

produce loss of some of the services given to system clients. The consequences are potentially the worst for the system including their main elements as generators or substations.

The cyber security has been presented always as one of the main concern in the electric systems management.

Networked computers reside at the heart of critical infrastructures and systems on which people rely on, such as the power grid. Today, many such systems are vulnerable to cyber-attacks that can inhibit their operations, corrupt valuable data, expose private information or even directly impact into the physical system elements.

Attacks might affect large portions of the European power system, make restoration difficult and cause huge societal impact.

Thus there is a need for establishing the economic and organisational impact of the implementation of emerging cyber security frameworks in Europe. The objective of ESSENCE is to identify costs and benefits for industrial stakeholders and for the society on an objective basis, and outline organisational processes wherever beneficial.

In order to improve cyber security, Standards against cyber-attacks testing is a part of the ESSENCE project that will evaluate their effectiveness evaluated in order to come to an assessment of the economic impact for the firms applying them and for customers who benefit of increased security and continuity of supply.

To do so, a general procedure has been designed and applied on two particular cases of cyber-attacks:

1. A SCADA based Control System operated by a TSO
2. A Control room of a thermal Power Plant, operated by a generation utility.

Along the text of this document, the aspects related to the physical system are included only for the sake of completeness, to have a global view of potential attacks and the standards and countermeasures that will potentially reduce the vulnerability of the systems or speed up the restoration.

## 2. ELECTRIC SYSTEM STRUCTURE AND THREATS

Electric Systems are Very Large and Complex Critical Infrastructures and can be traced as formed in four layers:

- a. **Service Layer**, constituted by all services provided by the system itself to all those clients, as final users of the electricity, and other infrastructures that has the electric system as part of the infrastructure.
- b. **Physical Layer**, as the assembly of all physical elements of the electric systems, from power plants to a single breaker.