

PLMI

1346 km of overhead transmission lines inspected in 15 days

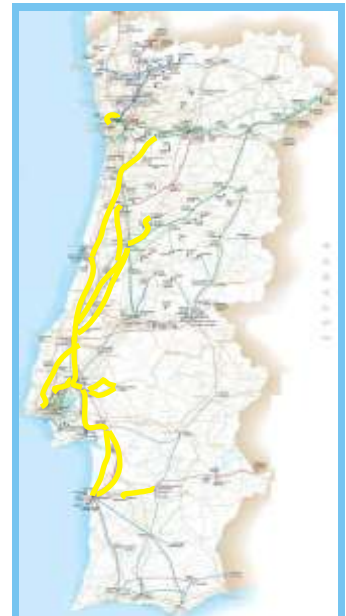
labelec (grupo edp, www.edp.pt) - the company responsible for maintenance inspections of assets in the Portuguese electrical transmission and distribution grids - inspected 1346 km of over head transmission lines operated by REN (www.ren.pt). Using the PLMI (Power Line Maintenance Inspection) system developed by Albatroz Engineering, the overhead lines were inspected in only 15 working days between the 22nd of November and the 13th of December 2007.

The inspection missions included conductor anomaly detection using thermographic image (infrared) analysis, physical anomaly registration using video images and track clearance inspection using a LIDAR laser. The inspections were performed in 150, 220 and 400 kV lines, corresponding to 19% of the entire Portuguese transmission grid. The three types of inspections were performed simultaneously, using a helicopter

operated by HeliPortugal and required, in addition to the pilot, only two line inspectors.

The PLMI system permits several different types of maintenance inspections to be performed simultaneously by digitally recording, synchronising and geo-referencing several data sources. Visualisation and analysis are possible using intuitive interactive interfaces. The data collected is used to generate detailed reports that enable urgent interventions to be solved quickly, optimised scheduling of the maintenance program increasing quality of technical service and efficient management of maintenance resources.

Despite delays due to weather conditions which demanded patience, motivation and flexibility in planning from the inspection crew, deadlines were met and inspection reports were delivered in the first two weeks of January.



1346 km of inspected lines (in yellow) over the transmission lines map.

Source: 2007 Map of the National Transmission Grid, REN



Line crossing reconstruction (LIDAR and image)

Thermography and video synchronization



The portuguese case

Economic benefits of maintenance inspection in distribution grids

Non Supplied Energy [MWh]	
AT, accid.cause > 3 min	1073
MT, accid.cause > 3 min	11432,1
Others, accid.cause > 3 min	63,8
total	12568,9

Service Quality Indexes	
SAIFI BT > 3 min	3,74
SAIFI MT > 3 min	4,22
SAIDI BT > 3 min [min]	235
SAIDI MT > 3 min [min]	262
No. Interruptions > 3 min	115459

Technical Service Quality Indexes for distribution

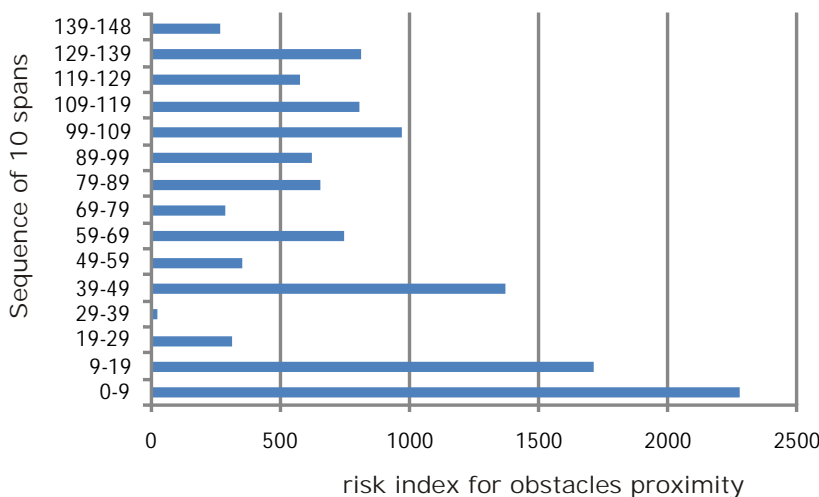
Source: 2006 Report of Service Quality, EDP Distribution, Portugal

Preventive maintenance practices in the aerial transmission and distribution grid equipment in Portugal have resulted in progressive improvements in quality of service. These improvements have had two consequences: more stringent client and regulator demands; and increased attention to anomalies associated to the power line environment.

Flicker, short duration interruption measurements (< 3 min) and voltage sags have been added to the traditional quality of service indicators such as SAIFI (System Average Interruption Frequency Index) and SAIDI (System Average Interruption Duration Index). The latter can result in penalties and losses in non-supplied energy (ENS) while the former reflect client satisfaction and public opinion of the company.

The transmission grid in Portugal has been able to comply with required levels of SAIFI and SAIDI. The distribution grid, however, is still progressing towards the performance level required by the regulator through continuous quality improvement programs. Data provided by the distribution concessionaire, edp (www.edp.pt), reveals losses due to unsupplied energy approximately €1.5 million (based on the mean price of high voltage, medium voltage and low voltage energy prices) and over €1 million in penalties for the quantity and duration of interruptions.

Accidental interruption risk due to vegetation, for a 60 kV line with 148 spans.



A detailed analysis of the origin of accidental interruptions in the aerial grid (programmed interruptions have a mild influence in the index calculation) indicates that associated losses total approximately €1.7 million.

Power line inspections are a fundamental tool in:

1. preventive identification of risks,
2. minimising travel costs to disperse assets throughout a vast territory
3. optimising resources and maintenance priorities, based on identified risks and grid analysis

Consider the risk analysis of accidental interruption as a result of conductor proximity to obstacles in a 60 kV over head power line with 148 spans. This risk is associated with phase-ground defects triggered by vegetation near the power line. By inspecting the power line, a risk index can be determined based on the proximity of the conductors to obstacles along the track and the minimum distances specified in the regulations. By summing the risk index over every ten scans, it can be concluded that by taking preventive measures in spans 1-9, 9-19 and 39-49, which represent 20% of the total line, the risk index of the entire line can be reduced by 50%. The inspection also supplies the exact location of the obstacles that pose the greatest risk in order to correctively address the situation.

In this manner, the time spent in correcting the situation by maintenance teams is minimised and risk reduction is maximised simultaneously.