Aerial MV covered networks: Worth a new look?

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1. INTRODUCTION

An increasing number of countries are deploying alternatives to bare conductors for aerial medium voltage networks. This trend is mostly driven by increased pressure on Distribution System Operators for aspects such as:

- Reliability of supply far more important now
- Safety of overhead networks becoming very important, particularly with respect to bushfire ignition.
- Tree trimming becoming both a cost and environmental issue.
- Wildlife concerns.
- Linemen and contractors are now more comfortable working with insulated networks.

While undergrounding networks addresses all of these issues, the additional cost and lack of flexibility limits the possibility to generalize these types of networks.

Various solutions exist for insulated overhead lines mostly based on 2 families of conductors: 1/ MVABC with fully insulated screened conductors and 2/ covered conductors, typically unscreened.

Medium Voltage Covered Conductor has been around for many years. Depending on the continents, various technical and network design approaches have grown.

MVCC has shown in many countries that it can provide a very secure supply network for a reasonable cost premium vs. bare networks.

Countries such as India are now looking for safe and reliable methods of delivering medium voltage supply to its ever-expanding population and MVCC is being used on a rapidly increasing basis.

However, MVCC networks must be designed correctly to achieve these levels of reliability. Some physical phenomenon need to be addressed properly such as but not limited to:

- Electrical stress around unscreened conductors
- Corrosion related to water ingress
- Over voltage focal points
- Thermoplastics wear, tear, relaxation to weather and pollution
- Cover materials and behavior with temperature
- Hotspots due to pour connections

Various unfortunate returns on experience in some countries have occurred when some of these aspects were neglected leading to a limited foothold in either the maintenance or the construction of new overhead circuits. Due to a better understanding of these aspects, simpler systems can now be designed which will achieve these levels of reliability and safety.

The authors are working closely with Indian utilities in developing cost effective MVCC systems for large scale deployments which address the many aspects of system design and operation.

2. MEDIUM VOLTAGE OVERHEAD INSULATED/ COVERED LINES

The push for ever increasing levels of reliability, reduced tree clearing, and concerns for the protection of wildlife have meant that Electricity Distribution Authorities have been forced to look for better ways of medium voltage distribution.

Due to budgetary constraints and the immense difficulty of trenching in heavily built up areas this has meant either using MVABC or converting the existing overhead bare circuits to MVCC.

The use of MVABC is still considered by many to be the ultimate solution due to its fully screened nature giving the cable a “safe to touch” characteristic however the costs associated with the cable, its significant additional weight resulting often in the need for pole replacement, its requirement for highly skilled installers, and its difficulty in the provision of connections has significantly limited its growth outside very specific areas where it can be the only solution. The simpler connection and jointing of MVCC is making it the preference in many countries such as India. Figure 1 is a typical metallic screened MVABC with either an insulated or bare catenary.

Figure1. Typical MVABC with screened phases and catenary.

These limitations therefore forced Utilities to investigate other means of achieving their objectives and this eventually led to the use of MVCC.

Various designs appeared in different countries, some successful and others with very poor performance.

3. EXPERIENCE

Medium voltage overhead covered conductors are not a new concept and they have been used with varying amounts of success in various countries over the last 30 to 40 years.