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Which is the preferred vector group for Solar or Wind Power Plant, Power evacuation Transformer?

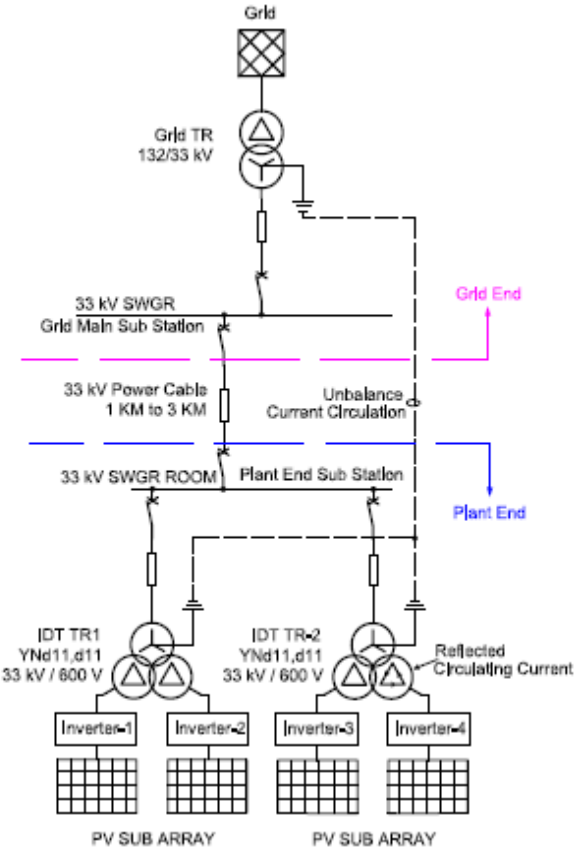
There are two vector group configurations feasible,

a. V1 Vector Group – YNd11,d11

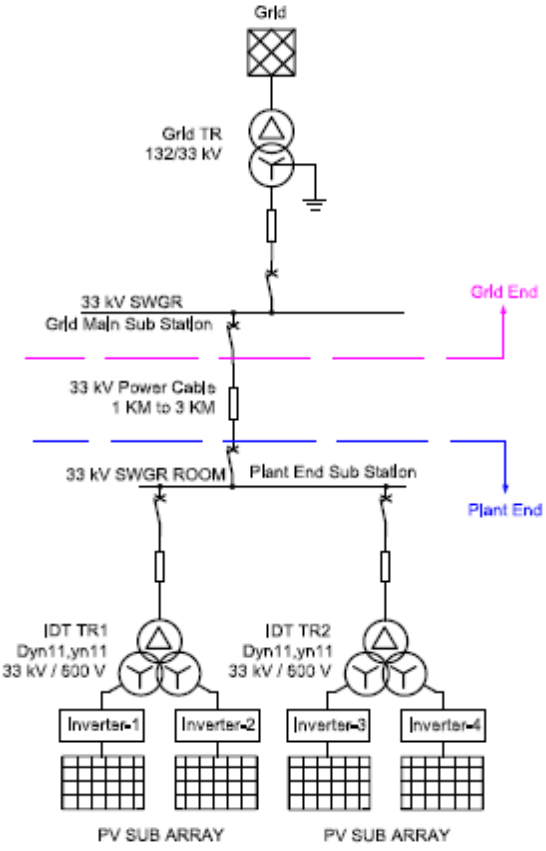
b. V2 Vector Group – Dyn11,yn11

The typical SLD of a Solar Power Plant Generation & Distribution is as follows,

V1 – Vector Group



V2 – Vector Group



IDT: Inverter Duty Transformer

Generally, the primary (MV) side is rated for 33 kV, whereas the secondary (LV) side is 400 V to 600 V, depending upon inverter selection. The 33 kV side is connected with a long cable, of app. 1 km to 3 km to the grid side sub-station.

In view of the above background, technically,

1.0 V1 Vector Group: YNd11,d11 is preferred with Star neutral solidly grounded.

Why?

1.1 For faults in a 33 kV system, the fault current will be seen by both,

a. Grid Transformer and

b. IDT Transformer.

1.2 Thus, the fault on the 33 kV side will be cleared as per the set time delay from sending and receiving end.

1.3 Advantage:

a. Isolation of fault takes place from both sides

b. For Power cable, phase voltage remains as phase voltage as both ends Star neutrals are grounded.

1.4 Likely Problem:

If there is a phase unbalanced current, then there will be a circulating neutral current flowing between two transformer Star Neutral. The magnitude will be low but it has the following effect.

This zero sequence current will reflect on Delta winding and circulate within Delta. Thus, Delta winding will have constant overloading, and overheating above normal operating conditions. A failure of Delta winding may be experienced. This will be like a failure of conventional tertiary winding.

In addition, zero sequence current will be induced in the tank also which acts like a fictitious delta and tank overheating may also happen.

In view of the above the V1 – Vector Group, although preferred from a system viewpoint, it is not recommended.

2.0 V2 - Vector Group: Dyn11,yn11:

The MV side (33 kV) is Delta and the secondary LV side is Star with isolated neutral.

The operation will be,

2.1 33 kV faults will be first isolated by Grid side protection only.

IDT side, isolation will be done by Inverter control circuit due to loss of voltage i.e. loss of synchronizing voltage.

In this short intervening period, the 33 kV system phase voltage will rise to line voltage, which will stress the power cable insulation. In long run, there may be cable failure.

2.2 The advantage of this Vector Group will be that, there will not be circulation of current on the 33 kV side, as Delta on the 33 kV, the side will provide isolation.

Thus, Dyn11,yn11 Vector group is recommended for IDT application of Solar as well as Wind Power.

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