



## Newsletter No.3, August 2021

Sweden-China Bridge – Collaborative Academic Platform for the Electrification of Transportation Systems project is funded by Trafikverket-TRV (Swedish Transport Administration) and started on September 1, 2020.

The authors of Newsletter No 3 are Dr. Jasmine Lihua Liu and Prof. Mike Danilovic.

### Exploring Battery-Swapping For Heavy Truck In China 1.0.

#### Battery-swapping for trucks is here

- In China, the number of heavy trucks were about ten million in 2020.
  - Nearly one million heavy trucks work for short-distance high-frequency operation scenarios. Battery-swapping has become an essential complementary charging solution for both passengers and heavy electric vehicles (EHT).
  - The cable-based charging is insufficient to fully support a rapidly growing number of electric vehicles in general and overcome the shortcomings of the established charging infrastructure based on charging piles.
  - Battery-swapping is a solution to the low operational efficiency of heavy trucks in terms of operating range, driving time, and long recharging time.
  - In 2020, 2,619 EHTs were sold in China, down 48% from 5,034 in the same period of 2019.
  - By 2035 there will be about 5 million light commercial electric vehicles and 600,000 medium and heavy electric trucks in China.
  - 98,7% of all sold new energy trucks in China in 2020 were pure electric, and 0,69% were hydrogen.
  - In 2021, in China (Nanjing), 17 new energy heavy trucks were introduced in the "International new energy and Intelligent connected vehicles" exhibition in June 2021.
  - Thirteen (13) models are pure battery EHTs; 11 provide both battery-swapping and cable-charging solutions for energy supplements, while only two models choose only the cable-charging supplement solution<sup>1</sup>.
  - This indicates that battery-swapping technology is becoming a dominant technology for BEH in China in 2021.
- Our experiences tell that swapping systems might become the new standard solution for EHTs in China due to the dual operational mode, combining cable-charging with battery-swapping method enabling the operator to choose multiple ways of charging.
  - The battery-swapping has received strong support from the central government and institutions and is placed on the national strategic list as the technology of national importance.
  - We estimate that in 2021 there might be more than 400 battery-swapping stations for EHTs in China, and the number will rapidly grow.
  - By utilizing the battery-swapping, the operational efficiency is improved by extending the access to EHTs significantly during a working day, from 4 h to 8 h, i.e., doubling the efficiency.
  - Battery-swapping enables the EHTs to operate on long-distance operations complicated by the operational shortcomings only by using cable charging.
  - China has developed an entire value chain for developing and manufacturing all-electric passenger vehicles, trucks, and buses.

#### Barriers to adopting electric trucks in China

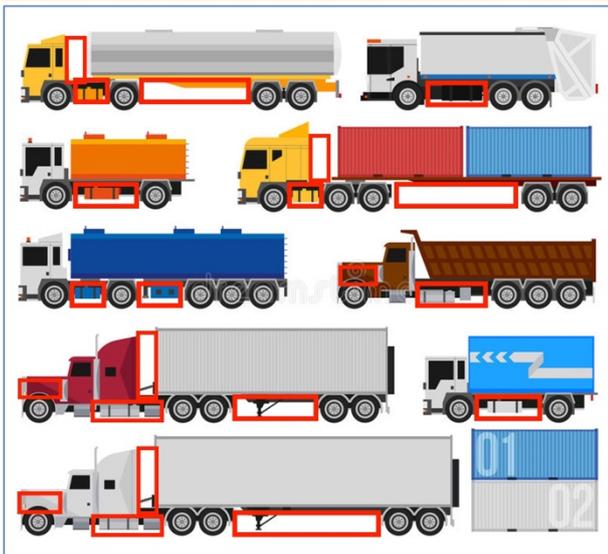
- The high price of EHTs and low operational efficiency of EHTs in terms of operating range (driving distance and recharging time) are two major barriers EHT is facing.
- By 2021 the price for EHT is almost double the cost of traditional ICE-based diesel trucks.
- Low operational efficiency, short driving range, and long charging time are some of the main barriers.



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Placements of battery-swapping solutions on trucks

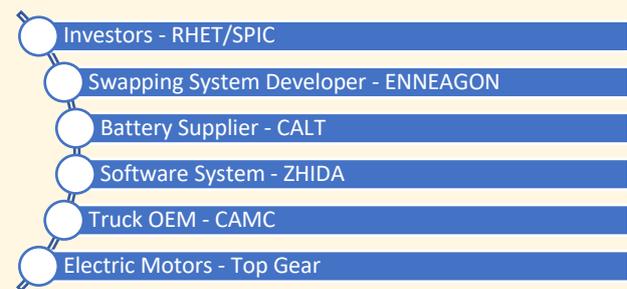
- Basically, the swappable batteries can be placed under the chassis, behind the cabin, or in the front nose of the truck.



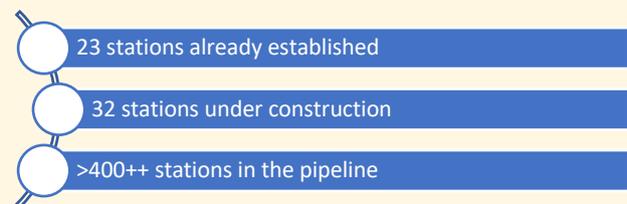
- The dominant solution in China, for the time being, is behind the cabin.
- The dominant battery size is 282kWh, and all use a lithium-ion battery. The size might vary between 50-500 kWh.
- One illustration of battery-swapping SAIC truck:



Key actors in developing, establishing, and operating battery-swapping in China



The battery-swapping situation in China in 2021



The new business model – Flexible dual-mode for heavy electric trucks – cable charging & battery-swapping

The main component of the business model is the separation of vehicle and battery.

