

STUDY ON PRACTICAL TYPICAL SINGLE LINE CONNECTION IN DISTRIBUTION NETWORK

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ABSTRACT

It plays one important role in 10kV distribution network plan by determining the concrete single line connection. The key problem of plan and re-construct distribution network is how to fulfil use the existed distribution network resource, try its best to distribution more and more power, and transmit to the goal network reasonable. Some connection that fit to realize transmit are studied in this paper, in order to transmit to the goal mesh network within lowest cost. Both linkage switch and sect switch are used in the overhead line, which could improve the line load. Dual II style loop network is used in underground cable. The H style connection is widely used in our real network to improve line load, which is transmitted from Dual II style loop network How to transmit from the simple loop network to the complex mesh network with the practical single line connection is also described in detail in this paper. Some engineering measures are also proposed latterly with the experience. The real application that used in hangzhou Municipal Electric Power Bureau shows that the proposed method has the better result. It is fit for the urban distribution network that faces the rapid development and re-construct frequently.

INTRODUCTION

Medium-voltage distribution system exist everywhere in urban, its connection is very complex, and link high-voltage with low-voltage together, it also plays important role in urban planning. Reference [1-5] studied Medium-voltage Distribution System Connection (MDSC) from different view. Reference [6] studied distribution system load forecasting method based on spatial Geographic Information System, which is the goal of MDSC. Combined with Distribution Automation application, reference [7] studied MDSC. Reference [8,9] studied MDSC by suing configuration-unit theory. Both complex mesh network and simple loop network are used in the urban distribution network. The key problem of plan and re-construct distribution network is how to fulfil use the existed distribution network resource, try its best to distribution more and more power, and transmit to the goal network reasonably, such as hangzhou, whose load has the rapid development and re-construct frequently.

Based on the experiences gained in Hangzhou Municipal Electric Power Bureau, some practical MDSC that fit to realize transmit are studied in this paper, in order to realize the goal mesh network.

CONCRETE MDSC

There are four MDSC normally used in real medium-voltage networks, radial mode, radial mode with center, tree mode and loop mode. The radial mode, radial mode with center, and tree mode just cost few investments. They are only power-supply by single power source, so they have lower reliability, whereas the loop mode has far more reliability. The loop mode obviously has much more investment. Although there are different MDSC, we could regard them as some lines, with different power source, which has the standby capability. All we can see, load ratio of line would more high, if it had more linkage and more power sources, see Fig.1. bellows.

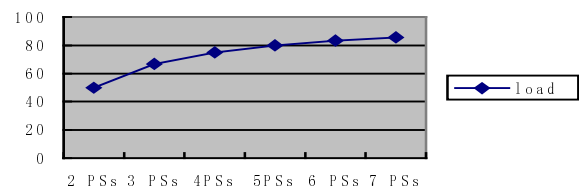


Fig.1. relationship between load and Power Source (PSs)

From the Fig.1., we can see some conclusions. With the increment of power sources, the increment rate of line load ration will slow down, whereas the connection will become more complex, and its management will become more difficulty. From our point of view, line with 3 PSs or 4 PSs has the strong reality and economy, has standby capability. Some MDSC are used in Hangzhou Municipal Electric Power Bureau, which has 3 PSs or 4 PSs.

Overhead line MDSC

We use much more sect and linkage to improve line load ratio in overhead line. For the overhead line network, sect switches are used to sect the gang-line, and to link with other feeders within linkage line in each sect gang-line. If any sect gang-line occurs fault, it would not affect power-supply of other sect gang-line. We normally use two MDSC, one is two sect and two linkage, which denotes as

Fig.2., another is three sect and three linkage.

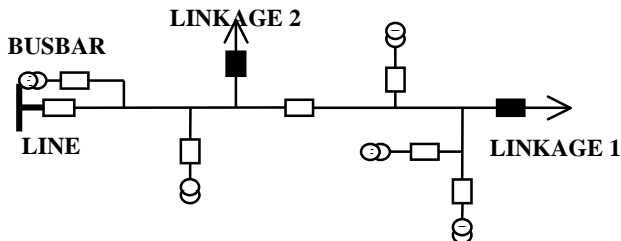


Fig.2. one MDSC with 2 sect and 2 linkage

We use these two MDSC to improve line load ration effectively, and decrease some necessary standby capacity. E.g. line load ratio under normal running condition could reach 67 percent with two sect and two linkage, and 75 percent with three sect and three linkage. From the reliability view, customers are still power-supply by single power source. Compare with single linkage MDSC, still has few improvements. The customer will also lose power, if it link with the terminal distribution and some branch line occur fault.

