Forecasting for dynamic line rating

This paper presents an overview of the state of the art on the research on Dynamic Line Rating forecasting. It is directed at researchers and decision-makers in the renewable energy and smart grids domain, and in particular at members of both the power system and meteorological community. Its aim is to explain the details of one aspect of the complex interconnection between the environment and power systems. The ampacity of a conductor is defined as the maximum constant current which will meet the design, security and safety criteria of a particular line on which the conductor is used. Dynamic Line Rating (DLR) is a technology used to dynamically increase the ampacity of electric overhead transmission lines. It is based on the observation that the ampacity of an overhead line is determined by its ability to dissipate into the environment the heat produced by Joule effect. This in turn is dependent on environmental conditions such as the value of ambient temperature, solar radiation, and wind speed and direction. Currently, conservative static seasonal estimations of meteorological values are used to determine ampacity. In a DLR framework, the ampacity is estimated in real time or quasi-real time using sensors on the line that measure conductor temperature, tension, sag or environmental parameters such as wind speed and air temperature. Because of the conservative assumptions used to calculate static seasonal ampacity limits and the variability of weather parameters, DLRs are considerably higher than static seasonal ratings. The latent transmission capacity made available by DLRs means the operation time of equipment can be extended, especially in the current power system scenario, where power injections from Intermittent Renewable Sources (IRS) put stress on the existing infrastructure. DLR can represent a solution for accommodating higher renewable production whilst minimizing or postponing network reinforcements. On the other hand, the variability of DLR with respect to static seasonal ratings makes it particularly difficult to exploit, which explains the slow take-up rate of this technology. In order to facilitate the integration of DLR into power system operations, research has been launched into DLR forecasting, following a similar avenue to IRS production forecasting, i.e. based on a mix of statistical methods and meteorological forecasts. The development of reliable DLR forecasts will no doubt be seen as a necessary step for integrating DLR into power system management and reaping the expected benefits

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Department of Electrical Engineering, Center for Electric Power and Energy, Energy Analytics and Markets, ParisTech, University of Liege, Ricerca Sistema Energetico SpA, Norwegian Meteorological Institute, Meteotest, Università degli Studi del Piemonte Orientale - Amedeo Avogadro, Aristotle University of Thessaloniki, VTT - Technical Research Centre of Finland
Number of pages: 18
Pages: 1713-1730
Publication date: 2015
Peer-reviewed: Yes

Publication information
Journal: Renewable and Sustainable Energy Reviews
Volume: 52
ISSN (Print): 1364-0321
Ratings:
BFI (2019): BFI-level 2
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 10.54 SJR 3.036 SNIP 3.594
Web of Science (2017): Impact factor 9.184
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 9.52 SJR 2.998 SNIP 3.501
Web of Science (2016): Impact factor 8.05
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 8.35 SJR 2.921 SNIP 3.368
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 7.79 SJR 3.03 SNIP 3.72