POWER QUALITY

Initiatives by BESCOM

Due to increase in usage of non-linear loads, there is distortion of Power quality.

Poor Power quality may be due to:

- **Drop in system voltage because of lengthy lines/over loaded lines – Improper planning.**
- **Drawl of more reactive power resulting in increased technical losses and poor voltage profile.**
- **Injection of current Harmonics by consumer loads.**

The non-linear behaviour of such loads causes distortion of current waveform, which in turn distorts the voltage waveform. It is a challenge for the distribution utilities to overcome such problems and they can be mitigated by:

- Improving the voltage profile with proper planning.
- Providing dynamic reactive power compensation.
- Conducting studies and taking suitable action to mitigate the harmonics.

Now, under SRTPV, solar power is injected to distribution grid at HT and LT level.

At 7 SRTPV installations of 100kwP and above, harmonics level and DC current injection study was conducted with the assistance of PRDC and the observations of the study report are:

- At some locations, though some of the harmonics levels are predominant/ exceeds the limits for shorter period, they are within the specified limits.

At one location, 5th voltage harmonic distortion violated continuously the specified limit for numerous times during non-solar period.

- Total distortion are within limits.
- During measurement of DC current injection, the solar generation was not at full capacity and the limits were within the specified limit.
- The DC current injection may exceed the limit when the system operates at rated capacity.

Similar studies were conducted at 10 different category HT installations and at 4 installations following observations were made:

- 5th harmonic Voltage distortion exceeds the IEEE specified limit of 3% by 85%.
- 5th harmonic voltage distortion exceed the IEEE specified limit of 3% by 43% and the disturbance has occurred at several instances and exceeds for a maximum continuous duration of 250 minutes.

The Total harmonic distortion is 14.41% and is just below the IEEE specified limit of 15%

- At one location, 2nd to 8th order voltage harmonic distortions exceeds the IEEE limit by 378%, 210%, 100%, 47%, 35%, 1% and 8% respectively.

  At the same installation, 2nd and 4th order current harmonics exceeds the IEEE specified limit by 64% and 23% respectively.

The study warrants BESCOM to move forward and BESCOM planned to conduct few more such studies and to:

- **Insist for Harmonic filters**
- **To have a penalty clause**
- **To Measure/record Harmonics.**

In addition, BESCOM has taken steps to identify some of the nodes where reactive power drawl is more and an initial study has already been conducted at one of the node.

Now it is the high time to plan for dynamic reactive power compensation which will:

- Enhance the network capability.
- Improve voltage profile.
- Less capital investment.
- Reduce technical losses.

- Implementation of DAS in major cities will also help in improving the power quality by keeping the 11kV ring system open at right location with prior study.
- Identifying the DTs which are overloaded/ not at load centers with proper planning and taking suitable action.

THANK YOU

Limits :IEEE 519-2014

Voltage distortion limits

Bus voltage at Point of Common Connection(PCC)	% Individual voltage distortion	% Total voltage distortion THD
1.0 kV and below	5.0	8.0
Above 1.0kV through 69 kV	3.0	5.0
Above 69 kV through 161kV	1.5	2.5
Above 161kV	1.0	1.5

Limits :IEEE 519-2014

Current distortion limits for systems rated 120V through 69kV:

Maximum harmonic current distortion in percentage of I_L						
Individual harmonic order(odd harmonics)						
I_{SC}/I_L	3≤h<11	11≤h<17	17≤h<23	23≤h<35	35≤h<50	TDD
<20	4.0	2.0	1.5	0.6	0.3	5.0
20<50	7.0	3.5	2.5	1.0	0.5	8.0
50<100	10.0	4.5	4.0	1.5	0.7	12.0
100<1000	12.0	5.5	5.0	2.0	1.0	15.0
>1000	15.0	7.0	6.0	2.5	14	20.0
Even harmonics distortions are limited to 25% of the odd harmonic limits.						
TDD = Total Demand Distortion						