

## French feedback on civil and installation works of transmission underground cable systems

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### ABSTRACT

*The number of underground cable systems of long length is growing significantly at RTE.*

*The increased mean length of cable sections contributes to the achievement of major projects, facilitated by the mechanised laying and the use of HDPE ducts.*

*The optimisation process is based on the improvement of construction sites and the reduction of the number of joint bays, taking into account environmental criteria or local employment for a better social acceptance.*

*In parallel, the calculation of cable pulling forces is a key factor of optimisation and a safety feature.*

### KEYWORDS

Civil works; installation; cable pulling; tension stress; side wall pressure; drums; long cable length; mechanised laying; mobile extrusion plant; HDPE ducts; environment; local employment; major projects;

### INTRODUCTION

The number of high voltage (HV) underground cable links of long length (more than 20 km) is increasing significantly, at RTE – the French transmission system operator – for both HVAC and HVDC circuits.

RTE has been building power links greater than 20 km for 2009. 45% the links scheduled for the 2014-2016 period should exceed this length, according to Fig.1.

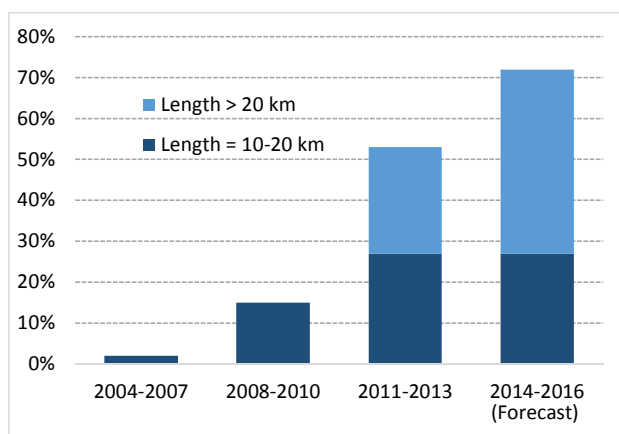


Figure 1: Evolution of the length of underground circuits

The optimisation of the grid development requires an improved efficiency of the works on one hand, and a reduction of the number of joint bays on the other hand.

However, the associated increase of section length must remain compatible with the management of the cable installation and must comply with the technical reference framework of RTE. In other words, this means to control pulling tensions and side wall pressure under the permissible values, allowed by the cable itself and the structure where the cable is installed.

### INTEREST OF LONGER SECTION LENGTH OF CABLES

The engineer has to consider two questions: are the permissible limits (pulling tensions and side wall pressure) stress values or upper bound values? Which is the optimal length for the cable route?

We first analyse the need for RTE to increase the mean length of the cable sections, the need for taking into account environmental requirements and local employment initiatives, as well as the effects on the calculation practices.

#### Need for increasing the mean length of the cable sections

Long cable lengths mainly relate to rural areas where cable route in open fields can be favoured. The little or no presence of other underground networks is required for civil work mechanised operations.

Nevertheless, the underground cable links may present some difficulty in terms of acceptance by residents. It is thus essential to add value to environmental criteria and local employment, with regard to the elected representatives and inhabitants.

#### Mechanisation of construction sites in rural areas

Linear lots allocated to joint ventures rising significantly, gains of scale can be performed, through mechanisation and simplification of civil works along two main lines:

- The reduction of the number of joint bays,
- The wide application of the cable installation in high density polyethylene (HDPE) ducts.

The first point requires longer cable sections. For a given distance, the increased length of elementary sections lowers the cost associated to joint bays (delivery and unloading of cable drums, supply and assembly of joints...) and contributes to reduce the number of weaker points for a better reliability.

The second point favours the use of a trenching machine, combined to a mechanised installation process (Fig. 2-5).