H1 2020

EXECUTIVE LENS

Summarized insights for Battery Energy Storage w.r.t. trends in technology, market, and players

01

1.1 State of the art: Technology, research and patent assessment

State of the Art – Battery Energy Storage in H1'20

- Li-ion battery continues to bolster the electric vehicle industry with improvements by researchers and industry
- Solid state batteries and Lithium-Sulfur batteries have attracted a lot of research work in H1 2020. These battery technologies are being considered as the next in line to replace the conventional lithium ion batteries

Upcoming technologies – a glimpse beyond 2030

- Solid-State battery
- Li-S
- Sodium ion
- Li-Air

ProLogium · oxis ENERGY · FARADION Advanced Energy Storage Solutions · PHINERGY

Emerging trends in cathodes for Lithium-Sulfur battery

- Composite cathodes
- Host Induced cathodes
- Other novel cathodes

Nanchang University · DGIST · Hangzhou Dianzi University · Shenzhen University 1983 · Beijing University of Science and Technology

Patent landscape in Battery Energy Storage – H1 2020

- China leads
- Lithium ion battery dominates filings
- CATL and BYD among the players with most filings

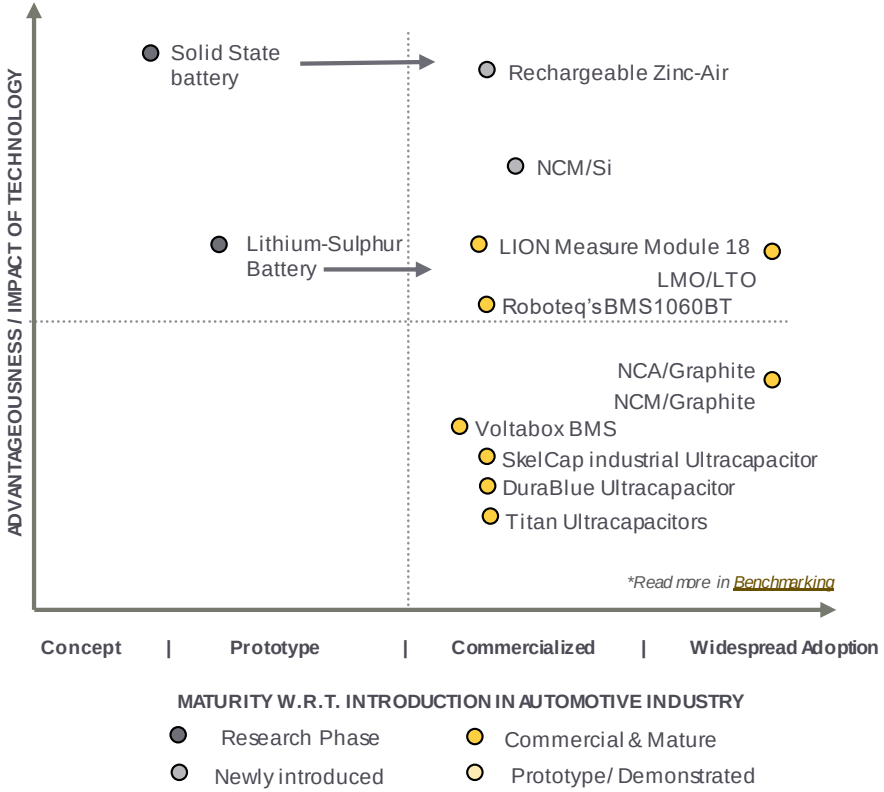
CATL · BYD

Interview on Solid-State battery deployment– Ilika

"We have faith in SSB and we do think that they will be adopted eventually. There will be a time when suppliers will have an alternative with superior batteries than Li-ion battery and this is when it will be the time for SSB" - ***Denis Pasero, product commercialization manager Ilika***

State of the Art – Battery Energy Storage in H1'20

Lithium-ion battery continues to be dominant and will do so for many years to come. Solid-state battery is gaining high research interest but the timeline for commercialization could be 2025-27. COVID-19 presents opportunities for South Korean and European battery suppliers to gain market share.



Lithium ion batteries

Lithium ion battery continues to be dominant and will do so for many years to come. The continuous improvements in higher energy density, lower cost and larger cycle life are extending the time period of its dominance in the industry. Technology improvements are not only coming from research efforts but from carmakers and suppliers too who are working towards addressing the main challenges of cost and range.

- The *Korea Institute of Science and Technology* (KIST) is developing a composite carbon-silicon anode material that could address range and faster charging;
- *Ulsan National Institute of Science and Technology* (UNIST) has developed an ion concentrate electrolyte that enhances cycling stability of Li metal batteries by forming a protective film on the anode.
- Many OEMS and suppliers are addressing the cost and range issues of lithium ion battery to support mass adoption of electric vehicles. GM and Tesla are working on "million-mile" batteries that could break the $100/KWh barrier and could be commercialized from 2021. Read more about the patent filing status here.

These research and industry efforts are stretching the position of lithium-ion battery which is also evident by the large number of collaborations of OEMs with suppliers for long term supply contracts of lithium-ion batteries. The examples worth mentioning are *Tesla-Panasonic*, *Lucid Motor-LG Chem*, *LG Chem-Tesla-CATL*, etc.

Emerging technologies

Solid state batteries and **Lithium-Sulfur batteries,** which are being considered as the next in line to replace the conventional lithium ion batteries, have attracted a lot of research work in H1 2020.

- Among the two, Solid-state battery is the most promising one which is evident by the number of industry developments tracked during H1 2020. This technology has been prototyped by various companies and research groups but it remains to be proven in operation. Recent developments of this technology show that cycle life, energy density and ionic conductivity – the technology's main challenges – are improving.
- On the other hand **Li-S battery** research is mostly focused on development of novel cathodes to improve the overall performance. We have presented some *emerging trends in novel cathodes* as highlighted by various research institutes.

COVID-19 is still having a serious impact on the global battery industry and could reshape the supply chain.

- China was the most adversely hit geography but has took some important steps towards road to recovery
- Europe has accelerated its plans towards Energy transition as it has realized the importance of having its own battery supply chain to minimize the dependence on Asian suppliers.
- The pandemic has given an opportunity to Korean battery makers to benefit from the EU EV market.

