Industry Note

May 22, 2020

Energy/Rechargeable Battery

OVERWEIGHT

Green New Deal, energy conversion, Battery Day

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Major issues and conclusions

- Europe and South Korea to implement Green New Deal to overcome COVID-19.
- Introduced in the namesake book by Jeremy Rifkin, *The Green New Deal* stresses the importance of renewable energy and smart infrastructure such as IoT.
- The accelerating pace of energy conversion to help highlight Korean companies with core technologies.

Industry and stock outlook

- Companies specializing in rechargeable batteries, solar cells and fuel cells merit attention.
- Tesla's "Battery Day" to help remove uncertainties and highlight the strength of Korea-based rechargeable battery players.

Europe to overcome COVID-19 with Green New Deal, pursue energy conversion

According to a draft report obtained by Reuters, the EU is believed to have planned to expand environmentally friendly investments to recover from the economic downturn caused by COVID-19. It will be announced on May 27. The key is building renovation, renewable energy and clean hydrogen investments. The main points are:

1. Enhance energy efficiency and reduce the consumer cost burden through Investments.
2. Invest EUR25bn to increase renewable energy capacity by 15GW over the next two years.
3. Loan EUR10bn from the European Investment Bank to invest in renewable energy and clean hydrogen projects.

Additionally, Bloomberg noted that the EU is considering drawing up tax policies to promote EV sales, including the exemption of VAT (approximately 20%) for EVs, and investing in charging infrastructure.

Clean hydrogen refers to green hydrogen that produces hydrogen in conjunction with renewable energy. Reuters predicted that green hydrogen will play a key role in the EU's drive toward decarbonation by 2050. We previously analyzed the role of hydrogen in the overall hydrogen industry and energy conversion through our report *The Dawning of the Hydrogen Economy* published on Mar 10, 2020.

Last December, the EU, excluding Poland, agreed to the European Green Deal to achieve its carbon-neutral goal by 2050. Since the EU, by the middle of this year, plans to raise the current target of cutting carbon emissions by 40% to 55% by 2030, the recent EU moves can also be understood in this context. The Kyoto Protocol will expire in 2021 and the new climate framework (Paris Agreement) adopted in Paris in 2015 will go into effect. In many ways, 2020 will be an important year for the energy industry.

South Korea to implement Green New Deal to move beyond COVID-19

South Korea is also planning a post-Corona economic recovery through the Korean version of the Green New Deal. *The Green New Deal* is also the title of the recently published book by futurist Jeremy Rifkin. He has been involved in the energy conversion policies of China and the EU. In his books *Entropy*, *The Age of Access,* and *The Hydrogen Economy*, Jeremy Rifkin has since the early 2000s warned that the future of humanity is unsustainable unless we rapidly shift our paradigm to move beyond a fossil-energy-centric society.

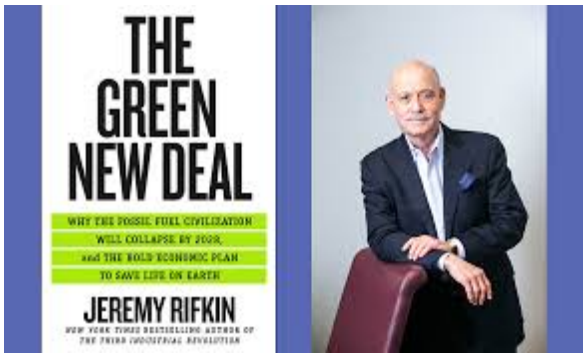
The above book highlights the link between renewable energy and digital infrastructure. Renewable energy sources such as solar and wind can be unstable on own their own as they are intermittent energy sources, but if applied to smart infrastructure such as energy storage technology (rechargeable battery, hydrogen) and IoT, energy conversion can gain pace.
The gist of the Green New Deal is to develop a sustainable society through this energy transition. Korea's decision to include the Green New Deal into the Korean New Deal, which focuses on digital infrastructure investments, should create considerable synergies.