It also fit to use in the developing area. With the existed single linkage MDSC, we could sect and link easily, then gain much more reasonable MDSC gradually. At the same time, the power supply capability also improves. We pre-design MDSC and line route during planning stage. We implement the single linkage MDSC at first, pay much more attention to insure the line load distribute evenly. With the development of load level, realize the goal MDSC step by step, where we could improve

reliability and fulfil the power supply requirement.

There also two three linkage MDSC. One is five sect and three linkage, another is six sect and three linkage. When faults occur, there are more load transfer methods that we could adopt with more sects. At this time, we could consider real line load and make use of linkage line standby capacity.

Underground cable MDSC

We use dual Π mode MDSC as the basic connection for underground cable network, which denotes as Fig.3. Based on dual Π mode MDSC, H mode connection is widely used in real network to improve line load, which denotes as Fig.4. Similar to the overhead line DSC described above, if one cable occurs fault in the H style connection, then it would not affect other cables running. At the same time, the load power-supply by the faulted cable could be re-power-supply by other cables, for their standby capacity. The main benefit of H mode MDSC is that it could improve line load, whose load ration could reach 67 percent under maximum running condition.

Similar to the sect and linkage growth of overhead line MDSC, the H mode MDSC has the similarity growth. With the development of local area in urban, its load level grows, and its load density becomes much more high, then we use much more underground cables. Based on the original single loop MDSC, we add linkage line in the desiable loop node, to fit the load development. It is widely used in downtown and some other areas, especially high load sensity area, there use underground