Academia's proposed solutions to technical challenges in H1 2020

Near future | Immediate | Distant future

Lithium ion battery

Range

Passivating a Li-ion cell and then self-heating before use resulted in a long cycle life battery. The cycle life at 60 degrees Celsius is over **4000**, which translates to over a ***million miles***

PennState

Faster charging

Carbon-silicon composite materials that can increase battery capacity four-fold in comparison to graphite anode materials and enable rapid charging to more than ***80%*** capacity in only ***five minutes***

KIST Korea Institute of Science and Technology

Safety

Separator whose one side is covered by a thin, partially conductive web of carbon nanotubes. When a dendrite punctures the separator and hits this web, electrons ***have a pathway through which they can slowly drain*** out rather than rush straight towards the cathode all at once, preventing explosion

UC San Diego

Solid-state battery

Energy density

Silver-carbon (Ag-C) composite layer as the anode. The ultrathin Ag-C nano-composite layer allowed in reduction of anode thickness and increased the ***energy density up to 900Wh/L.*** Range of **800km** on a single charge and cycle life of over **1,000** charges

SAMSUNG

Ionic conductivity

Sulfide-based superionic conductor (Argyrodite) that can be used as a high-performance solid electrolyte in all-solid-state batteries. It delivers the ***Li-ion conductivity of 10.2 mS/cm*** at room temperature and is comparable to that of liquid electrolytes used for typical Li-ion batteries

KIST Korea Institute of Science and Technology

Current density

Spreadable interlayer of a NASICON-type superionic conducting glass ceramics ($Li_{1+x}Al_xGe_{2-x}(PO_4)_3$ (**LAGP**)) nanoparticles and a room temperature ionic liquid (**IL**) increases solid-state battery ***current density 10-fold***

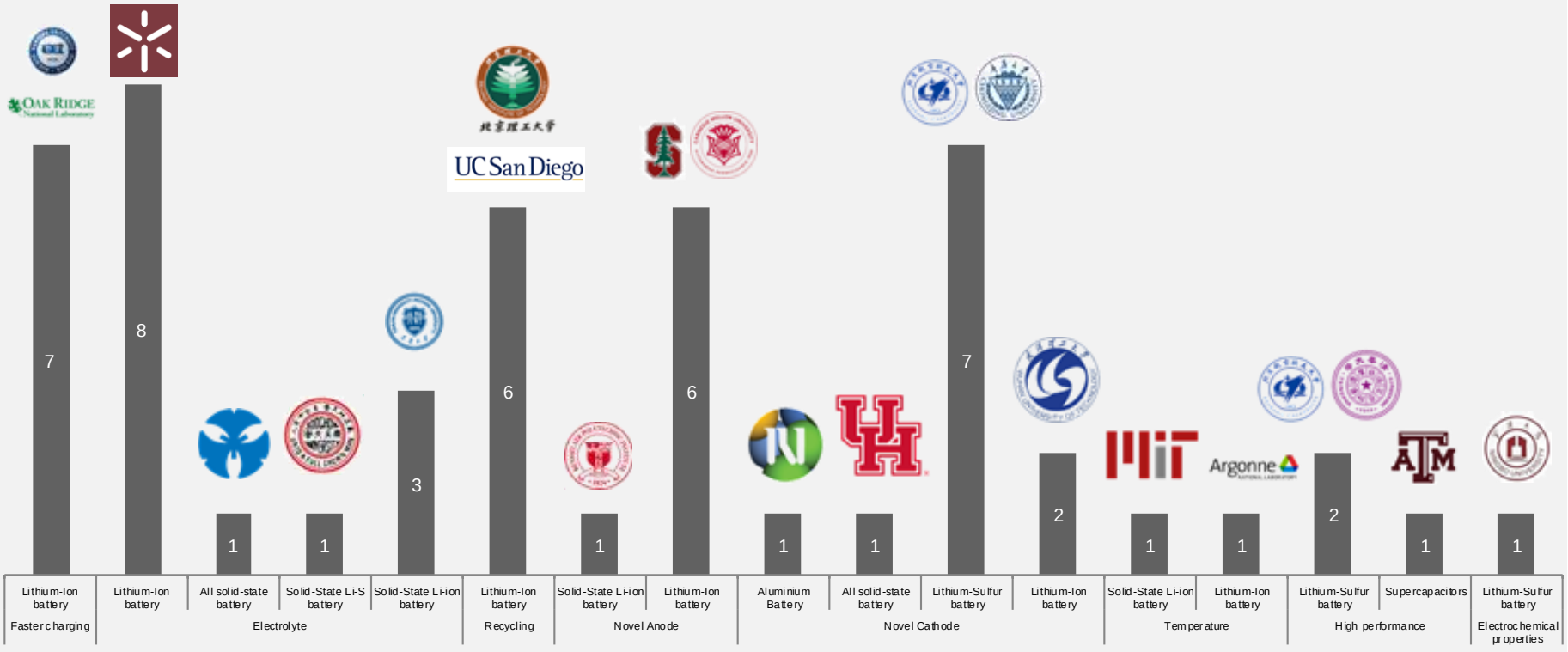
CHALMERS UNIVERSITY OF TECHNOLOGY

Refer *Appendix*

Research Focus – Distribution of papers by sub-technology (1/2)

New innovative methods to speed up the charging time of lithium-ion batteries and improve performance stand out in terms of their potential

Academic Papers by trigger points/ Key challenges addressed as per technology domain



 Refer our 2020 May Bulletin for details

Key findings for Top 50 academic papers in 2019 (2/2)

- The majority of papers are related to lithium-ion battery followed by Li-S battery which shows that research in lithium-ion battery is intensifying. This is mainly due to the monopoly enjoyed by li-ion battery in today's electric vehicle market.
- Furthermore, as expected, China leads battery research publications in 2019 as it is major hub for the global battery market. USA comes very close to China in terms of the number of papers published in 2019 which shows that USA is also gearing up for some serious competition in future.
- The major areas of focus in 2019 were faster charging, recycling, high performance batteries, novel anodes, cathodes and Electrolyte.