Fig 1. Types of hydrogen by production method

	Definition	Method	Pros	Cons
Grey hydrogen	Hydrogen extracted from fossil fuel	Natural gas steam methane reforming Coal gasification	Low production cost	High-carbon hydrogen
Blue hydrogen	Based on grey hydrogen; carbon capture & storage (CCS)	Natural gas steam methane reforming Coal gasification	CO2 production neutral if CCS is applied	Depends on fossil fuel CCS cost & limitations
Green hydrogen	CO2 free	Water electrolysis using renewable energy NH3 decomposition Biological hydrogen	CO2 free Zero cost if there is sufficient renewable energy	Renewable energy infrastructure needed

Source: Media reports, Korea Energy Economics Institute, Hyundai Motor Securities

Fig 2. Jeremy Rifkin



Source: Hyundai Motor Securities

Fig 3. Korean edition of Jeremy Rifkin's book

Source: Yes24, Hyundai Motor Securities

Green New Deal promotes linkage between renewable energy and IT infrastructure

The gist of *The Green New Deal* is to link power generation plants such as solar and wind power to IT infrastructure such as IoT, and in the process, the importance of energy storage technology will be highlighted greatly. In particular, the rechargeable battery technology used in ESS and EVs will be spotlighted as a key technology that can accelerate energy conversion. This is because it plays a critical role in resolving the "intermittence" issue of renewable energy and securing "flexibility." It also helps improve energy efficiency. Last year, the Nobel Prize in Chemistry was awarded to three individuals who contributed to the development of the lithium-ion battery industry, and it is worth noting that the Nobel Committee's comment, "It (lithium-ion battery) can also store significant amounts of energy from solar and wind power, making possible a fossil fuel-free society."

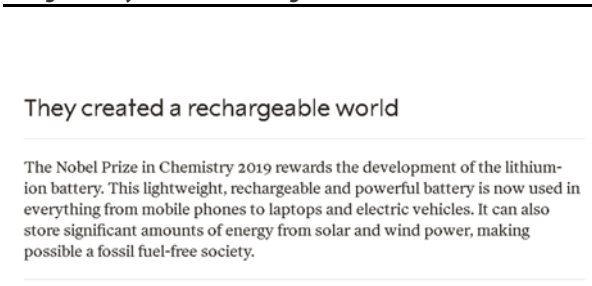
Hydrogen is also expected to play a role as a large energy storage device. The key to the hydrogen economy being pursued in each country is to decompose water using surplus renewable energy (which is intermittently generated), produce and store hydrogen, and use it for power generation or transportation, with the support of fuel cells, if necessary. In the long run, EVs or FCEVs will not only be connected to the grid to recharge, but will also evolve into a new industry by sharing their surplus power and supplying electricity to homes and communities.

Reuters recently reported that Tesla aims to become a traditional energy supplier such as Pacific Gas & Electric or Tokyo Electric Power by producing 1mn miles of batteries with CATL to be used as secondary and tertiary sources. Last year, Elon Musk even said Tesla Energy would become a global utility provider in the future, and it would eventually outgrow its automotive business.

In addition, Tesla has been developing S/W to control energy storage devices, and it recently developed "Autobidder," a real-time energy trading platform, which is known to be applied to Australia's energy storage system called "Tesla Big Battery." Meanwhile, Toyota introduced the "Woven City," a smart city where hydrogen is used as a power source. The key is energy storage, application technology, and IT.

After the coronavirus pandemic is contained, the eco-friendly growth paradigm is expected to accelerate further, highlighting the mid- to long-term growth potential of major relevant companies in South Korea. LG Chem (051910.KS, BUY) and Samsung SDI (006400.KS, BUY) are leaders of energy storage technology, which is the core of the global Green New Deal. Hanwha Solution (009830.KS, BUY) is recognized for its technology as it is the number one operator of solar energy businesses in major economies such as the US, Europe, and Japan. Doosan Purecell (336260.KS, BUY) is an heir to the legacy of UTC Power, a company that has a storied history of participating in the Apollo project in the 1960s, has the longest history among global fuel cell companies and boasts a stable track record.

