

The performance of HV insulators is an important issue for power utilities, as insulators are scattered throughout the network and a single insulator fault may lead to an excessive outage. The performance of outdoor insulators is strongly correlated to local service conditions, mainly the experienced weather and the distance from pollution sources, such as the sea. Hence, pollution is a major issue for the Greek power utility due to the country's location and geography and climate. Crete is probably the island that faces most problems due to the voltage level used (150 kV), the experienced strong winds and prolonged dry season, the island's shape and the coastal arrangement of the network. The Greek utility has therefore issued several R&D projects to investigate and battle the phenomenon through the years, often in cooperation with various HV labs and academic institutions. Different maintenance techniques have been applied over the years and the current situation is characterized by the extended use of polymer insulators in transmission lines and coatings in substations. As a result, current research is mainly focused on the performance of polymer materials. In this paper, the experience from Crete is described and further data are provided for the latest research steps: the construction and operation of TALOS High Voltage Test Station in Iraklion, Crete and a currently running project (POLYDIAGNO) aiming to assess the life time (aging) of polymer insulators.

THE CASE OF CRETE

- Greek island in the Mediterranean, elongated shape, rocky coasts
- Strong winds, prolonged dry season (usually April-October)
- Mostly coastal power system
- Medium-to-light pollution on the western side due to heavy rain
- Medium-to-heavy pollution on the eastern side (heavier close to the sea and cities)



TRANSMISSION LINES

- Mostly on the eastern side
- Pollution the single factor responsible for more faults in the 80s (32.5%) and 90s (19.6%)
- Situation improved over the years due to pressurized washing (ground crew since 1985, heli since 1995)
- HTV SIR insulators since 1993 in a small scale/trial basis
- Large scale installation started in 2004
- The vast majority of TLs will be fully refurbished by 2015.
- Until today, not a single pollution related fault has been recorded HTV SIR lines.
- Yearly cost of washing about 1/5 of cost of refurbishing the lines



Table 1 Insulators in transmission lines (by 2015)

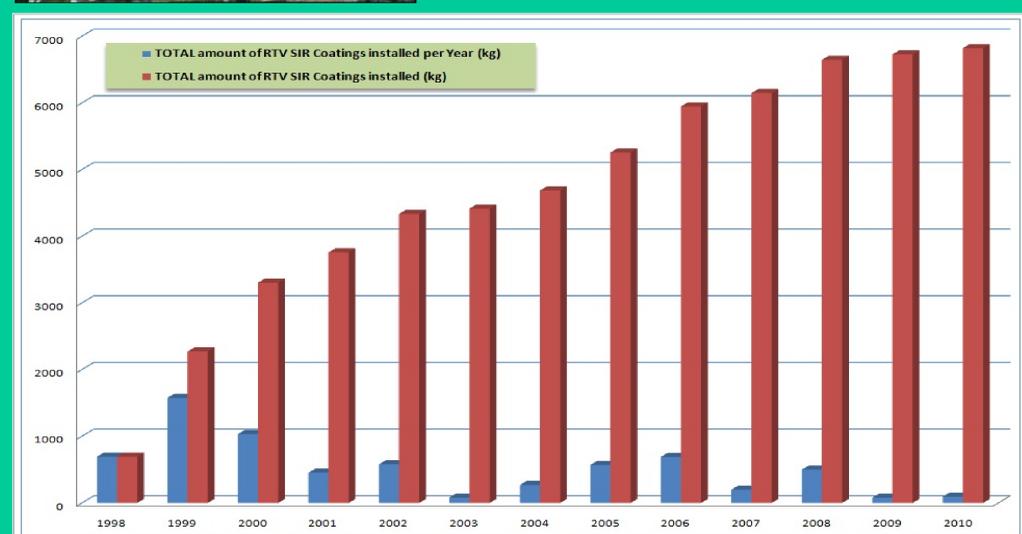
TL	Ins. Type	Year of large scale installation of HTVs
Linoperamata-Agios Nikolaos-Ierapetra-Atherinolakos	HTV SIR	2004
Atherinolakos-Sitia	HTV SIR	2006
Ierapetra-Sitia	HTV SIR	2010
Linoperamata-Mires	HTV SIR	2013
Linoperamata-Chania	HTV SIR	2013
Mires-Ierapetra	HTV SIR	2014
Chania-Kasteli	Porcelain	-

SUBSTATIONS

- Mostly located near the coast, several heavily polluted
- Past solution: offline pressurized washing (base units turned off, gas turbines turned on)



- Current solution: vast application of RTV SIR coatings (started in 1998: Linoperamata S/S)
- No problems reported.
- Cost saving: just for Linoperamata: more than 0.5 M Euro per year



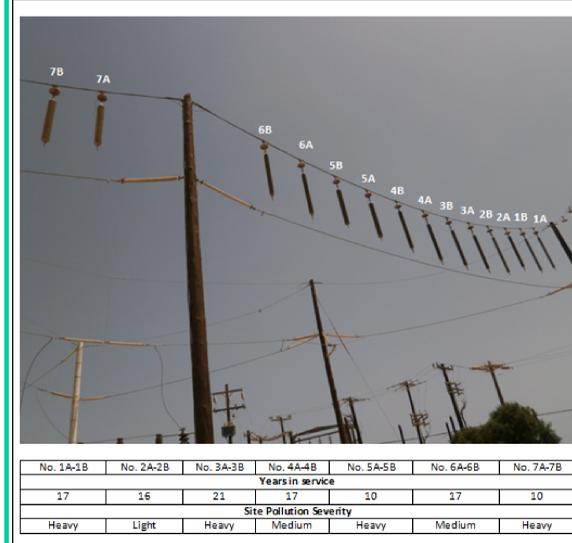
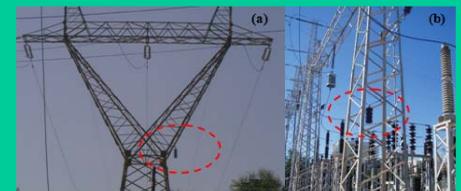
TALOS HIGH VOLTAGE TEST STATION

- R&D facility, constructed by HEDNO in the area of the Linoperamata Substation
- Three bays for 150kV and 21kV post and suspension insulators
- Leakage current monitoring
- Weather monitoring
- Comparative pollution measurements



THE "POLYDIAGNO" RESEARCH PROJECT

- Focused on the monitoring and diagnosis of polymer based outdoor insulators.
- Partners: HEDNO—TEI of Crete—FORTH—ENTECC
- Insulators removed from the network
- Towers selected based on pollution measurements



- Seven towers selected
- Three insulators removed from each tower
- Two installed in TALOS, one sent to the cooperating labs



- Lab tests conducted to stress insulators and monitor their aging
- Laser Induced Breakdown Spectroscopy (LIBS) proved promising
- First results hint that the ratio of certain chemical bonds may provide an aging indication for polymer insulators

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