Things to watch out for

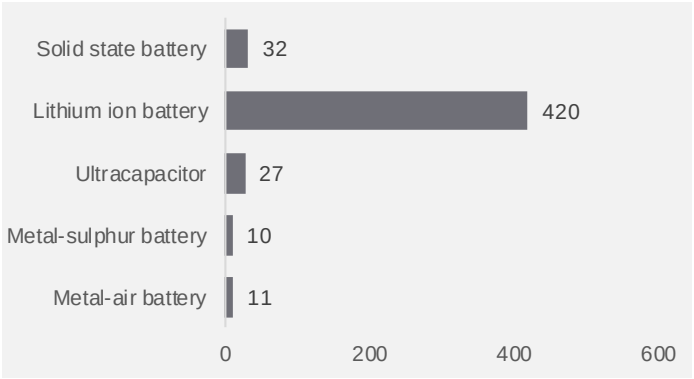
- Faster charging is key to accelerate mass adoption of electric vehicles. Electric vehicles will only be truly competitive when they can be charged as fast as refilling a gas tank
- Traditional LIBs based on intercalation compounds are approaching their theoretical energy density limits and as such alternate chemistries such as Li-S, Solid-State battery etc. should be considered for high energy density and thus enhanced performance
- Novel anodes and cathodes can lead to better stability and working of batteries. Some materials to focus are composites, polymers, MOF derived composites, etc.
- Electrolytes with high Li-ion conductivity and Li-ion transference number should be readily deployed as it not only enhances faster charging capability of cell but also improves parameters such as cyclic performance, capacity retention and lower corrosion of anode and cathode (if any)
- Amid shift of automotive industry towards electrification, batteries are being produced at enormous rate. While as batteries are considered as holy grail for future of automotive industry, there are concerns about some serious threat to environment as the used batteries lead to high wastage. Hence environmental-friendly recycling becomes need of the hour
- Second-life of batteries should be considered prior to recycling as it presents an opportunity to squeeze value out of existing resources

 Refer our 2020 May Bulletin for details

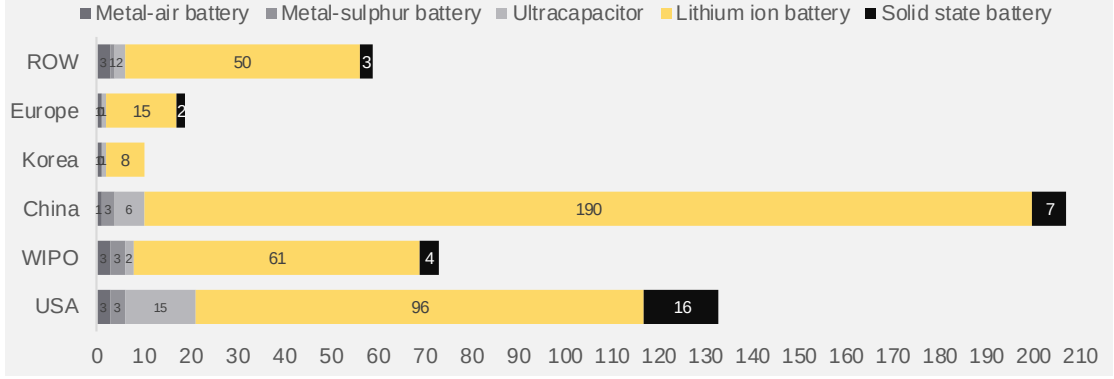
Patent landscape in Battery Energy Storage – H1 2020

Patent activity for alternate sources of power is very high as automakers are looking for suitable and more efficient, durable battery technologies

Patents published (H1 2020)

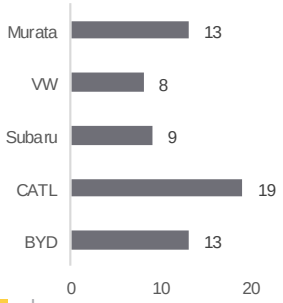


Geographical coverage of patents (H1 2020)

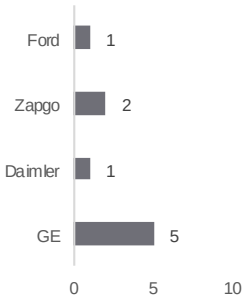


Patent published in H1 2020 (Major players)

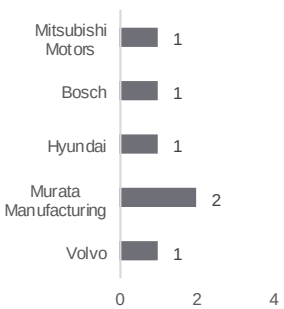
Lithium-ion



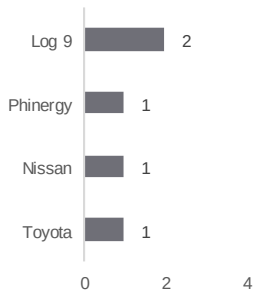
Ultracapacitors



Solid-State



Metal-Air



(*Refer Appendix for sources.*)

Analyst comment

- The patent activity in case of **Li-Ion** and **Solid-state** battery is very high than its industrial activity.
- **Lithium Ion** battery had the highest number of published patents in H1'20.
- **China** leads the race in the number of patents published. This comes despite the pandemic of COVID-19 halting all the operations and activity. China is expected to make V-shaped recovery and emerge once again as leader. That's why China's activity in innovating technologies has been very high in H1 2020.
- Companies like **Murata manufacturing, CATL**, **BYD**, and **GE** were the most active players in terms of patent filings in H1 2020.

Ilika's views on commercialization of solid-state batteries

Company website: https://www.ilika.com/
Insider Link: https://industryinsider.futurebridge.com/company/details/5db6bda5857ad8a94a737990

Ilika: "*Ilika is a company dedicated to the development and manufacturing of solid-state batteries. On the low format, micro batteries for IoT and meditech and larger batteries for EVs. Ilika has recently received funding to go into the scale-up and manufacturing of its micro-batteries for IoT, meditech implants and industrial sensors. The plan is to scale-up and transfer the technology in the next 18-24 months and start volume manufacturing in about that time. The technical readiness level of larger batteries is lower. So we are just finishing the three early step development program funded by the UK Faraday battery challenge program. At this moment Ilika has small lap scale pilot line for development and evaluation only. The plan is to go to manufacturing in two steps. Firstly setting up some MWh pilot facilities in UK by 2025 and secondly transferring it to GWh capacity.*"

What are the current challenges in SSB and how could it be resolved?