- Operators buy the vehicle and can choose to buy or rent the battery separately, subscribe to recharging in a swapping station or combine all according to the needs.

Benefits of battery-swapping solution for trucks

- Lower operational cost
- Lower repair and maintenance cost
- Lower investment cost.
- Longer warranty time of the battery when charged in the swapping station.
- Foreseeable battery life-cycle cost.
- Total life-cycle cost is reduced by 24% compared to diesel trucks.



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### The progress of battery-swapping in china

The full report shows six demonstration projects with battery-swapping system solutions.

In total, there are in China:

- 23 finished projects
- 32 projects under construction and
- 400 projects in the pipeline.

### Sources

Sara, 2021, China Trucks, 19th May 2021,  
[http://www.chinatrucks.com/news/2021/0519/article\\_9623.html](http://www.chinatrucks.com/news/2021/0519/article_9623.html)

SOHU, 2020, [https://www.sohu.com/a/448565278\\_526280](https://www.sohu.com/a/448565278_526280),  
[https://www.sohu.com/a/210419828\\_100086644](https://www.sohu.com/a/210419828_100086644)

QQ, 2021, <https://new.qq.com/omn/20210728/20210728A04N5300.html>,  
<https://new.qq.com/omn/20210728/20210728A04N5300.html>

360che, 2020, <http://www.360che.com/news/202006/148794.html>

White Pater on the Technology Development of EV Charging Facilities in China, Part 3: Battery Swap

Research report on vehicle and battery separation mode industry eco-system construction  
[http://www.bj.xinhuanet.com/bjxxjd/wqxx1/2020-12/09/c\\_1126841523.htm](http://www.bj.xinhuanet.com/bjxxjd/wqxx1/2020-12/09/c_1126841523.htm)  
[https://www.sohu.com/a/260034671\\_384549](https://www.sohu.com/a/260034671_384549)  
<http://www.cvworld.cn/news/sycnews/guangyao/210130/189535.html>  
<https://www.chyxx.com/industry/202003/843464.html>  
<https://baijiahao.baidu.com/s?id=1705333788266640236&wfr=spider&for=pc>  
<http://www.cvworld.cn/news/truck/tknews/210625/193178.html>  
[https://www.sohu.com/a/410606685\\_560178](https://www.sohu.com/a/410606685_560178)  
<http://www.360che.com/news/200610/148794.html>

Enneagon marketing director interview May 20, 2021, Shanghai, China  
<https://baijiahao.baidu.com/s?id=1692951928217930765&wfr=spider&for=pc>  
<https://m.360che.com/articleindexbyphone.aspx?articleid=158303>  
<https://www.d1ev.com/news/zhengce/141783>

2019 White Pater on the Technology Development of EV Charging Facilities in China, Part 3: Battery Swap

1 Lijie Jia, Lijun Yi, The development trend of new energy vehicle power exchange model in the post subsidy era. *Automobile Applied Technology*. 2020(1): 9-12

<https://baijiahao.baidu.com/s?id=1687925567203643252&wfr=spider&for=pc>

<http://www.spic.com.cn/2018jtgk/jtjs/>

<http://chuneng.bjx.com.cn/news/20210113/1129133.shtml>

<https://baijiahao.baidu.com/s?id=1688765355778517227&wfr=spider&for=pc>

Shenzhen Xieli New Energy Vehicle Innovation Center

<https://baijiahao.baidu.com/s?id=1693741598475494832&wfr=spider&for=pc>

[https://www.chinatruck.org/news/202007/13\\_91553.html](https://www.chinatruck.org/news/202007/13_91553.html)

Shiqiang Liu, Xiangjun Liu, Guangli Bai, Study on Cycle Life of LFP High Power Traction Battery Under Different Charge Rate, *Journal of Chongqing Institute of Technology*, 2018, 32(6):8-13

Report of China's automobile value preservation rate in 2019, China Automobile Finance and Residual value research committee

Meng Wu, Status, problems and Countermeasures of echelon utilization of retired power battery, *Resource Recycling*, 2019(10)

Jianlin Li, Yaxin Li, Chao Lyu, Wei Zhao, Jinghua Zhou, Key Technology and Research Status of Cascaded Utilization in Decommissioned Power Battery, *Automation of Electric Power Systems*, 2020, 44 (13):172-183

China EV100 Natural resource protection association, Case study of commercial prospects of EV and grid interaction——pilot case of demand response in Shanghai, June 2020.

China EV100 Research Department, Research of vehicle and battery separation mode industry eco-system construction, January 2021

<https://new.qq.com/omn/20200902/20200902A0D0EW00.html>

<https://www.xcmg.com/xgic/news/brandnews-detail-631261.htm>

<https://baijiahao.baidu.com/s?id=1685501222519915755&wfr=spider&for=pc>

<https://xueqiu.com/7862386466/161728745>

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### GET THE FULL REPORT:

Exploring Battery-Swapping For Heavy Trucks In China 1.0.

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- Shenzhen Bus Group, Shenzhen, China.
- Shenzhen Electric Vehicle Application and Promotion Center, Shenzhen, China.
- Shenzhen Truckload & Logistics Association, Shenzhen, China.
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