Study Committee B2

Overhead Lines

10911_2022

DYNAMIC LINE RATING IN THE SPANISH OVERHEAD TRANSMISSION NETWORK

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Introduction

- The goal of the paper is to spread the approach and experience of the Spanish TSO regarding the deployment of dynamic line rating (DLR), show the final results of the technical and economical assessment of sensors performed, and explain the ongoing pilot project carried out to test the functioning of the whole DLR system in the overhead transmission network.
- The transmission grid planning, which is approved by the Council of Ministers and is binding for the Spanish TSO, includes for the first time the DLR as a development way of the transmission network, considering around 700 km of overhead circuits to be operated in a dynamic fashion.

Spanish TSO approach

- The Spanish TSO considers that it must know the details of every component of the system, both software and hardware, and have access to the data, algorithms, and results. Third parties' close solutions working as black boxes do not fit this approach; the power transmission system is strategic and critical, and the transmission capacity of the circuits is a key factor for a TSO to duly perform its tasks.

Technical and economical assessment of sensors

- Test performed in an existing transmission power line considering weather stations and sensors (spot, discrete and distributed).
- Regarding the sensors, the technical results are presented in the next slide: the first figure corresponds to the discrete sensors and the second one corresponds to the distributed one.
- The next table sums up the technical and economical test results. It is important to bear in mind that these results are only valid in the context of the test, i.e., one span and assessing only the sensor functioning, without considering neither communications nor real time thermal rating (RTTR) algorithms.

✓: valid – ✓: partially valid – ✗: not valid

DLR system	TECHNICAL validation	ECONOMICAL validation	GLOBAL validation
Remote WS	✓	✓	✓
Local WS	✓	✓	✓
Pilot tilt sensor	✓	✓	✓
CS#1	✗	✗	✗
CS#2	✗	✗	✗
OPPC	✓	✗	✗

Conclusions

- Tilt (sag) sensors are working well, nonetheless, the RTTR computation process would be much more straightforward if conductor equivalent temperature and/or effective wind low-cost sensors were available.
- It is necessary to look for more sensor providers that meet the technical and economical requirements within the Spanish TSO approach.
- It is also advisable to keep collaborating with industrial internet of things (IIoT) communication providers to extend the coverage areas.
- RTTR is a necessary result but is not the final one; forecasting is indispensable for a system operator to use the DLR.

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continued

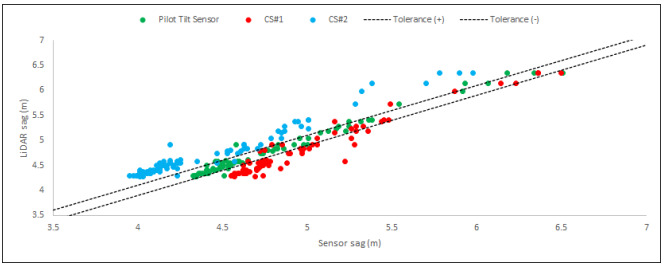

Figure 1 – Sensor versus LiDAR sag (discrete sensors test results)

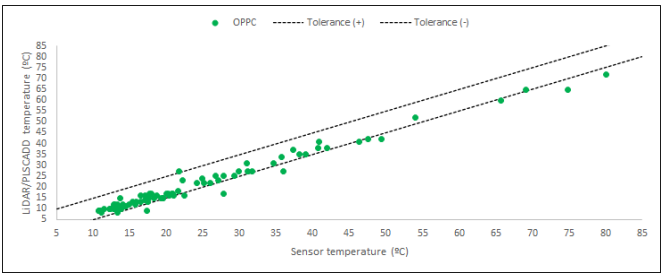

Figure 2 – Sensor versus LiDAR/PLSCADD temperature (distributed sensor test results)

Pilot project

- Evolution from the span to the circuit and taking into account the whole system, not only the sensors but also communications, cloud platforms, system architectures, RTTR algorithms and capacity forecasts.
- The final DLR system solution to be deployed at circuit scale encompasses both local weather stations and tilt sensors following the next general rule: one tilt sensor in each circuit section plus a local weather station associated to every other tilt sensor. This way, the tilt sensors cover the effective wind speed and the local weather stations cover the ambient temperature and solar radiation.
- There were chosen four transmission circuits for the pilot project, ranging from 400 kV to 66 kV, and considering both mainland and one island.