Ilika: "*As we know that SSB has no liquid electrolyte and we also know that a liquid with Li ions in it will conduct li faster than a solid. Hence people are looking for various types of materials such as polymers, mixtures of glass, sulphides, oxides etc. in order to solve the problem of faster conduction of ions in SSB. As we move towards more and more full solid state, the problem of conduction is getting more difficult. Hence there is a need to find tactics about the process of depositing anode, cathode and electrolyte close enough for faster conduction but far enough so that there are no electric shocks. It depends on company's view on what time in market is valid for them. We think that we want to be providing the highest density batteries to those markets so we are taking time to the research.*"

What do you think in the commercial ready version 0f 2025 that Ilika is working for will reach in terms of energy density?

Ilika: "*We do have a roadmap both in terms of manufacturing and specifications of batteries and the energy density is going up year after year. We tend to start manufacturing and make the batteries available that have commercial attraction in terms of energy density. So we are planning by that stage to be at least 350-400 Wh/L to start with and then carry on using processes to increase this number. This is a little bit early for us. We are currently doing alpha samples now and the energy density is lower than what I stated but we do think that there is a potential for this technology to have improved cycle life and energy density.*"

Which application will SSB serve in most appropriate way?

Ilika: "*We are developing materials and processes to get a low cost battery. We have created print type processes that can produce low cost batteries. We think we have good knowledge of materials and processes such as print type which will provide superior quality batteries. In reality with some tweak in the cell format, we could approach a lot of markets but in terms of larger batteries what we are finding now is that these batteries could benefit from energy density and cost for smaller formats than for EVs and right now we are getting a lot more interest in the consumer electronics market mainly because they have shorter time to market and are really interested in testing this technology soon with any improvement in terms of energy density and usage of form factor.*"

Will SSB replace Li-Ion battery or maybe in near time we can see some other battery technology giving a serious competition to SSB?

Ilika: "*We are aiming to use materials and processes that actually are not very different to li ion batteries so that we can get the switch from li ion to SSB as simply as possible. This is why we are not offering SSB's for larger formats through our VDP that we use for micro batteries. We got adapted process for SSB that is aiming to be as near as possible to li ion process but not completely the same though to help with the adoption of SSB. SSB are not going to take over li ion batteries straight away. Its still going to take a bit of time, later in the decade. Also SSB still have an issue with the supply chain as the some materials like solid electrolyte needs work from supply chain and many materials are not available in large volumes.*"

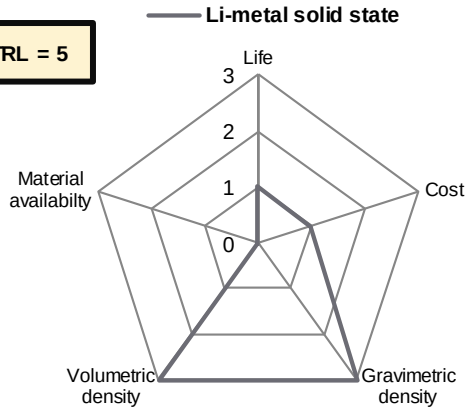
Interviewee Profile

Denis Pasero
Product Commercialization Manager
LinkedIn: https://uk.linkedin.com/in/denis-pasero-phd-acim

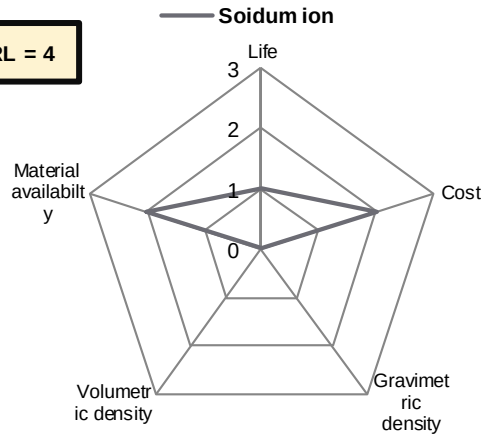
"We have faith in SSB and we do think that they will be adopted eventually. There will be a time when suppliers will have an alternative with superior batteries than Li-ion battery and this is when it will be the time for SSB"

Upcoming technologies – a glimpse beyond 2030 (1/2)

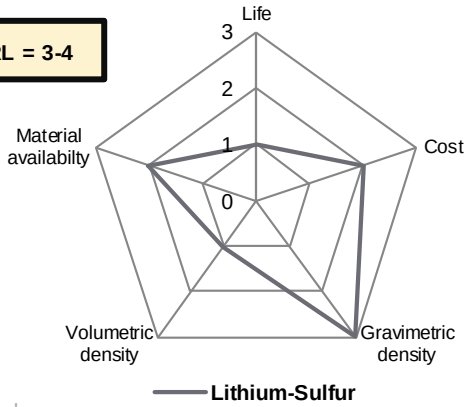
TRL = 5



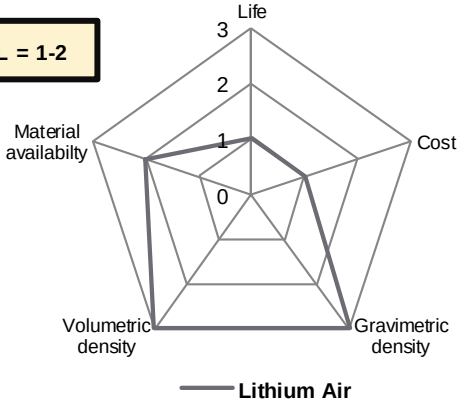
TRL = 4



TRL = 3-4



TRL = 1-2



Startup | Research institutes

Solid-State	Li-S	Sodium-Ion	Li-Air
Brown University	Monash University	cpi	IndianOil
Chalmers		LiNa energy	PHINERGY
		Washington State University	UNIST
SAMSUNG		Pacific Northwest National Laboratory	
ProLogium		FARADION	
Ampcera			
QuantumScape			
Hydro Québec	oxis ENERGY		

*All the mentioned players have been active in H1 2020

Key parameters

- **TRL:** The technology Readiness Level ~~(TRL)~~ scale is used to rate the status of technologies according to their status in the progression from research, development and deployment to commercialization.
- **0** = worse than Li-ion battery
- **1** = comparable to Li-ion
- **2** = improvement compared to Li-ion
- **3** = major improvement relative to Li-ion

Source: IEA Global EV Outlook 2020

Upcoming technologies – a glimpse beyond 2030 (1/2)

For the period after 2030, there are a number of potential technologies that might be able to push the boundaries beyond the performance limits imposed by Li-ion battery technology. Lithium-metal Solid state battery seems leading the front.

