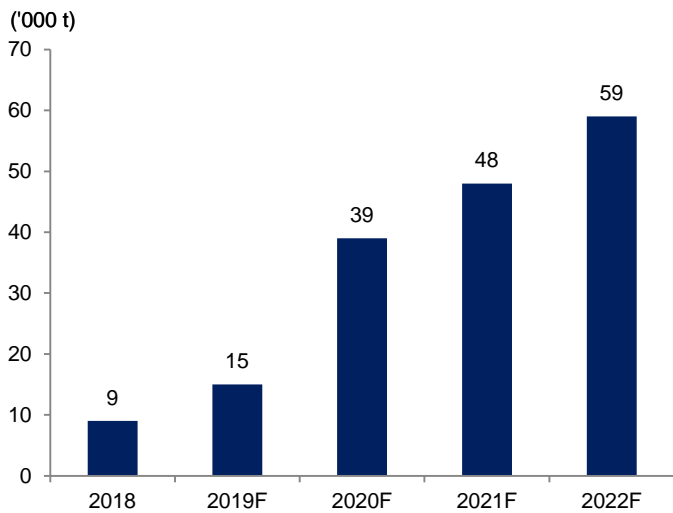
SOURCES: CGS-CIMB RESEARCH ESTIMATES

Figure 16: Posco Chemical's cathode customer breakdown (2019F)



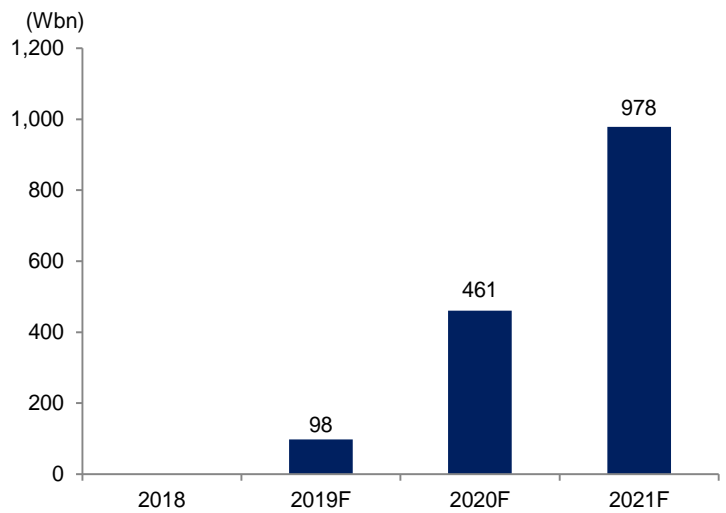
SOURCES: CGS-CIMB RESEARCH ESTIMATES

Figure 17: Cathode capacity expansion plan (2019-22F)



