

# Research on the Design Scheme of New Energy Elevator

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**Abstract:** As the new energy technology gradually matures, people are more and more enthusiastic about the use of new energy. The formerly tall new energy has gradually become common consumers, such as new energy vehicles, solar water heaters, roof photovoltaic power supply, etc. In fact, our elevators have unique conditions to use new energy, but elevator new energy technology is still rarely used. On the one hand, ordinary consumers pay little attention to elevators, and on the other hand, manufacturers' technological innovation often only focuses on cost reduction and profit maximization, or only to meet national mandatory standards.

**Keywords:** Elevator, New energy, Solar energy.

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## 1. Bright Prospect of New Energy Technology

On December 12, 2020, President Xi Jinping delivered an important speech entitled "Carrying forward the past and opening up a new journey for the global response to climate change" by video at the Climate Ambition Summit, stressing that by 2030, China's total installed capacity of solar energy and wind power will be more than 120 billion kilowatts, and non fossil energy sources will account for about 25% of primary energy consumption. Therefore, the development of new energy, especially solar assisted energy elevators, The bright future also meets the requirements of the development of the times.

## 2. Energy Consumption State During Elevator Operation

In the process of elevator running, only the driving state will consume electric energy, but in the braking state will use the gravity difference to generate electricity. At present, this potential energy generation is consumed by braking resistance, so this situation is not in line with the mainstream idea of energy conservation and consumption reduction. The elevator is a relatively fixed electromechanical equipment, which provides great convenience for the use of external energy. Especially for vertical elevator, the enabling parts are often located on the roof, so it greatly facilitates the use of solar energy on the roof and wall. Many of our elevator shafts are open-air, especially many of the elevator shafts installed now are of this structure. The outer wall of the open-air shaft is an ideal place for solar energy collection. The villa elevator has small power and travel, which is generally 2-4 floors. It has low use frequency and is especially suitable for this energy collection method.

Of course, since the external energy obtained in time cannot directly drive the elevator and can not be kept flowing, it is only equivalent to energy debris. Therefore, it requires special design and coordination with the municipal power supply to maximize the use of external energy debris, thus greatly reducing the use of municipal power, achieving power saving effect, and at the same time ensuring the normal and stable operation of the elevator, in line with national safety technical standards.

## 3. New Energy Elevator Design Scheme

The following is the design scheme. I will make some practical demonstration for this scheme and take some targeted precautions against possible problems.

The solar energy in Figure 1 can come from the roof photovoltaic system or the photovoltaic system installed on the outdoor shaft wall, and some regions can even use the wind power system. The power generated by the photovoltaic system will be stored in the battery. The role of the battery in Figure 1 is to collect energy fragments. The battery should have the corresponding capacity to ensure a stable current supply during the operation of the elevator. For example, the elevator can run fully once at least; It also has the ability to absorb energy fragments for a long time, such as at least meeting the capacity of continuous solar charging for 10 hours. The battery must have a battery management system. When the battery energy is lower than the early warning value of the energy required for a single operation of the elevator, it should be timely switched to the mains power for supplement. When the charging speed is lower than the output speed, it should be fully switched to the mains power drive. The main function of the battery intelligent management system is to maximize the use of energy debris, but it cannot reduce the stability of elevator operation.

Due to the variable load of the elevator during each operation, the load of the elevator driven by the remaining battery capacity has a certain range. Therefore, in addition to the battery management system that needs to timely detect the remaining battery energy, there should also be a system that timely detects the elevator load, that is, the elevator load detection module, to determine whether the remaining battery power can complete the driving of this load after the elevator closes the door and before starting to determine whether it is necessary to switch to the mains power drive, or to supplement the drive with mains charging. The power switching device is completed by the power distribution module, which can realize the fast switching between the battery and the mains power according to the corresponding relationship between the battery capacity and the elevator load. Therefore, the power management module and the load detection module are the core of the power distribution control, which determine the key factors of power saving and stable operation.

At present, the drive module is mainly driven by frequency conversion, and the power used is AC power. According to the requirements of this article, since there is a direct battery

power supply link, our inverter should have the ability of AC and DC power supply compatibility.