Most promising technologies in 2020

Lithium-Metal Solid-State battery

The most promising near-term chemistry among these advanced concepts is the lithium-metal solid state battery. This technology has been prototyped by various companies and research groups, but it remains to be proven in operation. Recent developments of this technology show that cycle life, energy density and ionic conductivity – the technology's main challenges – are improving.

- ***Samsung*** researchers have developed a prototype with a volumetric density of over ***900 Watt-hours per litre*** (Wh/L) (and an estimated gravimetric density of 400 Wh/kg) that is able to retain 89% of its charge after 1 000 cycles.
- ***Terawatt's*** breakthrough solid-state battery technology improves energy density to ***432Wh/kg*** (1122Wh/L)).
- ***Imec*** doubles energy density of its solid-state batteries to ***400Wh/liter*** is aiming to reach 1000Wh/L by 2024 for long-range electrical vehicles.

Lithium Sulfur battery

Lithium-sulfur battery is also gaining prominence with high amount of research activity focused on improving the performance and overcoming the challenges. H1 2020 witnessed large number of activities from research institutes and startups towards developing viable Li-S chemistry.

- ***Monash university*** researchers claim to be close to ***commercializing*** the world's most efficient Lithium-Sulfur battery
- ***Hong Kong University of Science and Technology*** team develops high-capacity, long-life Li-S battery
- ***OXIS Energy*** close to achieving ***500Wh/kg*** and is targeting ***600Wh/kg*** with ***solid state lithium sulfur*** technology
- ***OXIS Energy*** and ***CODEMGE*** sign lease agreement with Mercedes Benz Brazil to build world's first ***Li-S manufacturing plant***

Research focus – Emerging trends in cathodes for Lithium-Sulfur battery

Novel cathode types are being used to address specific parameters such as energy density, specific capacity, cyclability and decay rate in Li-S batteries to improve its overall performance

Composite cathodes as efficient Li–S battery cathodes with high reversible capacities and slow decay rate

SnS@C/S MS cathode with initial capacity of 1074.7 mAh g−1 at 0.1 C and ultra-stable cycling performance with a slow capacity decay rate of 0.073% per cycle over 600 cycles at 0.5 C >>

S@C/Co_3O_4 composite cathode long-term cyclability over roughly 1000 cycles at 1 C and 2 C with low decay rates of 0.076% and 0.062%, respectively >>

NOPC-2/S cathode with a reversible capacity of 449.3 $mAhg^{-1}$, even after 400 cycles at 1C with only 0.085% capacity fade per cycle >>

TACM/S cathode exhibit high initial discharge capacities of 1041.7 mAh g^{-1} at 0.1 C, and outstanding capacity retention of about 77.5% after 500 cycles at 0.5 C >>

Introduction of host materials in cathode for high cycling stability

Gigaporous carbon microsphere as host exhibits high cell performance with a highly stable capacity at ~1000 mAh g−1 under a charge/discharge current of 0.2C for 200 cycles and a columbic efficiency of 100% >>

pOMS/S cathode with a sulfur mass fraction of 80 wt% demonstrates outstanding long-term cycle stability for 2000 cycles even at a high current density of 2C >>

Seven-fold improvement in cyclability is seen by introducing Te at the cathode >>

NiCo2S4/S cathode with a sulfur loading of 8.9 mg cm−2 exhibits high areal capacity of 8.3 mAh cm−2, low polarization and high cycling stability >>

Other novel cathodes enabling high performing Li-S batteries

Polymer-Composite cathode

Sulfurized polyacrylonitrile (**SPAN**) cathode in solid-state Li-S battery delivers an ultrahigh initial discharge capacity of 1793 mAh g−1 at 75 °C with high columbic efficiencies and stable cycling performance >>

Biomimetic cathode

RBC-mimetic micro cell cathode delivering the discharge capacities of 995 and 720 mAh g−1 after 500 and 700 cycles at 0.5 and 2 C, with the capacity retention around 80% >>

Bio-composite cathode

NNH/PC/S cathode guarantees a sufficient output in specific capacity of 583.9 mAh g−1 >>

Hybrid cathode

TiN/rGO-S) cathodes demonstrate rapid charge transfer, lower polarization, faster surface redox reaction kinetic and enhanced stability cycling performance >>

1.2 Top highlights of H1 2020

MOBILITY INDUSTRY INSIDER

Emerging trends in H1 2020

- Europe launching battery projects to accelerate the European Energy Transition
- OEMs and Suppliers investing millions for expansion of battery facilities in a race for supremacy
- Million-mile and low cost/KWh batteries are being worked upon for early commercialization
- Research in battery materials for improved versions to address various performance issues

Key developments among major categories

- Product unveiling
- Investment in battery facilities
- Partnerships
- Million mile and low-cost battery

BYD · BASF The Chemical Company · UC San Diego · TESLA

Funding and Investment activity continued even amid the pandemic

A total of ~$12.6 billion spent by OEMs and Suppliers in H1 2020 for battery activities

Collaboration and partnerships proliferated in H1 2020

OEMs and Suppliers were very active during H1 2020 in relation to partnerships. There was high activity from the players despite the pandemic of COVID-19 as OEMs were focused on securing the supply contracts for their electrification roadmaps

Highlights – H1 2020

Europe is accelerating its efforts to reduce dependence on Asian suppliers and build its own battery hub by means of investments and funding in battery facilities while as research into battery materials continue to bolster the automotive industry.