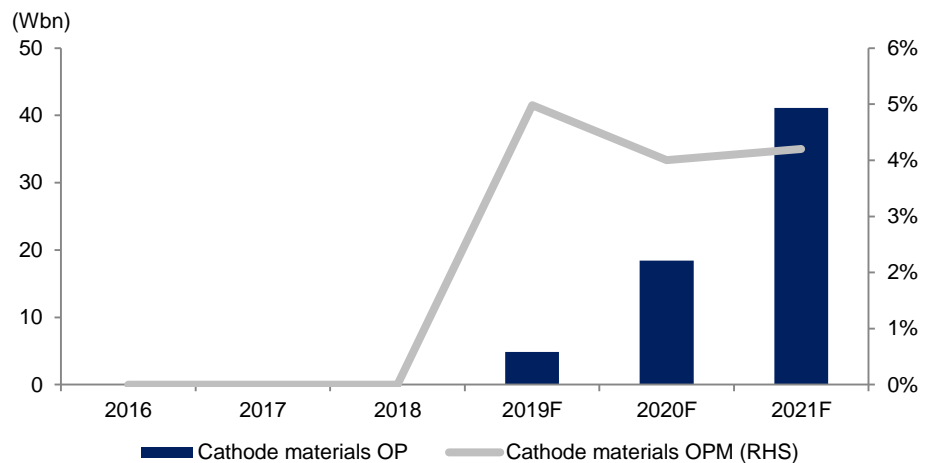
SOURCES: CGS-CIMB RESEARCH ESTIMATES, COMPANY REPORTS

Figure 18: Posco Chemical's cathode revenue forecast



SOURCES: CGS-CIMB RESEARCH ESTIMATES, COMPANY REPORTS

Figure 19: Cathode OP and OPM trend



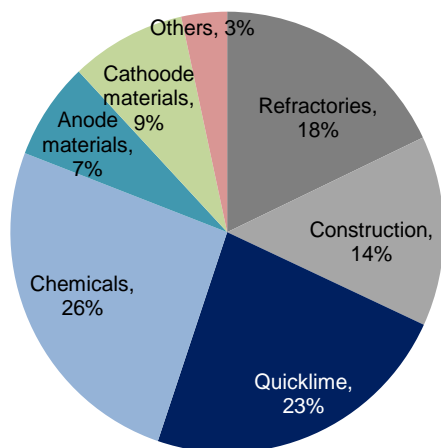
SOURCES: CGS-CIMB RESEARCH ESTIMATES, COMPANY REPORTS

COMPANY BACKGROUND

Posco Chemical (003670 KS) was established in 1971 and has two main business divisions: refractory manufacturing and limestone chemicals. The company's main products are crushed limestone, refractories, secondary battery cathode and anode materials, carbon materials, and coal chemicals.

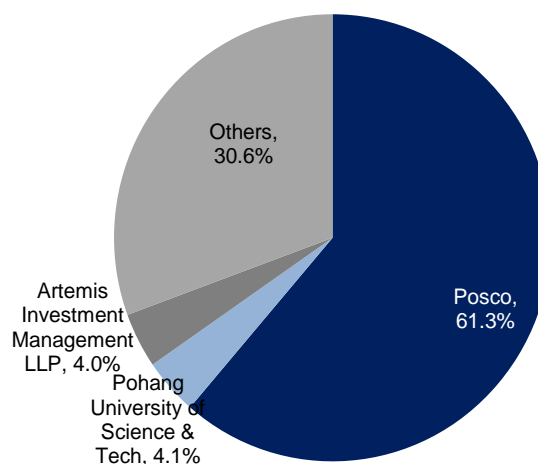
Posco Chemical aims to win a considerable proportion of share in the electric vehicle secondary battery material market. Some recent notable capacity additions include a production plant in Gwangyang with additional manufacturing capacity of 6,000 tonnes of cathode materials annually. Coupled with its existing Gumi plant, the company now has production capacity of 15,000 tonnes of cathode materials. Moreover, we expect the new Gwangyang plant to have total capacity of 59,000 tonnes of cathode materials by 2022F. Posco is the company's dominant shareholder with a 61.3% stake, followed by Posco University of Science & Technology with 4.1% and Artemis Investment Management LP with 4%, as of Nov 2019.

Figure 20: Revenue breakdown by business segments (3Q19)



SOURCES: CGS-CIMB RESEARCH, COMPANY REPORTS

Figure 21: Major shareholders of Posco Chemical (Nov 2019)



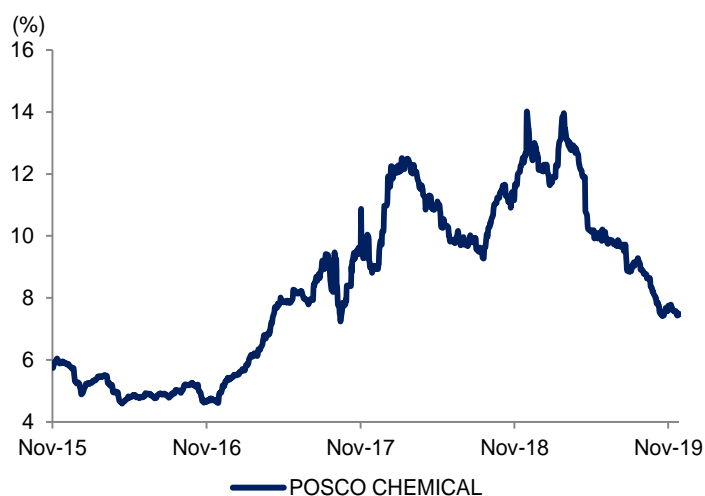
SOURCES: CGS-CIMB RESEARCH, COMPANY REPORTS

Figure 22: New Gwangyang plant under construction (Oct 2019)