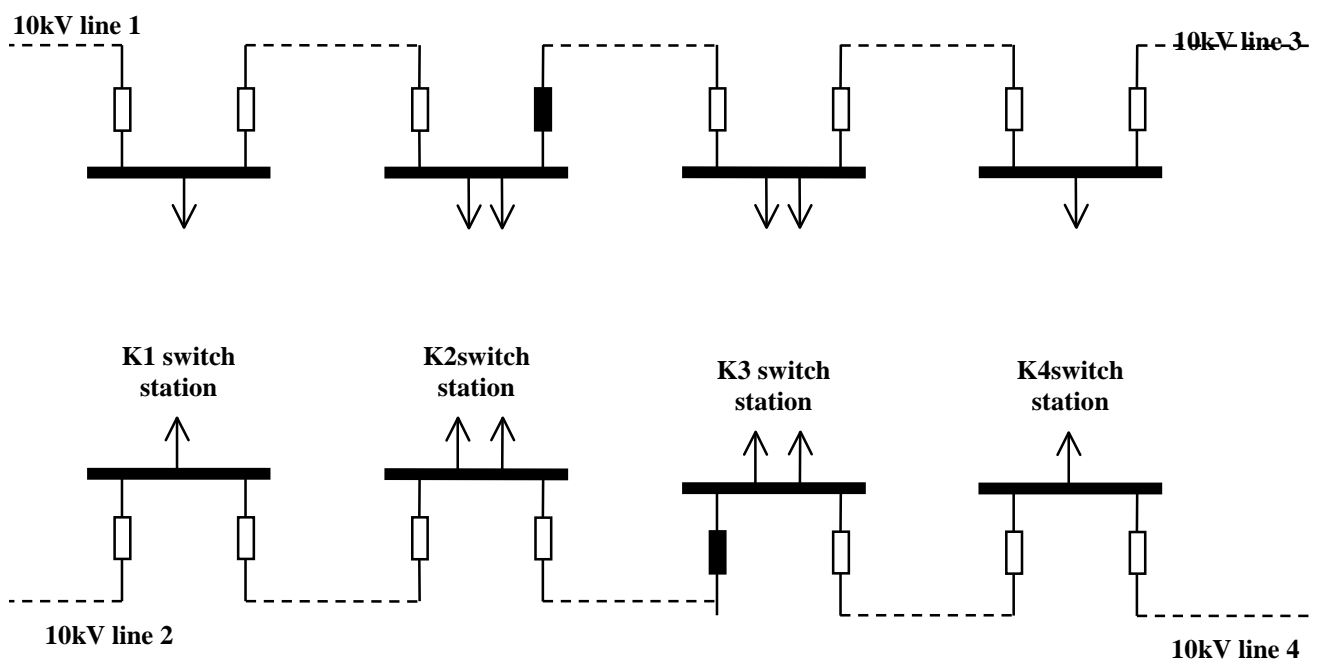


Fig.3. dual Π mode MDSC

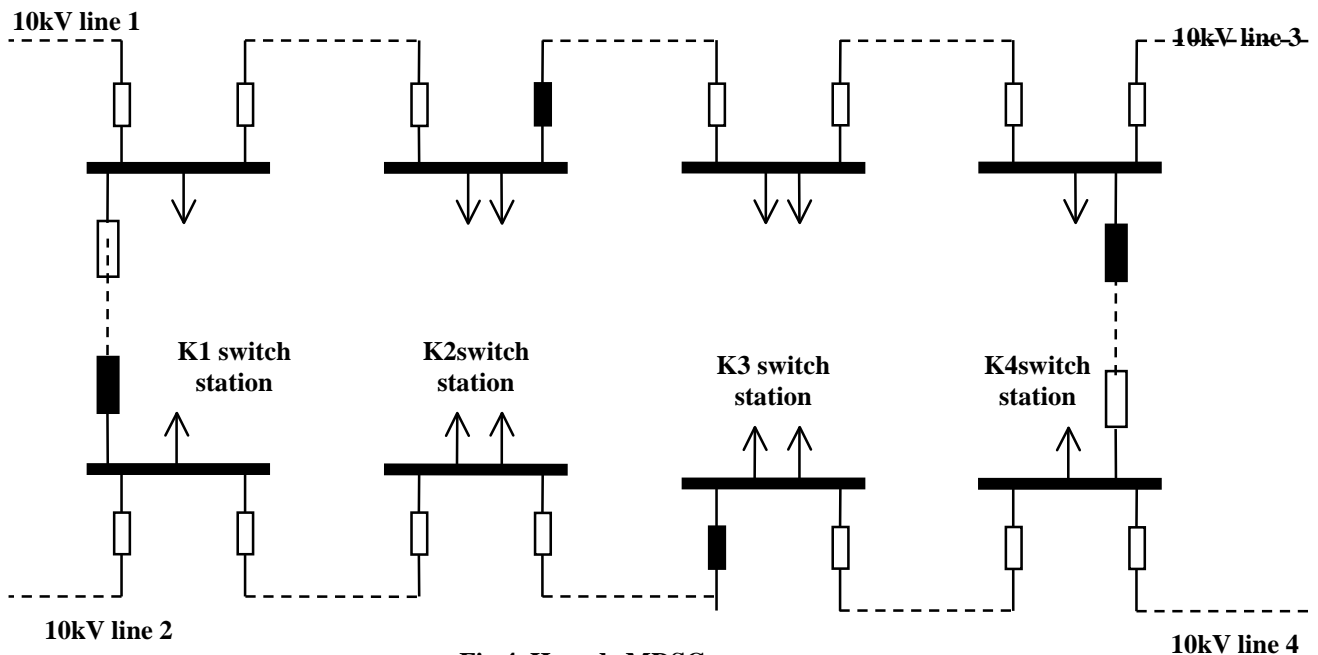


Fig.4. H mode MDSC

cable network to replace overhead line network. We pre-design MDSC and line route during planning stage. We implement the single linkage MDSC at first, pay much more attention to insure the line load distribute evenly. With the development of load level, realize the goal MDSC step by step, where we could improve reliability and fulfil the power supply requirement.

APPLICATIONS

Based on the method described above, we use two linkage mode MDSC in our overhead line network, dual Π mode MDSC and H mode connection in our underground cable network. In 2005, we use dual Π mode MDSC, H mode connection to plan one area, which called as WANGJIANG.

Load forecasting

According to the paper that we collected, the planned area needs 301783kVA. If we consider the maximum distribution transformer load is 80 percent, maximum coherent indent is 0.5, then WANGJIANG needs 150000KW load totally.

Power source

There are three substations in WANGJIANG, two 110kV substations, named as wangjiang and qiutao, and one 220kV substation, named as houchao. The total 10kV capacity is about 375MVA, whereas is 250MVA.

Planned network

According to the load forecasting and block in WANGJIANG, we plan to establish 29 switch stations. Every switch station will power supply 10000kVA. There are 2 cables power supply from wangjiang. There are 12 cables power supply from qiutao. There are 16 cables power supply from houchao. According the dual Π mode MDSC and H mode connection described above, these 30 feeders combine as the mesh network. Its connection is Π mode MDSC and H mode connection.

CONCLUSION

It plays one important role in medium-voltage distribution network plan by determining the concrete connection mode. The key problem of plan and re-construct distribution network is how to fulfil use the existed distribution network resource, and transmit to the goal network reasonable. Both linkage switch and sect switch are used in the overhead line, which could improve the line load. The two linkages mode describes in detail in this paper. Dual Π style loop network is used in underground cable. The H style connection is widely used in our real network to improve line load. How to transmit from the simple loop network to the complex mesh network with the practical single line connection is also described in detail in this paper. Some engineering measures are also proposed latterly with the experience. The real application that used in hangzhou Municipal Electric Power Bureau shows that the proposed method has the better result. It is fit for the urban distribution

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