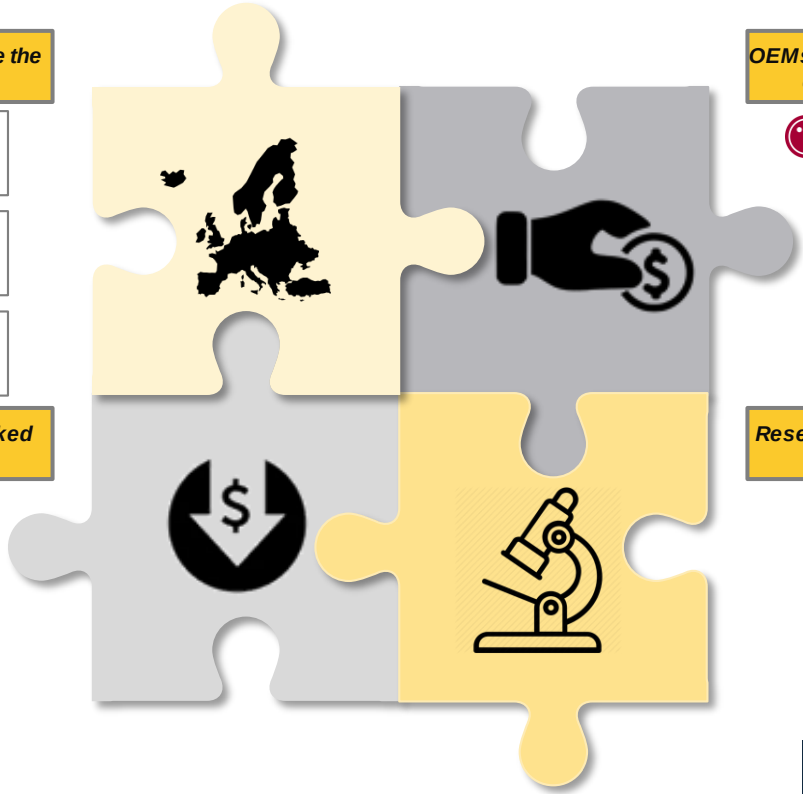
Read more in Q1 2020 pulse

Europe launching battery projects to accelerate the European Energy Transition

- AgiloBat project for flexible battery production in terms of format, material and quantities >>
- Project NAIMA aims to develop a new generation of high-competitive and safe Na-ion cells >>
- LiPLANET project aims to build a more competitive Li-ion battery cell manufacturing ecosystem >>

Million-mile and low cost/KWh and being worked upon for early commercialization

- Ultium batteries (NCMA) priced below $100/KWh >>
- Million-mile battery cell with price below $100/KWh >>
- Cobalt-free car batteries with reduced cost and million-mile range >>



Read more in Q2 2020 pulse

OEMs and Suppliers investing millions for expansion of battery facilities in a race for supremacy

- ~$541M to finance the expansion of its production capacities in Poland >>
- Total of $2.5 billion in its US battery business to build two plants >>
- ~$486.4M in Northvolt factory that is to produce lithium-ion battery cells >>

Research in battery materials for improved versions to address various performance issues

- Simpler way to fabricate silicon anodes for solid-state lithium batteries for use in EVs >>
- Combined a macroporous silicon anode and alumina-coated NMC cathode to provide stable cyclability >>
- Ion concentrate electrolyte increasing the lifespan and output of the entire battery >>

Read more in Q2 2020 pulse

Read more in Q1 2020 pulse

Snapshot of Key Developments

Product unveiling

- **ProLogium** has presented a *solid state battery package* (MAB battery pack) for electric cars, buses and two-wheelers at CES 2020
- **Samsung** reveals new *solid-state lithium metal battery* with 900Wh/L density
- **BYD** launched the *Blade Battery* intended to mitigate concerns about battery safety in electric vehicles.

BYD SAMSUNG ProLogium

Battery facilities

- **Morrow Batteries** to build *32GWh Gigafactory* in Norway to revolutionize battery production and establish a more sustainable supply to European car makers
- **AMTE Power** and **Britishvolt** sign MoU for UK's *30 Gigafactory* enable scalable production of a diverse product portfolio of lithium ion batteries
- **BASF** to build *new cathode active materials* production site in Germany

MORROW amte power BASF The Chemical Company BRITISHVOLT POWER ON

Investment

- **Volkswagen** investing *€450M* in Northvolt JV battery operations at Salzgitter to build a 16GWh plant
- **Volkswagen** to invest another *$200M* in QuantumScape to advance the joint development of solid-state batteries and to prepare for their large-scale production
- **CATL** invests around *$410M* in new battery research centre - 21C Lab that will focus on the development of next-generation batteries and new energy conversion systems

CATL

Research

- Researchers at **Brown University** use rGO to *double toughness* of ceramic electrolytes used in solid-state lithium-ion batteries
- **University of Texas** team uses *tellurium* as cathode additive to improve Li-S performance
- **UCSD** researchers develop *draining safety* feature for Li-metal batteries

