Ampacity and other design considerations for Medium Voltage cables used in renewable energy applications

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Renewable energy systems often include underground distribution cables to connect solar panels or wind turbines to collector stations where there is a step up in voltage for transmission to the nearest utility system. The general approach is to utilize medium voltage distribution cables. Many of these systems are designed and installed by developers that are seeking to minimize the project cost so that the payback period of the systems can be realized sooner, making the economics of these systems more attractive to regulators, utilities and other entities.

There have been many instances of these cable systems failing after being placed in service due to issues related to thermal overload. The cause of these problems is based on applying traditional utility distribution cable system practices to the environments and operating scenarios associated with many of the renewable energy sites that have alternate characteristics.

Factors to consider include:

- Common cable installation practices for renewable energy projects
- Geographic environments for renewable projects
- Route thermal survey and trench design and backfill characteristics
- Load and loss factors and circuit loading diversity as affects ratings
- Selection differences between utility distribution cables and renewable energy cables
- Economic factors
- Common project ownership
- Generating characteristics of wind and solar farms
- Cable system ampacity

The combination of these factors and their proper consideration impacts longevity of the cable system and can result in rapid thermal degradation within a few years, affecting the availability and reliability of the renewable energy source that normally would have an expected life of decades.

The paper summarizes and discusses each of these issues and shows that economic factors encourage minimizing the cable size for a given project while also seeking to reduce installation costs without fully engineering the cable ratings and design. Often, the assumed characteristics of the thermal environment are highly optimistically such that cable ratings based on the selected cable size are over stated. The paper identifies the key features of the cable system design to enhance reliability by avoiding thermal degradation of the cable system.

The conclusion states that with careful selection of the cable size with proper consideration for the approach used during installation of the cable, including realistic evaluation of the extent of trench preparation and application of specialized backfill, can allow a reliable cable connection for renewable energy projects. The work is a guide to the renewable energy industry.