Analysis of Cloud Indicators to Derive the Bus Bar Voltage at a Local Low Voltage Distribution Grid Transformer

Introduction
The aim is to identify an indicator to characterize the influence of irradiance fluctuations on voltage stability at the bus bar of a distribution transformer in a low voltage grid with noteworthy PV penetration. Cloud mask and other cloud physical parameters of the weather satellite MSG are taken as the basis for cloud indicators and the comparison of clouds and voltage.

Approach
The raw voltage measurement values from the bus bar are not usable to find a correlation to the cloud information. Thus, the measurements have to be corrected according to three variables of influence:

- voltage drop due consumption
- voltage drop due generation
- voltage in the medium voltage grid

The approach to correlate voltage and cloud data is to analyse the reduction of the disturbances due to the medium voltage and the load consumption by using the voltage drop over the transformer and the standard load profiles adjusted to the yearly energy demand and grid losses of the test site investigated.

Results
The installed PV systems reduce the load driven voltage drop over the transformer on clear sky days by 2% p.u. of the nominal voltage in average.

There is also a reduction of the voltage drop during the overcast days. For cloudy days this reduction is in average down to 0.5% p.u. only.

The approach rejects the influence of the medium voltage and the load by using the voltage drop over the transformer. Necessary input parameters are the load flows over the transformer and cloud information, especially cloud mask, cloud coverage and cloud types. All these results were calculated without specific information of the installed PV systems. The only information is the installed nominal power which is available by the distribution system operator.

There is also no need for a detailed model of the medium voltage grid and the nearby low voltage grids.

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