SOURCES: CGS-CIMB RESEARCH, COMPANY REPORTS

Figure 23: Ratio of foreign shareholders (Nov 2019)



SOURCES: CGS-CIMB RESEARCH, WISEFVN

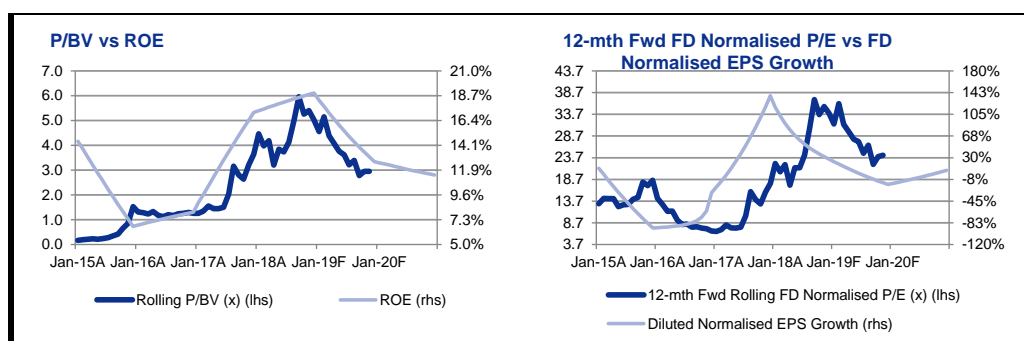
Figure 24: Peer comparison

Company	Bloomberg Ticker	Recom.	TP (Lcy)	Price (Lcy)	Mkt cap (US\$m)	P/E (x)		P/BV (x)		ROE		EV/EBITDA (x)		Div yield	
						FY19F	FY20F	FY19F	FY20F	FY19F	FY20F	FY19F	FY20F	FY19F	FY20F
Cathode															
Posco Chemical	003670 KS	ADD	56,000	49,000	2,534	25.4	23.4	2.8	2.6	13%	11%	17.0	12.3	0.8%	1.0%
Umicore	UMI BB	NR	na	39	10,625	30.4	25.4	3.5	3.4	12%	14%	15.3	13.4	2.0%	2.1%
Nichias	5393 JP	NR	na	2,638	1,635	11.8	10.9	1.4	1.3	12%	12%	6.1	5.4	2.8%	2.9%
BASF	BAS GR	NR	na	69	69,679	17.8	15.2	1.6	1.6	14%	10%	10.1	8.8	4.6%	4.7%
L&F	066970 KS	NR	na	20,700	435	na	29.7	3.5	3.2	2%	12%	33.2	14.9	0.5%	0.5%
Mitsui	8031 JP	NR	na	1,950	31,046	7.5	7.5	0.8	0.7	10%	10%	15.5	15.5	4.2%	4.3%
Ecopro BM	247540 KS	NR	na	50,900	887	27.5	16.3	3.8	3.1	18%	22%	16.2	10.5	0.0%	0.0%
Beijing Easpring Material	300073 CH	NR	na	21	1,327	25.8	18.6	2.6	2.3	10%	12%	19.5	13.0	0.7%	0.9%
Ningbo Shanshan	600884 CH	NR	na	12	1,843	21.7	17.4	1.2	1.1	4%	5%	15.5	12.2	0.5%	0.5%
Xiamen Tungsten	600549 CH	NR	na	12.1	2,421	52.0	31.2	2.3	2.1	3%	5%	na	na	0.5%	0.7%
Cathode average						17.2	14.7	1.6	1.6	13%	10%	12.1	10.9	3.9%	4.0%
Anode															
Mitsubishi Chemical	4188 JP	NR	na	824	11,348	8.4	8.1	0.8	0.8	10%	10%	8.2	7.8	4.9%	4.9%
Hitachi Chemical	4217 JP	NR	na	3,945	7,512	34.7	28.3	1.9	1.8	5%	7%	10.9	9.7	1.5%	1.6%
JFE Holdings	5411 JP	NR	na	1,401	7,866	15.3	9.7	0.4	0.4	3%	5%	8.5	6.7	2.2%	3.3%
Ningbo Shanshan	600884 CH	NR	na	12	1,843	21.7	17.4	1.2	1.1	4%	5%	15.5	12.2	0.5%	0.5%
Anode average						18.1	14.5	1.0	1.0	6%	7%	9.5	8.3	3.0%	3.3%
Total average						17.6	14.6	1.3	1.3	9%	9%	10.8	9.6	3.4%	3.7%

