How to efficiently manage a high voltage electric underground link against all evidence

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ABSTRACT

The increasing use of underground cable systems is often based on the argument of the easy acceptance by the people living in the neighbourhood, compared with the overhead line scenario.

Hence a project manager may be inclined to believe it is more straightforward to succeed in an efficient project with underground techniques, whether in terms of technical optimisation, deadlines, costs or environmental impact.

This is not the case at all: to make such a project efficient, it is necessary to be aware of and to integrate the constraints, opportunities and limits of the underground cable solution

KEYWORDS

project management - studies & survey – engineering - installation.

PROJECT DEVELOPMENT STUDIES AND PUBLIC CONSULTATION

A grid project is the outcome of either a need assessment (for example integration of renewable) or a network study thus enabling the project owner to decide the nature of the investment.

The choice between underground or overhead lines is usually driven by environmental expectations but such choice should not mask the potential traps of wrong ideas such as acceptability, ease or simplicity. This is not the case since an underground solution will be therefore considered as a starting point with no compensation, while forgetting that regulations and public consultation prove to be as long and complex as for an overhead line and the duration of the legal proceedings erratic.

CHOICE OF GENERAL ROUTE: PITFALLS TO AVOID

As early as this stage, it is necessary to think about and be aware of the potential consequences of the choices made. Inappropriate route choices can be detrimental to the technical and economic performance of the project. Opportunities can be deceptive and backfire. For instance, burying an underground link in a sandy zone can seem easier than in arable land. Here's a list of pitfalls:

Sand: easy to dig through but crumbles easily, hence excavation needs to be fully supported with trench shoring or shielding to protect workers. The heat from the cable is also less well dispersed in sand than in loamy soil, hence a decrease in current transport capacity for the same conductor section.

Wetlands: apparently favorable for cooling the cable but there is a need for perfect waterproof quality of the permutation chambers and permutations themselves, otherwise the equipment deteriorates quickly.

Routes along roads make it easy to bring machinery and equipment, but the works time length (open trench) is often restricted by highway operators so as not to disturb traffic too long; those restrictions as well as a works protection plan are often imposed (road safety barriers, traffic management barriers...) and the cost of projects is multiplied by the need to reinstate the road surfaces. Often, those routes are also longer than one across fields. Moreover a field trench can usually stay open the whole season. If gas transport engineering can produce straight pipelines in fields, why would it not be possible to do it for underground electric links?

Routes along other electric networks: the benefits of common ground works are unfortunately neutralized by the thermal proximity of the other network. This generally leads to adopting a superior section of cable. This proximity also increases the probability of simultaneous breakdown in case of accidental damage with a digger. This can have dire consequences if the two contiguous links are the only connection between an electric site and the rest of the network (delivery substation or evacuation of production substation).

Any temptation to **longitudinally follow some large infrastructure** or heavy traffic carriageways (tunnel, bridge, motorway, railway...) means becoming hostage of the owner of those infrastructures and having to bend to their demands and pay for it (depth of work, dimensions and specifications, planning of works, health and safety constraints...).

In the same way, **neighboring metallic ducting** (copper telephone lines, oil pipelines) can incur compensation measures (draining grids for circuit-trip currents to prevent surges in power, inclusion of insulation valves on pipelines...).

Following steep slopes to pass an elevation point through the shortest way can damage the link's longevity; rainwater runs along the slope, filters into the civil engineering structures and can wash it away or expose it following heavy rains. As well as repairing costs to the structure, landslides can damage the cable itself (plastic outer jacket, aluminum sheath, insulation complex...).