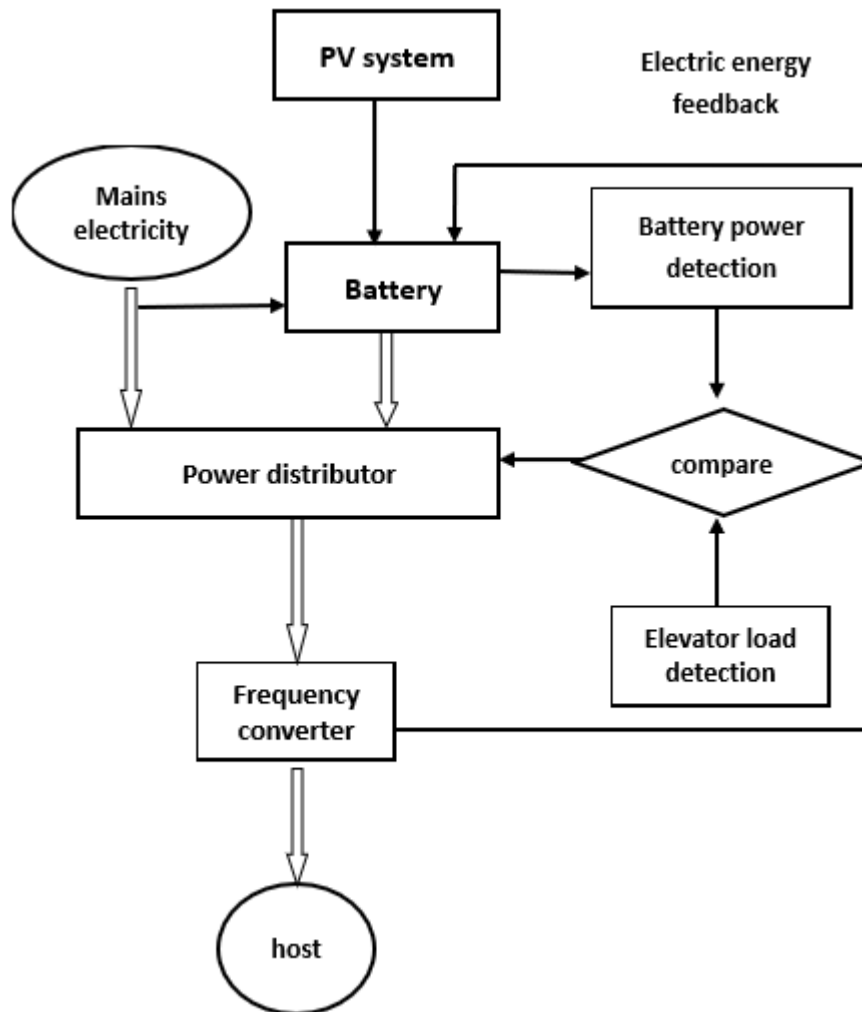


Figure 1. Design Solution of New Energy Elevator

Since the elevator is often in the braking operation state, such as no-load up or full load down, and the current mainstream driving host is permanent magnet synchronous, the elevator is in the power generation state at the moment, and the electricity generated can be stored as energy fragments to the battery, and the amount is considerable.

The elevator load detection in Figure 1 can be carried out in two ways: one is the analog weighing device. The data acquisition mode is the same as the overload mode of the elevator. First, determine the no-load data, then correct the test load data, determine the power consumption according to the elevator running speed and distance, and then compare it with the effective capacity of the existing battery to determine whether it is necessary to switch to the battery power supply mode for this operation; The other is to place weighing sensors at the rope head on the lift car side and the rope head on the counterweight side of the machine room respectively, timely detect the weight difference between the two, and then judge whether to switch to battery power supply according to the comparison between the energy demand corresponding to the weight difference and the current running speed and

distance and the effective capacity of the existing battery. Of course, before making a judgment, the energy correspondence needs to be tested, calculated and adjusted, which is also a key factor of this scheme.

#### 4. Conclusion

At present, the development of new energy elevators still faces many obstacles. The main reason is that the current elevators are directly driven by electricity, and there is relatively no shortage of electricity. However, in order to reduce emissions, we hope that elevators can make some contributions to the national emission reduction goals; In addition, if new energy technology is adopted, the production and manufacturing cost of elevators will be greatly increased, because the acquisition and storage of energy will greatly increase the manufacturing cost, but in the long run, the use cost will be reduced through electricity saving. Overcoming these obstacles requires the support of national policies and technical standards.

## References

- [1] Bingyan Chen,Xingfu Ma,Yi He,Xian Zhou. Elevator design and research [M]. Beijing:Chemical Industry Press, 2015: 118.
- [2] Fuyong Yang.Design and construction of solar photovoltaic power generation system[J].Light source and lighting, 2022 (01): 146-148.
- [3] Fei Xue. Research on elevator design and manufacturing and safety [J]. Science and Technology Innovation, 2019(12);193-194.