NOTE: DATA FOR NOT RATED COMPANIES IS BASED ON BLOOMBERG CONSENSUS ESTIMATES

SOURCES: CGS-CIMB RESEARCH, BLOOMBERG

*DATA AS AT 28 NOV 2019

BY THE NUMBERS

Profit & Loss

(Wb)	Dec-17A	Dec-18A	Dec-19F	Dec-20F	Dec-21F
Total Net Revenues	1,197	1,384	1,493	2,007	2,661
Gross Profit	156	166	165	236	306
Operating EBITDA	118	123	155	236	291
Depreciation And Amortisation	(14)	(16)	(61)	(90)	(108)
Operating EBIT	104	106	95	145	183
Financial Income/(Expense)	(1)	2	2	(4)	(8)
Pretax Income/(Loss) from Assoc.	29	71	19	0	0
Non-Operating Income/(Expense)	(6)	(2)	11	13	24
Profit Before Tax (pre-EI)	126	177	127	155	199
Exceptional Items					
Pre-tax Profit	126	177	127	155	199
Taxation	(22)	(44)	(16)	(35)	(45)
Exceptional Income - post-tax	0	0	0	0	0
Profit After Tax	104	133	111	120	154
Minority Interests	(0)	(1)	(0)	0	0
Preferred Dividends					
FX Gain/(Loss) - post tax					
Other Adjustments - post-tax					
Preference Dividends (Australia)					
Net Profit	104	132	111	120	154
Normalised Net Profit	104	133	111	120	154
Fully Diluted Normalised Profit	104	132	111	120	154

Cash Flow

(Wb)	Dec-17A	Dec-18A	Dec-19F	Dec-20F	Dec-21F
EBITDA	118.2	122.7	155.1	235.6	290.7
Cash Flow from Inv. & Assoc.	28.6	70.9	18.9	0.0	0.0
Change In Working Capital	(35.9)	(26.2)	12.3	(169.1)	(78.2)
(Incr)/Decr in Total Provisions					
Other Non-Cash (Income)/Expense	24.1	9.4	69.1	99.5	118.0
Other Operating Cashflow	(46.0)	(37.3)	(76.4)	(80.8)	(151.1)
Net Interest (Paid)/Received	1.6	1.3	0.0	(3.7)	(8.1)
Tax Paid	(21.6)	(43.9)	(15.6)	(34.8)	(44.7)
Cashflow From Operations	69.0	96.8	163.4	46.6	126.5
Capex	(60.2)	(97.2)	(248.6)	(240.0)	(220.0)
Disposals Of FAs/subsidiaries					
Acq. Of Subsidiaries/investments					
Other Investing Cashflow	14.0	58.5	90.0	0.0	0.0
Cash Flow From Investing	(46.3)	(38.7)	(158.6)	(240.0)	(220.0)
Debt Raised/(repaid)					
Proceeds From Issue Of Shares					
Shares Repurchased					
Dividends Paid	(20.7)	(23.6)	(22.4)	(26.6)	(29.5)
Preferred Dividends					
Other Financing Cashflow	(2.4)	(5.8)	123.6	176.6	109.5
Cash Flow From Financing	(23.0)	(29.4)	101.2	150.0	80.0
Total Cash Generated	(0.3)	28.7	105.9	(43.4)	(13.5)
Free Cashflow To Equity	22.8	58.1	4.8	(193.4)	(93.5)
Free Cashflow To Firm	24.3	59.6	7.2	(186.5)	(85.0)

