



UNDERGROUNDING AND REORGANIZATION OF THE ELECTRICAL SYSTEM OF THE CITY OF MADRID



Josu ORELLA, Iberdrola Ingeniería y Construcción, Spain, josa@iberinco.com
Mikel BARRIOCANAL, Iberdrola Ingeniería y Construcción, Spain, mbr@iberinco.com
Roberto CABERO, Iberdrola Ingeniería y Construcción, Spain, rcal@iberinco.com

ABSTRACT

Nowadays, the strong growth and fast development of cities require the reorganization and modernization of their electrical systems, with a view to be able to satisfy the present and increasing demands, and the future ones of the new industrial and residential areas.

The execution of this project, committed to the environment and of doubtless social benefits, requires the collaboration, support and will of the different official administrations such as City and County Councils, etc.

This one of a kind project not only comprises the undergrounding of more than 120 km of overhead lines that range from MV to EHV, but also the dismantling of old lines, substations compaction and the reduction of the visual and environmental, economic and social impact that the electrical infrastructures produce on high density urban nuclei.

This paper identifies the key points for the achievement of the project, starting with the network planning and the creation of standardized components, the optimized design, participation of the public administrations and utilities, including suppliers pre-qualification and finally the coordination of the different contractors.

KEYWORDS

Underground, XLPE, cable system, High Voltage, EMF, horizontal drilling, gallery, installation, environment.

1. BACKGROUND

Nowadays, there is considerable public pressure against overhead lines that can be summarized by the well-known NIMBY effect (Not In My Back-Yard), which describes the phenomenon in which residents oppose a development as inappropriate for their local area, but do not oppose such development in another's.

In Spain, there is an intense debate on the possible health risk from electromagnetic fields, not only from the powerlines but also from mobile phone antennas.

Moreover, concerns regarding aversion to powerline towers and property devaluations have played a powerful part when considering the construction of overhead powerlines and have forced the undergrounding and reorganization of the electrical system of the city.

Cable systems based on current technology, and compared to overhead powerlines, have several advantages from social and environmental standpoint:

- Socially accepted
- Negligible visual effect
- Small right-of-way
- Low overall electromagnetic fields
- Lesser land depreciation
- No noise or corona activities
- Small transmission losses
- Less prone to failures

2. PROJECT FEATURES

Iberdrola is implementing a major project of reconstruction of the powerlines of the city of Madrid, also known as Plan Madrid within the company.

This project is comprised of the following major parts:

- Construction of 16 Compact Substations (GIS)
- Dismantling of more than 125km of overhead lines
- Construction of more than 180km 220kV, 132kV 66kV and 45kV underground lines

3. PLANNING

As previously said, the project comprises both Medium Voltage (MV) and High Voltage (HV) networks. However, in HV extra consideration had to be taken into account due to the following aspects:

- Some are part of the backbone of the transmission system. Thus, reliability is the highest priority.
- The higher the voltage level, the more difficult it is to design and coordinate cables and accessories.
- HV cable systems are subjected to higher electrical stresses, thicker insulation and greater thermo mechanical effects.

The cable route selection is done taking care of minimizing the impact on the environment and social community, always considering the most cost-effective alternative. For each powerline project it is assessed the impact of the construction on this topics: Land use, geotechnical and soil condition, traffic and parking affection, archaeology, health and safety, electromagnetic fields and the social-economical benefits.