Case study—When there is motor load in an energy storage system

When designing an energy storage system, the motor load is always a headache due to its large starting current. Sometimes it could be up to 8 times the rated current. To ensure the system's normal operation, The only solution is to choose a bigger power of inverter , and the system cost thus increases.

So how to resolve this kind of problem? Here we will analyze through a typical case of a farm with motor loads. Below is the load list:

Equipment name	Equipment power (kw)	quantity	Total power (kw)
Water pump	11	1	11
Ventilation fan	1	7	7
air conditioner	1.5	2	3
lamp	0.05	20	1
computer	0.05	3	0.15
total			22.15

Let's analyze the above load types. Generally, the starting power of the water pump can reach 6 ~ 7 times the rated power; The same is true for the ventilation fan. Since the customer uses a constant frequency air conditioner, the maximum starting power is 6 times the rated power (the starting of Inverter air conditioner will not exceed the rated current); Lights and computers are ordinary loads and will not have impulse current.

Therefore, the maximum output power of the above loads should be: 11kW * 7 + 7 kW* 7 + 3kW * 6 + 1kW + 0.15kW = 145.15kw. Considering that the output power of the inverter without instantaneous fault reporting is generally 1.2 times the load of the rated power, the inverter power shall be at least 138.15kw / 1.2 = 121kW, that is to say, a 120kW inverter shall be applied. The load is 22KW, but we need to choose a 120kW inverter, which will undoubtedly increase the cost of the system.

So how to reduce costs while ensuring the normal operation of the system? The primary solution is the problem of high starting power. The VFD(Variable-frequency

Drive) is a special inverter for motor with high price–performance ratio. It also has soft start, speed regulation and various protection functions such as overvoltage, undervoltage, overcurrent, overload and phase loss protection. It can perfectly solve the problem of the high starting current of the motor, and meanwhile, attach additional protection to the system and greatly reduce the hardware loss of energy storage system, so as to prolong the life of the energy storage system.

Therefore, we can use the VFD to drive the water pump and ventilation fan to achieve the effect of soft start (under the same power, the cost of the frequency converter is far cheaper than PCS or HPS). Although the starting power of the air conditioner is relatively large, the PWM waveform voltage output by the VFD can not drive the air conditioner, so it is better to choose the Inverter air conditioner directly when purchasing the air conditioner.
Let's calculate that when the water pump and ventilation fan are driven by VFD, the maximum output power of load is 11 + 7 + 3 * 6 + 1 + 0.15 = 37.15kw. Therefore, a 50KW inverter can do the work, which will greatly reduce the cost. If the customer chooses Inverter air conditioner, the maximum output power of the load can even be as low as 11 + 7 + 3 + 1 + 0.15 = 22.15kw. A 30kW inverter would be enough for the system to further reduce the cost.

How to select the most economical energy storage system while keeping the normal use of load requires rich energy storage experience as well as an in-depth understanding of various types of loads.
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