SOURCES: CGS-CIMB RESEARCH, COMPANY REPORTS

BY THE NUMBERS... cont'd
Balance Sheet

(Wb)	Dec-17A	Dec-18A	Dec-19F	Dec-20F	Dec-21F
Total Cash And Equivalents	186.5	137.6	173.0	62.8	57.4
Total Debtors	177.4	181.7	234.2	431.7	483.0
Inventories	98.6	108.9	229.3	407.6	467.2
Total Other Current Assets	5.7	11.8	28.2	28.2	30.0
Total Current Assets	468.3	440.0	664.6	930.3	1,037.6
Fixed Assets	182.7	263.5	647.1	796.9	909.3
Total Investments	116.9	187.2	197.5	213.8	231.4
Intangible Assets	5.9	7.1	13.6	14.7	15.9
Total Other Non-Current Assets	62.1	49.9	53.9	91.0	96.9
Total Non-current Assets	367.6	507.7	912.1	1,116.3	1,253.5
Short-term Debt	5.1	4.5	21.1	37.5	46.3
Current Portion of Long-Term Debt					
Total Creditors	138.7	125.0	310.9	517.6	549.6
Other Current Liabilities	15.1	23.3	38.9	38.9	41.4
Total Current Liabilities	158.9	152.7	370.9	594.0	637.3
Total Long-term Debt	22.7	15.7	171.2	304.8	376.0
Hybrid Debt - Debt Component					
Total Other Non-Current Liabilities	2.1	21.1	22.8	38.5	41.0
Total Non-current Liabilities	24.8	36.8	194.0	343.3	417.0
Total Provisions	0.0	0.0	0.0	0.0	0.0
Total Liabilities	183.7	189.5	564.9	937.3	1,054.3
Shareholders' Equity	644.5	749.6	1,003.0	1,100.6	1,228.1
Minority Interests	7.7	8.5	8.8	8.8	8.8
Total Equity	652.2	758.1	1,011.8	1,109.3	1,236.8

Key Ratios

	Dec-17A	Dec-18A	Dec-19F	Dec-20F	Dec-21F
Revenue Growth	7.1%	15.6%	7.9%	34.4%	32.6%
Operating EBITDA Growth	18.4%	3.8%	26.4%	51.9%	23.4%
Operating EBITDA Margin	9.9%	8.9%	10.4%	11.7%	10.9%
Net Cash Per Share (W)	2,687	1,987	(327)	(4,731)	(6,176)
BVPS (W)	10,910	12,690	16,980	18,632	20,790
Gross Interest Cover	N/A	N/A	N/A	N/A	N/A
Effective Tax Rate	17.2%	24.8%	12.4%	22.5%	22.5%
Net Dividend Payout Ratio	20.0%	17.9%	20.2%	22.2%	19.2%
Accounts Receivables Days	49.24	47.37	50.85	60.72	62.74
Inventory Days	27.13	31.10	46.49	65.82	67.80
Accounts Payables Days	40.60	39.52	59.92	85.62	82.71
ROIC (%)	34.1%	28.1%	19.9%	17.0%	15.1%
ROCE (%)	16.2%	14.6%	9.5%	11.0%	11.8%
Return On Average Assets	13.5%	14.7%	8.6%	6.8%	7.5%