Fig 4. "They created a rechargeable world"

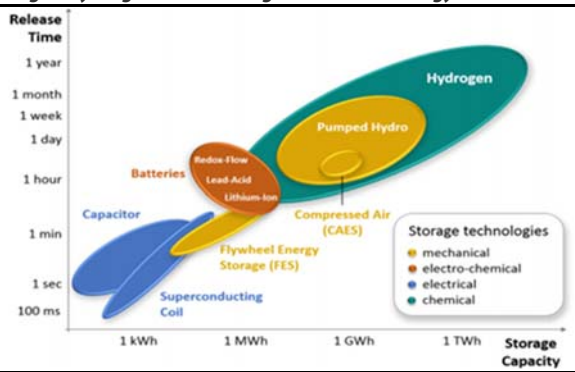


They created a rechargeable world

The Nobel Prize in Chemistry 2019 rewards the development of the lithium-ion battery. This lightweight, rechargeable and powerful battery is now used in everything from mobile phones to laptops and electric vehicles. It can also store significant amounts of energy from solar and wind power, making possible a fossil fuel-free society.

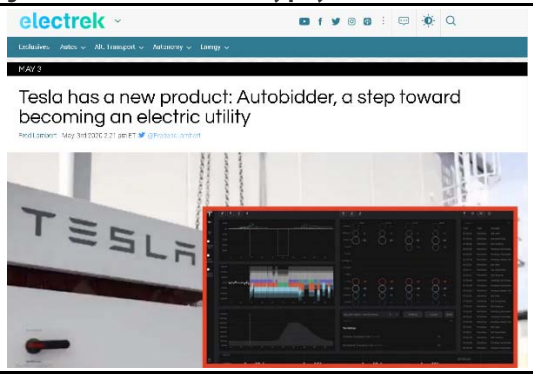
Source: Nobel Committee, Hyundai Motor Securities

Fig 5. Hydrogen stores a large amount of energy



Source: Korea Development Bank, IDT, Hyundai Motor Securities

Fig 6. Will Tesla become a utility player?



Source: electrek, Hyundai Motor Securities

Fig 7. Tesla's batteries and electric power business

Exclusive: Tesla's secret batteries aim to rework the math for electric cars and the grid

Norihiko Shirouzu, Paul Lienert 7 MIN READ

(Reuters) - Electric car maker Tesla Inc (TSLA.O) plans to introduce a new low-cost, long-life battery in its Model 3 sedan in China later this year or early next that it expects will bring the cost of electric vehicles in line with gasoline models, and allow EV batteries to have second and third lives in the electric power grid.

Source: Korea Development Bank, IDT, Hyundai Motor Securities

Fig 8. Hydrogen cars supplying homes with electricity

Source: Hyundai Motor Securities

Fig 9. Toyota Woven City

Source: Toyota, Hyundai Motor Securities

Tesla Battery Day to remove uncertainty and serve to highlight Korea's battery technology

We believe Tesla's Battery Day will serve as an opportunity to highlight the strength of Korean rechargeable battery names and ease uncertainties. Some are concerned about Tesla's potential internalization of battery technologies but we believe there is little possibility of the rapid internalization of such technologies and that Tesla's partnership with battery makers will grow going forward. Tesla suffered a setback in its battery supply last year due to the growing conflict with Panasonic over the battery internalization issue. If Tesla, which currently relies on battery makers, pushes for rapid internalization, it may have some problems ensuring a stable supply of batteries from its supply chain.

In the long term, the 100% internalization of battery technology is not necessarily positive, because it will be difficult to respond to a technological breakthrough if that happens externally. There is still a great deal of research that needs to be carried out in the field of batteries, and it is hard to predict how the development will unfold. This is why battery cell companies choose open innovation and diversify their supply chains. Accordingly, Tesla may move to build some capacity of their own but it will still continue to work with Korean companies with top-notch technology because the full internalization of battery production can be risky.

Korean companies are willing to invest heavily. LG Chem is believed to be planning to greatly expand its cylindrical battery capacity (currently 15GWh) by the end of the year as it begins supplying Tesla's Shanghai factory. We estimate that Tesla needs roughly 9GWh of batteries needed to produce 150,000 units of its Model 3/Y. This means that with increased capacity, LG Chem can supply 300,000 units of Model 3/Y.

