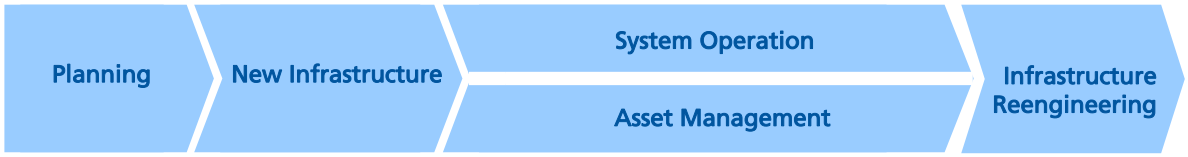
CESI SERVICES FOR TRANSMISSION SYSTEM OPERATORS

CESI provides consulting and solutions in the whole Power Transmission Lifecycle



CESI consulting services range over the entire Power System Lifecycle and use the state of the art methodologies and advanced SW solutions. CESI portfolio is especially focused on the entire Power System as well as on the each lifecycle phase. Planning, New Infrastructure, System Operation, Asset Management and Infrastructure Reengineering services are synthesized in the following page.

METHODOLOGIES FOR NETWORK & ENERGY MARKET ANALYSIS

CESI is able to offer advanced consulting services based on its experience and knowledge and on innovative methodologies and relevant SW tools. In particular:

- *Innovative methodologies* to achieve traditional goals (PS security and reliability, generation cost reduction), and sustainable ones, such as higher efficiency of the Power System, higher penetration of Renewables and reduction of network losses.
- *Innovative tools for the simulation of the electricity market* in order to determine the benefit coming from the network expansion plan, in terms of reduction of user fees, Increasing of power system efficiency and GHG's (Greenhouse gas) emission reduction.

Most of the Consulting Activities are performed through the use of SW tools developed by CESI, in particular:

- Solutions for ***Power Network Analysis*** trough SPIRA and SICRE tools.
- Electricity ***Market Simulator*** trough PROMED tool.
- Day ahead **congestion Management** and **security optimization** trough CRESO tool.
- ***Dynamic Security Assessment*** trough DSA tool.
- Operators ***Training Simulator*** trough OTS tool.
- ***Maintenance Business Intelligence*** trough MBI tool.
- ***Wide Area Measurement*** System trough WAMS tool.
- Creation of ***engineering simulators*** with different scales of complexity trough TOSCA tool.
- Verification and **performance analysis of the alternator-network** system trough ALICE tool.

CESI consulting methodologies and services, as well as the SW tools are designed taking in the account:

- different time scale scenarios to be faced by technical structure, from long term planning to real time operations;
- different activity features (i.e. adequacy, sustainability, market, security, etc.);
- the ultimate goal of the customer's activities (i.e. network planning, load forecast, congestion resolution, dynamic security assessment, etc).