SOURCES: CGS-CIMB RESEARCH, COMPANY REPORTS

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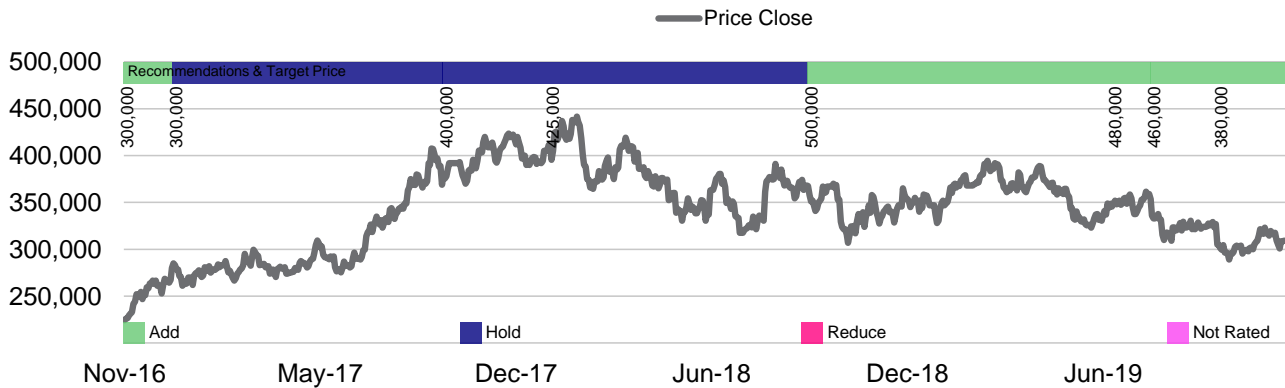
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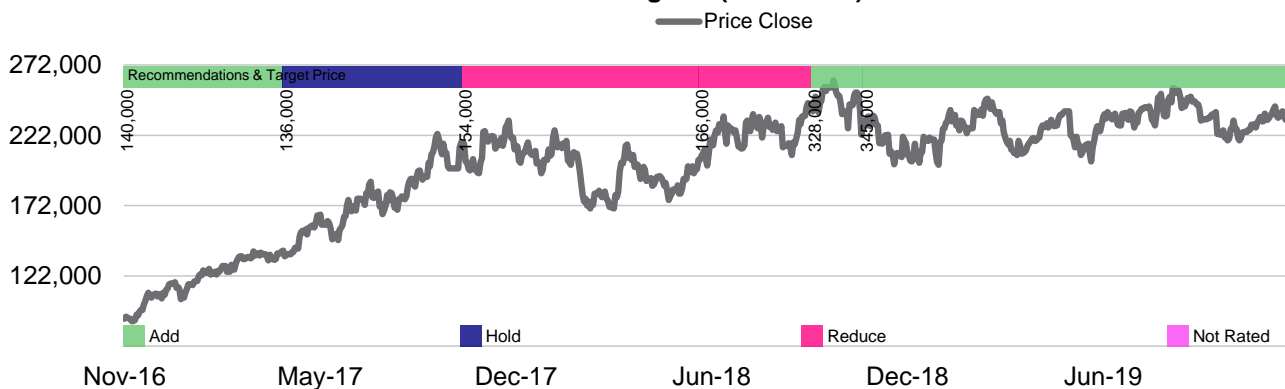
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Samsung SDI (006400 KS)



Corporate Governance Report of Thai Listed Companies (CGR). CG Rating by the Thai Institute of Directors Association (Thai IOD) in 2018, Anti-Corruption 2018

