XVIII World Water Congress
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Resilience Improvement of Water Project Based on New Emergency Power Supply

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Objectives

Operation resilience improvement of water conservancy project is important for disaster prevention and dispose.The main source of key infrastructures in water conservancy project is power supply system.Power loss of water conservancy project induced by extreme events leads to function reduce or function loss. In order to improve operation resilience of water conservancy project related to large area power blackout,quick power supply restoring ability enhancement is studied.An effective way for quick power supply restoring of key infrastructures in water conservancy project is employing emergency power supply. Configuration and dispatch optimization of emergency power supply for operation resilience enhancement of water conservancy project are necessary.

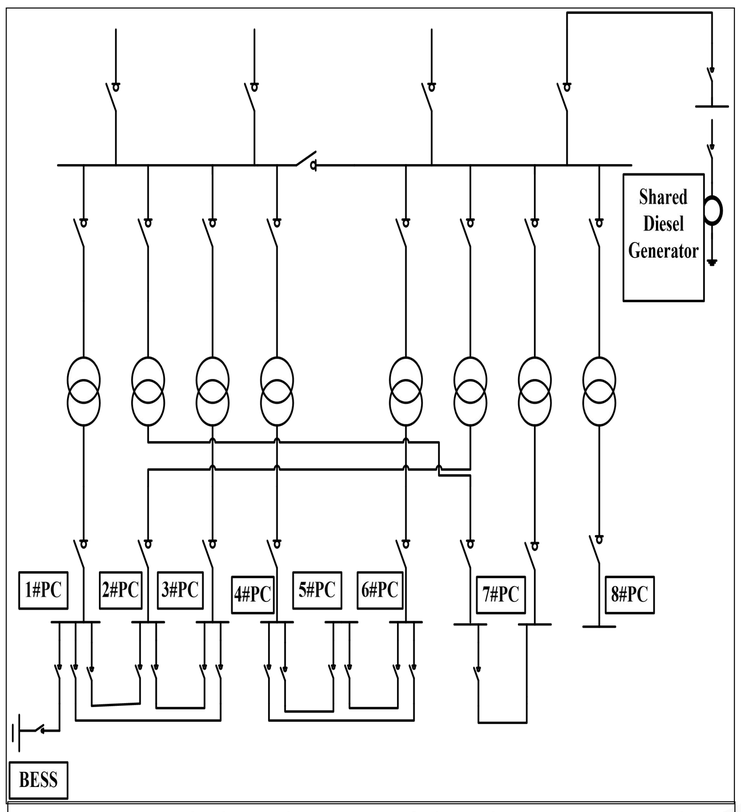

Figure 1 Single line diagram of distribution network in water project with BESS

$$\min f(l) = \sum_{k=1}^{n} \frac{l_k}{\omega_k}$$

$$\min f(t) = \sum_{p=1}^{n} \left(\frac{t_p}{\omega_p} + s_p \right)$$

Figure 2 Models used for location and dispatch optimization of emergency power supply for water project
l is the electrical distance from emergency power supply to load,ω is load weight,*t* is start time of emergency power supply,*s* is electrical distance from emergency power supply to load.

Methods

Discharge ability of project is selected as operation resilience index of water conservancy project,which includes restore capability and restore speed.Location optimization and dispatch optimization of emergency power supply for key infrastructures in water conservancy project are carried out for operation resilience improvement.Effects of different emergency power supply connection points for water project operation resilience restore capability are compared based on calculation results.Recovery time for key infrastructures with different emergency power supplies are compared based on calculation results.Minimizing electrical distance from load to emergency power supply and recovery time are the goals of optimizaiton.Battery energy storage system(BESS) is selected as new emergence power supply.

Results

Locations selected for BESS connection are the orifice hole power center(7#PC) and the power center in 1# intake tower(1#PC).Based on dispatching optimal value calculated,the dispatch order of emergency power supply resources is: BESS in 1# PC,diesel generator,BESS in 7# PC and mobile diesel generator.

Resilience improvement of water project with BESS is 77.82% in terms of recovery capability of discharge ability.

Resilience improvement of water project in terms of recovery speed of discharge ability with BESS is 25%.

Conclusions

Water project resilience can be improved with emergency power supply configuration optimization and scheduling optimization. Local BESS can be used to improve operation resilience of water conservancy project in terms of restore capability and restore speed.Configuration optimization of emergency power supply is achieved by connection point selecting based on load importance considering discharge ability and electrical distance.Emergency power scheduling optimization is achieved by shortening load recovery time and reducing power supply cost with selection of emergency power supply.

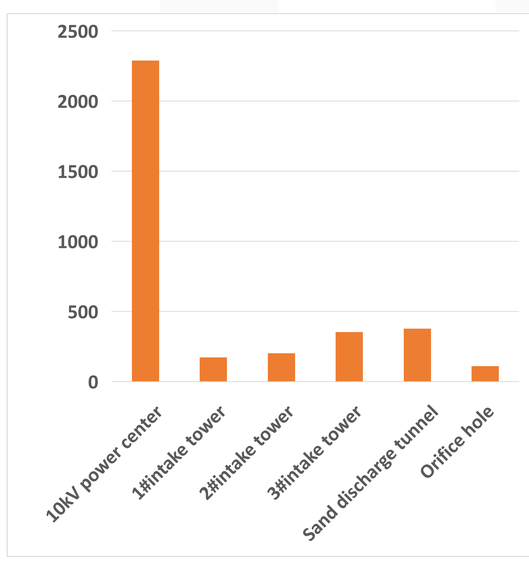

Figure 3 Location selection value for BESS in different places

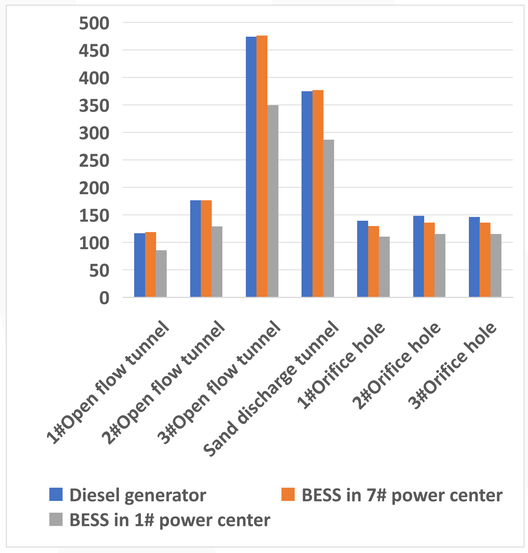

Figure 4 Dispatch optimization value of emergency power supply for different infrastructures