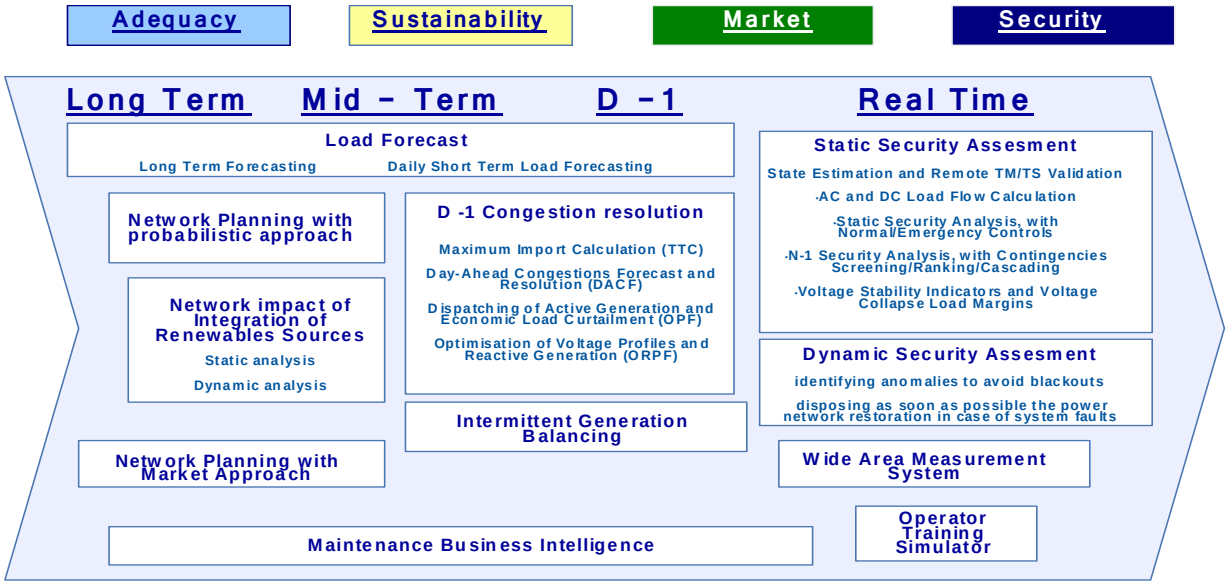


Figure 1 – Typical framework for Network planning and Operation

PLANNING

CESI services cover the following aspects:

- Bulk and distributed generation expansion plans (including the integration of new generation technologies like fuel cells, renewables, innovative combined cycles, etc.); evaluation of their impact on the system.
- Comparison and selection among various energy transmission vectors (electricity, gas, hydrogen, etc.)
- Energy master plan

- Expansion plans for transmission networks; need for new voltage levels
- Feasibility of power transmission and interconnection systems; comparison of AC and DC technology, sizing and location of FACTS
- Integration of RES into the network
- Impacts of new generation and transmission technologies (fuel cells, power electronic based devices, new voltage levels for distribution, etc.)
- markets and regulatory scenarios simulations.

NEW Infrastructure

CESI services are relevant to the evaluation of expected stresses due to both normal operation and fault conditions of the power system aimed to insulation coordination, EMC analysis, personnel and apparatus safety (EMF, grounding systems). In particular CESI portfolio is focused on main Owner Engineering activities, such as:

- Feasibility and specification
- Tender assistance
- Quality assurance
- Assistance to Construction and Commissioning

The above mentioned activities are related to:

- overhead transmission lines, underground and submarine cables air and SF6 GIS station components, machinery, power electronic devices (SVC, HVDC converters, FACTS)
- power quality devices
- protection, control and supervision systems
- SCADA and EMS systems
- communication systems based on PLC (Power Line Carrier) technology

Operation

CESI services are relevant to the following items:

- Operational planning of the transmission planning (with reference to the liberalised or monopolium dominated market)
  - minimizing losses
  - optimizing voltage profiles
  - respecting security constraints
- Defense plans against major disturbances
- Restoration plans (black start-up and parallel operation procedures after island separation and Optimal operation schemes)
- Supply of tailored solutions for Dispatching
- System performance evaluation:
  - reliability analysis and dynamic security assessment (DSA)
  - protection coordination and setting contribution of generators to system voltage and frequency regulation
  - maintenance, diagnostics and monitoring plans of electrical and mechanical apparatus and plants
  - fault reconstruction and failure analysis

- component diagnostic and condition assessment

- Power quality assessment and improvement:
  - estimate of power quality provided and identification of measures (maintenance, component replacement) for its improvement
  - supply of weather and lightning to ground data; correlation analysis of weather effects with failures in transmission networks
  - connection procedures of Customers and generators to transmission and distribution network.

Asset Management

CESI has developed an innovative strategy for the optimal technical management of electrical and mechanical equipment installed in electric power system facilities. CESI strategy is an integrated approach for all required activities to follow the equipments and the systems during their entire life cycle. There are three major steps characterising the entire life cycle of electrical and mechanical equipment, such as manufacturing, normal operation and end of life operation. CESI approach considers the equipment as a whole. In this framework each step has direct influence on others, thus determining a direct influence on the operation of the entire system. CESI has developed this strategy for the equipment management, so each step of life cycle is suitably taken under control, allowing people involved in equipment operation, from operative to managerial level, to take prompt and effective decisions, thus preventing the occurrence of faults and maximising the cost/benefit ratio.

Figure 2 – Typical life cycle of electrical and mechanical equipment

INFRASTRUCTURE REENGINEERING

CESI services are relevant to the main aspects of the infrastructure reengineering. In particular:

- Capacity performances improvement related voltage level, short circuit capacity, dielectric stresses, including electrical component replacement.
- Automation performances improvement
- Replacement of protection, automation, diagnostic and telecommunication systems and devices.

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