Technologies that can enhance battery performance are also being developed by Korean companies. At LG Chem, high-nickel anodes on par with NCM811 are already being used, silicon is added to cathodes, and carbon nano tube (CNT) is used as an anode conductor (LG Chem recently announced the expansion of its CNT plant in Yeosu, from 500TPA to 1,700TPA).

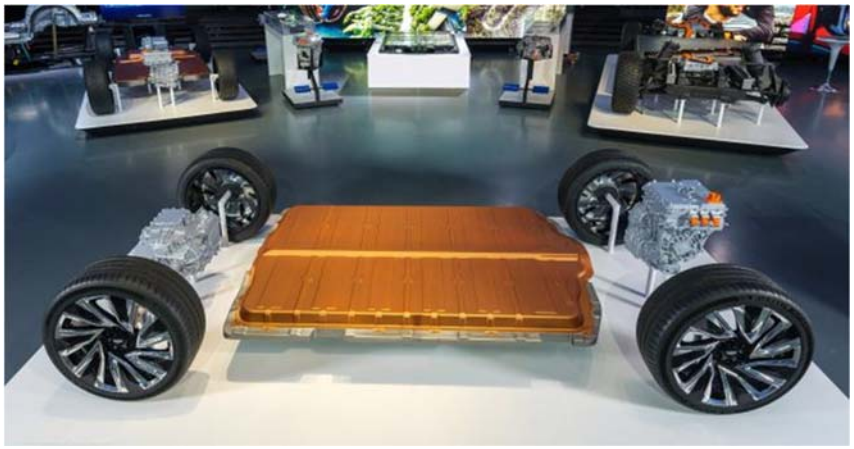
There is a possibility of Tesla using NCMA anode materials in the long run, and LG Chem is already set to be the first to use NCMA anode materials through the Ultium battery that it jointly developed with GM. In particular, the Ultium battery is said to have reduced the use of cobalt by 70% vs. the current NCM622 battery and increased the use of nickel by 85% to improve the energy density by 40%. This will work to reduce the use of cobalt by around 5%, so with the exception of LFP chemistry which has limitations in energy density, it is likely to become the chemistry most closely resembling a zero-cobalt battery, which is Tesla's target.

We believe Samsung SDI will mass-produce GEN5 batteries from the end of this year with an increased use of nickel vs. lower use of cobalt, leading to significantly improved energy density. Korean companies are continuing to make significant advancements in battery technologies.

The fact that China's CATL is still using LFP chemistry is a telltale sign of the widening technology gap. From 2H20, Model 3s using CATL's battery will be produced in China, with a driving range of around 250km on a single charge, the shortest among Standard Range models. The media reports that NCM batteries will be supplied to Tesla in the future, suggesting that it does not see much potential in LFP chemistry in the long term.

To sum up, the delayed Tesla Battery Day will help clear up uncertainties and rather serve as an opportunity to once again confirm the competitiveness of Korean rechargeable battery makers.

Fig 10. Ultium battery

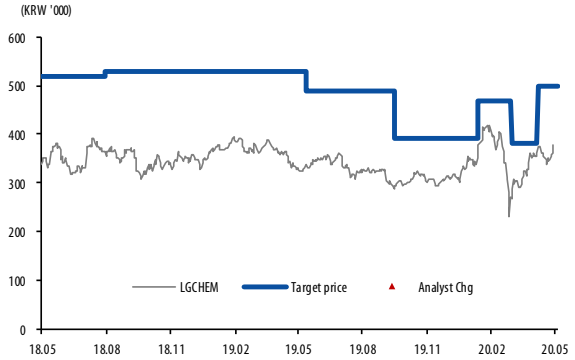


Source: GM, Hyundai Motor Securities

Investment rating and target price history

Date	Rating	TP	Difference (%)	
			Average	High/Low
2018.04.10	BUY	520,000	-32.14	-24.81
2018.08.21	BUY	530,000	-33.70	-25.57
2019.02.21	AFTER 6M	530,000	-31.81	-26.04
2019.06.04	BUY	490,000	-32.26	-26.22
2019.10.08	BUY	390,000	-19.66	-9.23
2020.02.04	BUY	470,000	-20.34	-10.74
2020.03.23	BUY	380,000	-14.89	-4.61
2020.04.29	BUY	500,000	-29.14	-24.50
2020.05.22	BUY	500,000		

