

Heat dissipation of high voltage cable systems - A technical and agricultural study

Jan **BRÜGGMANN** (1), Ludger **JUNGNITZ** (1), Peter **TRÜBY** (2), Dirk **UTHER** (1)

- 1 Amprion GmbH, Dortmund, Germany, jan.brueggmann@amprion.net, ludger.jungnitz@amprion.net, dirk.uther@amprion.net,
- 2 Albert-Ludwigs-Universität, Freiburg, Germany, peter.trueby@bodenkunde.uni-freiburg.de .

Germany is going to restructure its whole energy sector within the framework of the so called "Energiewende". Due to the fact that wind energy and especially off-shore wind farms are located in the North of Germany, there is the need to strengthen the North-South transport capacity of the electricity network. To increase the overall public acceptance of electrical infrastructure certain projects were identified by the government and given by law, where partial cabling at 380kV AC shall be implemented as pilot projects to gain experience.

An important aspect in designing these cable systems is the bedding material. It influences the ampacity significantly. For cable links of smaller transmission capacity, sand was applied and rated to be sufficient. Due to the increasing transmission requirements, accompanied by increasing ohmic losses and thus increased emitted heat, there was the need to look for bedding materials with lower risk of partial drying.

The analysis of possible alternatives turned out, that in general, there are materials available fulfilling the more advanced technical requirements. Among those were promising new bedding materials. However there was the lack of experience concerning the behavior of this new type of bedding material that showed up strengths and weaknesses under laboratory conditions.

To qualify these new bedding materials it was decided to launch a field test under life conditions and to investigate the thermal properties in detail. Therefore, a new build cable system with a length of about 400 m was equipped with various bedding materials. The applied materials were chosen with respect to their expected performance as well as their acceptance by permitting authorities and landowners.

As a second, not less important aim was to gain insight about the influence of the cable system as a heat source on the performance of soil used for agricultural purposes covering the cable route. Therefore, the vicinity of the cable system was equipped with temperature and moisture probes. Right above the cable system, different agricultural crops were cultivated. The harvest from the cable route was compared to the one of a reference field nearby.

The test setup including the cable system, the bedding materials, the circuit to heat up the system artificially as well as the arrangement of temperature and moisture probes will be explained. An analysis of the thermal distribution with respect to the applied bedding material and its shape will be provided. The results of different harvests will be displayed.