BROWN UNIVERSITY THE UNIVERSITY OF TEXAS AT AUSTIN UC San Diego

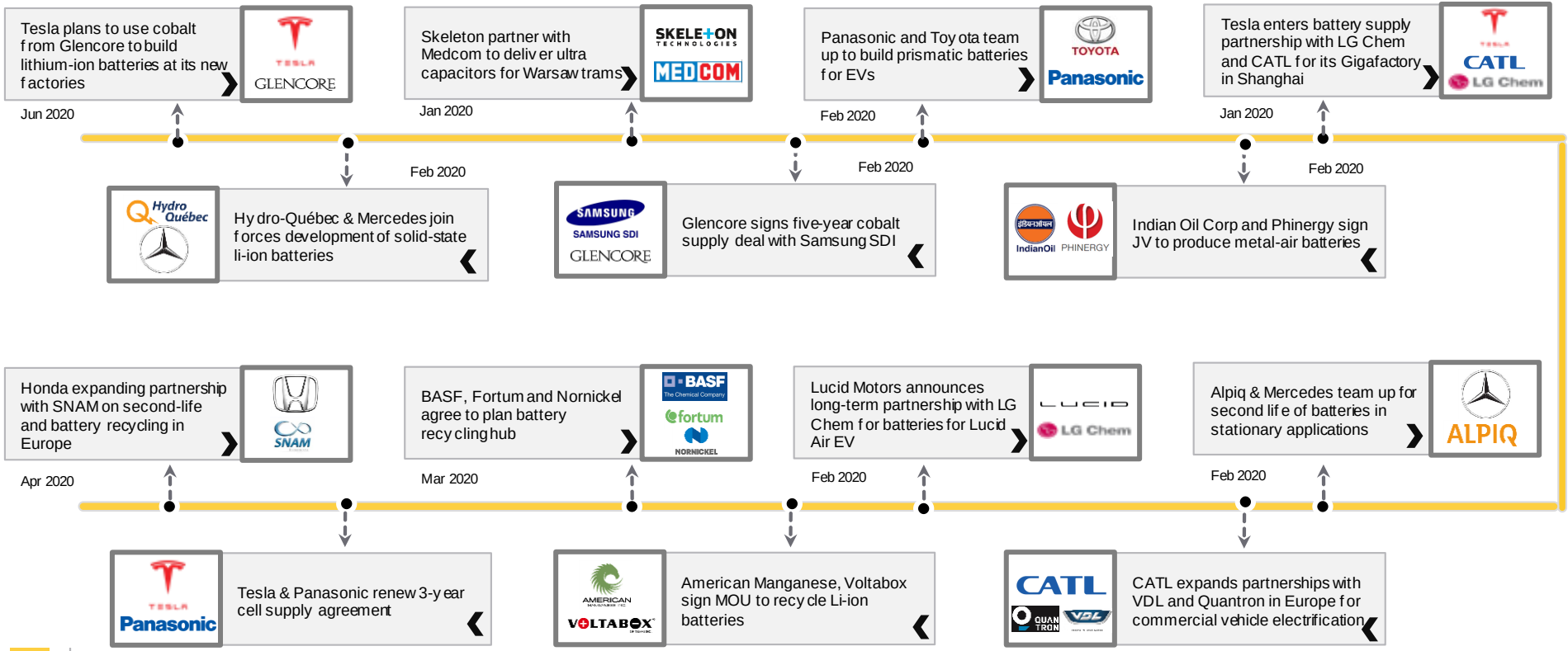
Million-Mile/Low-cost battery

- China's **SVOLT** launches *million -mile* cobalt-free car batteries and to be expected in 2021
- **Tesla**-to launch their *million-mile* battery in China first aiming to break the ***$100/kWh*** barrier
- **GM** reveals new ultium batteries likely have cells priced below the *$100 per kilowatt-hour* mark due to a reduced reliance on cobalt.

TESLA SVOLT 蜂巢能源 GM

Collaboration and Partnerships – H1 2020

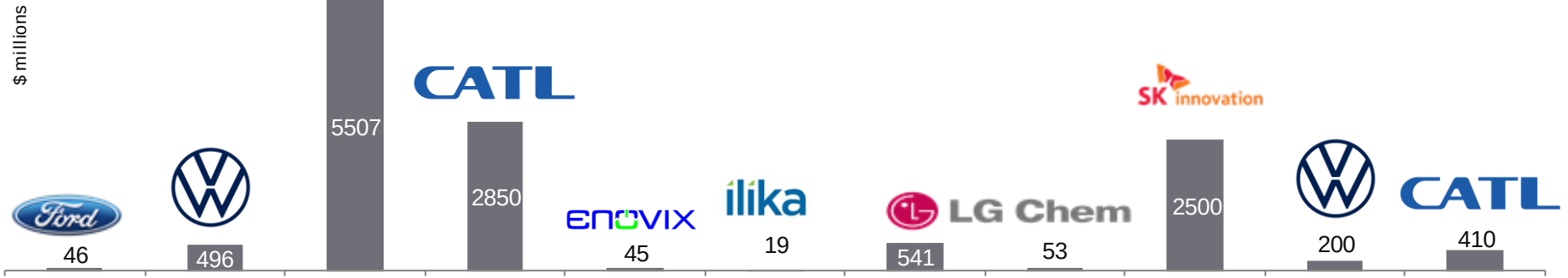
OEMs and Suppliers were very active during H1 2020 in relation to partnerships. There was high activity from the players despite the pandemic of COVID-19 as OEMs were focused on securing the supply contracts for their electrification roadmaps.



Funding and Investments – H1 2020

Large number of investments by OEMs and Suppliers is evident in 2020 with main focus on either expansion of existing battery facility or building new factories across globe to establish dominance. Asian suppliers were the front runners during this period

~ $12.6 billion spent in H1 2020



Ford	Volkswagen	Total | Groupe PSA	CATL	Enovix	Ilika	LG Chem	LG Chem	SK Innovation	Volkswagen	CATL
Invests in Valencia plant for new hybrid models and battery assembly operations	investing €450M in Northvolt JV battery operations at Salzgitter	Investment in joint venture to produce EV batteries in Europe	Investment for EV battery programs	To produce and commercialize its 3D Silicon™ Lithium-ion Battery	To support solid-state battery commercialization	For expansion of its production capacities in Poland	To expand carbon nanotube production; targeting EVs and batteries	To build second EV battery plant in US, increasing investment	Investing $200M in solid-state battery startup QuantumScape	Investing $410M in new battery research centre - 21C Lab
Jan 2020	May 2020	Jan 2020	Feb 2020	Mar 2020	Mar 2020	Apr 2020	Apr 2020	Apr 2020	Jun 2020	Jun 2020

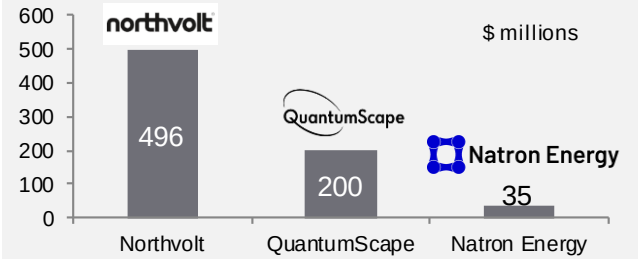
Startup Tracker summary: For more information access our Startup Tracker

Of the 174 startups we monitor, 51% are working on Metal-ion battery. USA leads as the major startup hub followed by Germany and China. Northvolt and QuantumScape secured highest funding both done by Volkswagen.

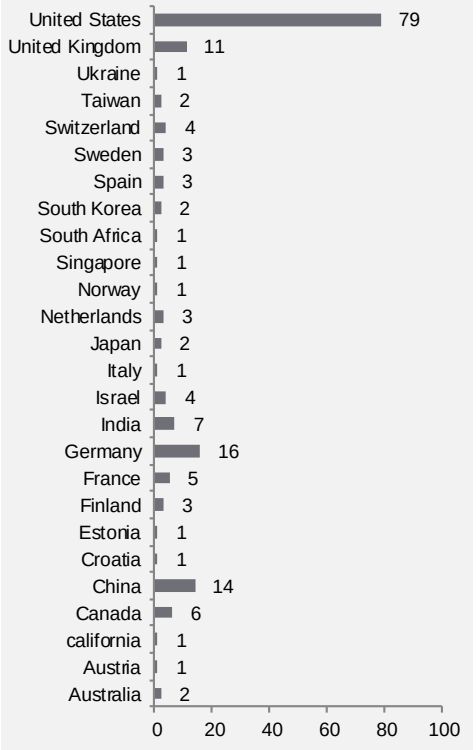
Key startups active during H1 2020

- northvolt: Norsk Hydro-Northvolt joint venture to recycle electric vehicle battery in Norway
- QuantumScape: Solid-state battery technology to increase the range of electric cars
- Natron Energy: Sodium-ion batteries