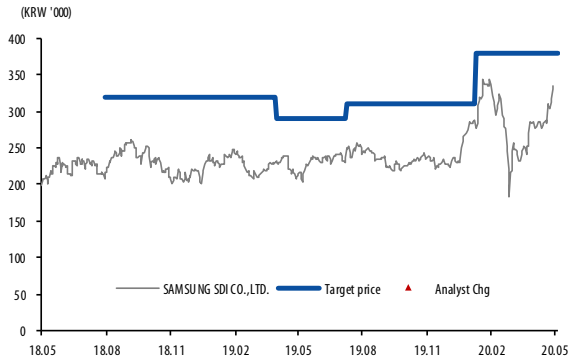
Two-year price chart



Investment rating and target price history

Date	Rating	TP	Difference (%)	
			Average	High/Low
2018.08.21	BUY	320,000	-28.28	-18.44
2019.02.21	AFTER 6M	320,000	-30.56	-23.28
2019.04.22	BUY	290,000	-20.78	-16.38
2019.07.31	BUY	310,000	-23.13	-7.42
2020.01.31	BUY	380,000	-24.76	-9.61
2020.05.22	BUY	380,000		

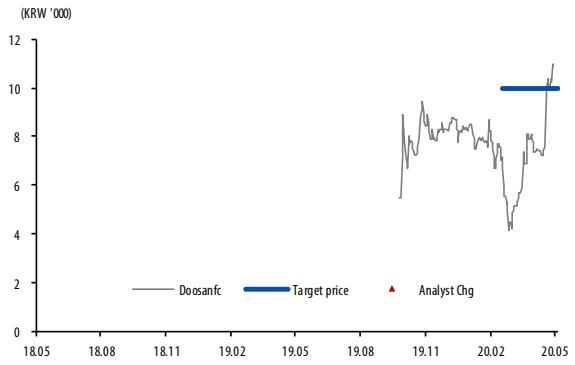
Two-year price chart



Investment rating and target price history

Date	Rating	TP	Difference (%)	
			Average	High/Low
2020.03.10	BUY	10,000	-29.10	10.00
2020.05.22	BUY	10,000		

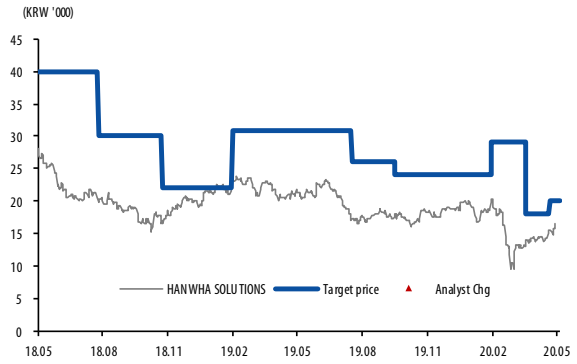
Two-year price chart



Investment rating and target price history

Date	Rating	TP	Difference (%)	
			Average	High/Low
2018.05.15	BUY	40,000	-42.90	-28.63
2018.08.16	BUY	30,000	-38.53	-29.00
2018.11.14	BUY	22,000	-7.73	5.45
2019.02.21	BUY	31,000	-30.32	-23.23
2019.08.08	BUY	26,000	-32.26	-27.88
2019.10.08	BUY	24,000	-24.16	-16.46
2020.02.21	BUY	29,000	-49.77	-34.14
2020.04.10	BUY	18,000	-20.82	-13.61
2020.05.13	BUY	20,000	-21.92	-17.50
2020.05.22	BUY	20,000		

Two-year price chart



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SELL	0	0