ADVANC – Excellent, Certified, **AEONTS** – Good, n/a, **AH** – Very Good, n/a, **AMATA** – Excellent, Declared, **ANAN** – Excellent, Declared, **AOT** – Excellent, Declared, **AP** – Excellent, Certified, **ASP** – Very Good, Certified, **BANPU** – Excellent, Certified, **BAY** – Excellent, Certified, **BBL** – Very Good, Certified, **BCH** – Good, Certified, **BCP** – Excellent, Certified, **BCPG** – Excellent, Certified, **BEM** – Very Good, n/a, **BDMS** – Very Good, n/a, **BEAUTY** – Good, n/a, **BEC** – Very Good, n/a, **BGRIM** – Very Good, Declared, **BH** – Good, n/a, **BJC** – Very Good, Declared, **BJCHI** – Very Good, Certified, **BLA** – Very Good, Certified, **BPP** – Very Good, Declared, **BR** – Good, Declared, **BTS** – Excellent, Certified, **CBG** – Very Good, n/a, **CCET** – Good, n/a, **CENTEL** – Very Good, Certified, **CHG** – Very Good, Declared, **CK** – Excellent, n/a, **COL** – Excellent, Declared, **CPALL** – Very Good, Certified, **CPF** – Excellent, Certified, **CPN** – Excellent, Certified, **DELTA** – Excellent, n/a, **DEMCO** – Excellent, Certified, **DDD** – Very Good, Declared, **DIF** – not available, n/a, **DREIT** – not available, n/a, **DTAC** – Excellent, Certified, **EA** – Excellent, n/a, **ECL** – Very Good, Certified, **EGCO** – Excellent, Certified, **EPG** – Very Good, n/a, **ERW** – Very Good, n/a, **GFPT** – Excellent, Certified, **GGC** – Excellent, Certified, **GLOBAL** – Very Good, n/a, **GLOW** – Very Good, Certified, **GPSC** – Excellent, Certified, **GULF** – Very Good, n/a, **GUNKUL** – Excellent, Certified, **HANA** – Excellent, Certified, **HMPRO** – Excellent, Certified, **HREIT** – Excellent, Certified, **ICHI** – Excellent, Declared, **HUMAN** – not available, n/a, **III** – Good, n/a, **INTUCH** – Excellent, Certified, **IRPC** – Excellent, Certified, **ITD*** – Very Good, n/a, **IVL** – Excellent, Certified, **JASIF** – not available, n/a, **JWD** – Very Good, n/a, **KBANK** – Excellent, Certified, **KCE** – Excellent, Certified, **KKP** – Excellent, Certified, **KSL** – Excellent, Certified, **KTB** – Excellent, Certified, **KTC** – Excellent, Certified, **LH** – Very Good, n/a, **LPN** – Excellent, Certified, **M** – Very Good, Certified, **MACO** – Very Good, n/a, **MAJOR** – Very Good, n/a, **MAKRO** – Excellent, Declared, **MALEE** – Very Good, Certified, **MC** – Very Good, Certified, **MCOT** – Excellent, Certified, **MEGA** – Very Good, n/a, **MINT** – Excellent, Certified, **MTC** – Excellent, Declared, **NETBAY** – Good, n/a, **OSP** – not available, n/a, **PLANB** – Excellent, Declared, **PLAT** – Very Good, Certified, **PR9** – not available, n/a, **PSH** – Excellent, Certified, **PSTC** – Good, Certified, **PTT** – Excellent, Certified, **PTTEP** – Excellent, Certified, **PTTGC** – Excellent, Certified, **QH** – Excellent, Certified, **RATCH** – Excellent, Certified, **ROBINS** – Excellent, Certified, **RS** – Very Good, n/a, **RSP** – not available, n/a, **S** – Very Good, n/a, **SAMART** – Excellent, n/a, **SAPPE** – Very Good, Declared, **SAT** – Excellent, Certified, **SAWAD** – Very Good, n/a, **SC** – Excellent, Declared, **SCB** – Excellent, Certified, **SCC** – Excellent, Certified, **SCN** – Very Good, Certified, **SF** – Good, n/a, **SIRI** – Very Good, Certified, **SPA** – Good, n/a, **SPALI** – Excellent, n/a, **SPRC** – Excellent, Certified, **STA** – Very Good, Certified, **STEC** – Excellent, n/a, **SVI** – Excellent, Certified, **SYNEX** – Very Good, Declared, **TASCO** – Excellent, Certified, **TCAP** – Excellent, Certified, **THANI** – Excellent, Certified, **TIPCO** – Very Good, Certified, **TISCO** – Excellent, Certified, **TKN** – Very Good, Declared, **TMB** – Excellent, Certified, **TNR** – Very Good, Declared, **TOP** – Excellent, Certified, **TPCH** – Good, n/a, **TPIPP** – Good, n/a, **TRUE** – Excellent, Certified, **TU** – Excellent, Certified, **TVO** – Very Good, Declared, **UNIQ** – Good, n/a, **VGI** – Excellent, Certified, **WHA** – Excellent, Certified, **WHART** – not available, n/a, **WICE** – Very Good, Certified, **WORK** – Good, n/a.

Companies participating in Thailand's Private Sector Collective Action Coalition Against Corruption programme (Thai CAC) under Thai Institute of Directors (as of August 31, 2018) are categorized into:

- Companies that have declared their intention to join CAC, and
- Companies certified by CAC

* The company, its director or management had been reportedly accused for breaching proper corporate governance such as violation of the SEC's regulations or charged with

corruption.

Recommendation Framework

Stock Ratings

Definition:

- Add** The stock's total return is expected to exceed 10% over the next 12 months.
- Hold** The stock's total return is expected to be between 0% and positive 10% over the next 12 months.
- Reduce** The stock's total return is expected to fall below 0% or more over the next 12 months.

The total expected return of a stock is defined as the sum of the: (i) percentage difference between the target price and the current price and (ii) the forward net dividend yields of the stock. Stock price targets have an investment horizon of 12 months.

Sector Ratings

Definition:

- Overweight** An Overweight rating means stocks in the sector have, on a market cap-weighted basis, a positive absolute recommendation.
- Neutral** A Neutral rating means stocks in the sector have, on a market cap-weighted basis, a neutral absolute recommendation.
- Underweight** An Underweight rating means stocks in the sector have, on a market cap-weighted basis, a negative absolute recommendation.

Country Ratings

Definition:

- Overweight** An Overweight rating means investors should be positioned with an above-market weight in this country relative to benchmark.
- Neutral** A Neutral rating means investors should be positioned with a neutral weight in this country relative to benchmark.
- Underweight** An Underweight rating means investors should be positioned with a below-market weight in this country relative to benchmark.

#03c

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