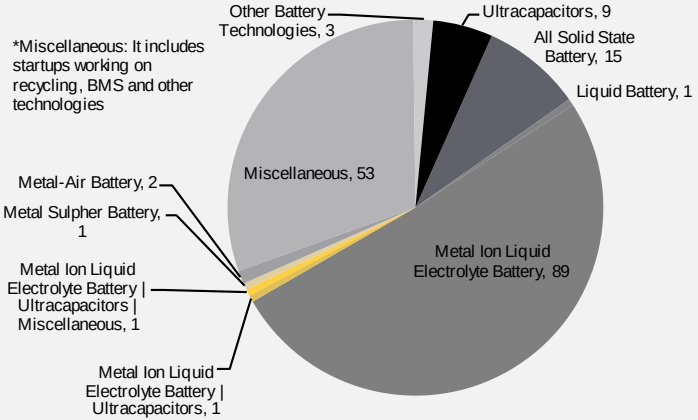
Funding distribution of key startups



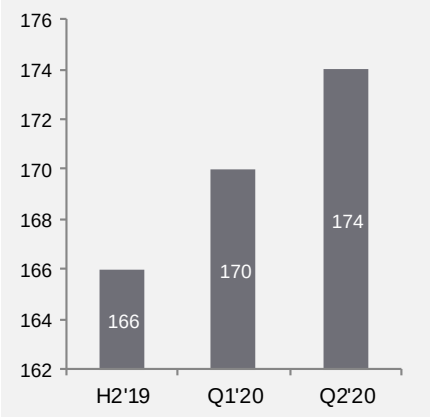
Startups by geography



Startups by technology



Number of Startups covered

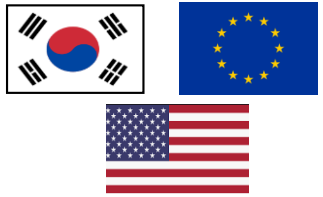


1.3

COVID and consequences in BES industry

Actions and Impact of COVID-19 – Asian, Europe and the USA

- Korean battery makers to become winner in growing European EV market
- European Lithium-Ion Battery Dilemma — Build Or Buy?
- USA slowly trying to build its battery competency



Road to recovery – Key strategies to overcome the pandemic loss

Future Outlook – Short term and long term

Asian suppliers look favorites to continue dominating the battery industry sector post covid-19 with large amount of investments being done to expand the production facilities even in the current scenario as compared to Europe

European Energy Transition – Acceleration in efforts owing to push by COVID

*A total of **$6.7billion** investment in 2020 till June*
*A total of **$488 million** funding in 2020 till June*

Actions and Impact of COVID-19 – Asian, Europe and the USA

China is expected to make a V-shaped recovery from the COVID pandemic and is expected to continue its road to battery dominance while as Europe is spending billions in order to build its own battery hub and cut reliance on Asian suppliers

ASIA

Europe

USA

Korean battery makers to become winner in growing European EV market

- Serious fall in the world's two biggest economies was driven by the Chinese government's decision to reduce subsidies and the economic slowdown in the U.S. Korean battery makers will become unexpected beneficiaries from the move. **LG Chem** already decided to build manufacturing facilities in Poland in 2016, with two other makers of **Samsung SDI** and **SK Innovation** also seeking to ramp up their battery output in Hungary since 2017 and 2018 respectively
- China's attempt to fight the coronavirus outbreak has led to delayed production across a number of battery production facilities located in key coronavirus hit provinces and is expected to lower the output of Chinese battery manufacturers by around 26 GWh in 2020

European Lithium-Ion Battery Dilemma — Build Or Buy?

- Although European battery manufacturing is growing apace, much of the planned fabrication capacity in the EU is from Asian giants like CATL who opened a 14 GWh capacity plant in in Thuringia, Germany
- These Asian incursions into the European battery market are being actively supported by funding bodies anxious to maintain a supply of low-cost batteries for Europe's rapidly electrifying auto industry. E.g. **EIB approved** €480 million loan for LG Chem to build 35 GWh plant in Poland
- Outgunned on manufacturing scale, Europe is betting on research that could allow it to undercut Asian battery makers on price. EU is injecting cash into concepts across all technology readiness levels (TRLs) and chemistries. Many projects such as NAIMA, LiPLANET etc. have been launched in this regard

USA slowly trying to build its battery competency

- In the race to make more batteries, Europe is beating the US with a little help from China. By 2023, Europe will have more lithium-ion battery manufacturing capacity than the US
- The US government has done little to support its electric-car industry, which continues to rely heavily on the success of Tesla
- Although US is far behind Europe and China, it has made some efforts towards establishing battery production facilities by providing incentives to companies such as LG Chem, SK Innovation etc. to setup plants
- The DOE has also players a vital role in setting up of first lithium-ion battery recycling R&D center: ReCell which will help the United States grow a globally competitive recycling industry and reduce our reliance on foreign sources of battery materials

Other latest deliverables to read

June 2020 – BES Bulletin 2.0 >>

What's new in bulletin ?

1. In-depth analysis of developments that happened in the month of May from different angles like Funding, investments, Collaborations etc. to give compressive view of the plans of the players in BES.
2. Spotlight showcasing the acceleration of European Energy Transition particularly after the COVID-19 pandemic

Upcoming Webinar:

COVID-19's impact on Battery Energy Storage for Mobility

Do you need customized, actionable insights aligned with your priorities?

Submit a Business Objective

North America
55 Madison Ave, Suite 400
Morristown, NJ 07960
USA
T: +1 212 835 1590

Europe
328-334 Graadt van Roggenweg
4th Floor, Utrecht, 3531 AH
Netherlands
T: +31 30 298 2108

United Kingdom
5 Chancery Lane
London EC4A 1BL
United Kingdom
T: +44 207 406 7548

Asia Pacific
Millennium Business Park
Sector 3, Building # 4, Mahape
Navi Mumbai 400 710
India
T: +91 22 6772 5700

members@futurebridge.com

FutureBridge