E-29	Keywords	Y4	system or software	Z4	Power	F33	Electric Utility

TEPCO Power Grid, Inc.

Engineering Service: Power System Planning

Features

When developing a power supply network in accordance with demand increases and power generation plant developments, an optimum development plan is formulated with consideration for the following aspects, to maximize the effect of investment.

- Power supply reliability (N-1 criteria, etc.)
- Tidal current and voltage
- Fault current
- Stability
- Voltage stability
- Overvoltage analysis

A highly reliable, as well as economical and efficient power system, can be formed through optimum power system planning, which will produce the following benefits:

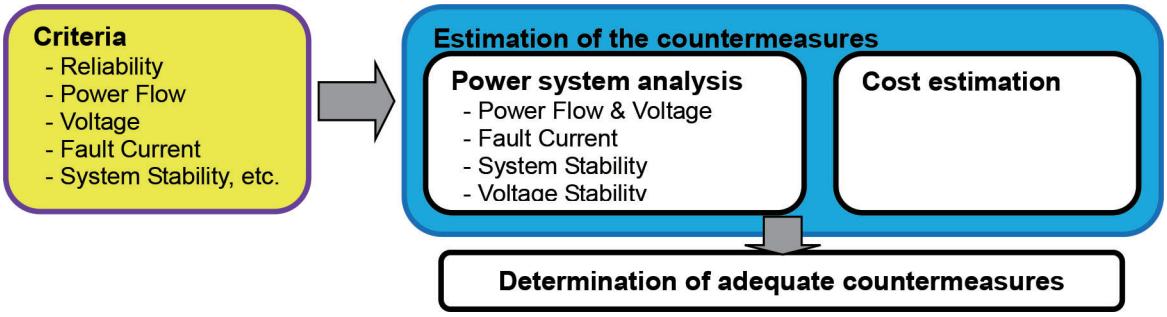
- Reduce frequency and time power outages
- Improve power quality (supply voltage, etc.)
- Reduce transmission losses
- Optimize the loading ratio of power transmission facilities
- Reduce power transmission equipment failures

Overview or Principles

TEPCO Power Grid, Inc. offers technical assistance for power system planning, in order to achieve a highly reliable power system that can provide high quality power in a stable manner.

Deterioration in the quality of the power system is a matter of concern, as the scale of the power system expands. There are, for instance, such issues as the overloading of facilities, increased fault current, as well as declines in system stability and voltage stability. It is essential that such matters are thoroughly considered during the planning stage, in order to ensure that the whole power system functions in a well-balanced manner.

TEPCO Power Grid, Inc. identifies issues with the power systems of customers before considering countermeasures for such issues. Such countermeasures may include enhancing the transmission facility, changing the configuration of the system, installing protective and control facilities and the like. Overvoltage analysis can also be conducted as needed, to identify problems and propose countermeasures.



Example 1: Reduced fault current

The fault current flows from each generator to a fault point, when a power system fault occurs. The fault current increases throughout the system when the system is upgraded and expanded with additional power generation and transmission facilities.

- Problems with fault current increases
  - Facility damage occurs as the fault current on transmission lines exceeds the allowable current and breaking capacity.
  - Faults occur on communication lines, due to electromagnetic induction.
- Countermeasures
  - Unloop the power system (network partition)
  - Enhance the transmission facilities

Example 2: System interconnection

Independently operated systems are linked with system interconnection facilities to facilitate power pooling, achieving economical, efficient power system planning and system operations.

- ◆ Purpose of system interconnection
  - Reduce supply reserve capacity
  - Pool power for emergencies
  - Power pooling for economical operations
- ◆ Consideration details
  - Consider system interconnection measures for various situations
  - Change system constants, due to system interconnection
  - Economic assessments
- ◆ Problems of interconnection
  - Decline in stability of whole system (network partition)
  - Unexpected loop tidal current

Example 3: Power system master plan

An economical and efficient power system master plan is formulated, with consideration for such requirements as the supply reliability of the target nation.

- ◆ Power supply reliability
  - Required power supply reliability is established, with consideration for the conditions of the targeted area
- ◆ Preparation and evaluation of power system master plan according to power supply reliability
  - A power system master plan is formulated, with consideration for the supply reliability, such as the N-1 standard and the like
  - Current power system and existing power system plans are also assessed
  - An economical and efficient power system plan is proposed

Energy saving effects & special notes

TEPCO Power Grid, Inc. provides technology transfers through consultation services, based on experience gained in Japan. The principal indices of power supply reliability and efficiency, at TEPCO Power Grid, Inc., are described below:

- ◆ Annual total number of accidental power outages per user - 0.09 times (2017)
- ◆ Annual total duration of accidental power outages per user - 6 minutes (2017)
- ◆ Transmission and distribution loss rate: 3.8% (2017)

Past or planned implementations

Domestic Power system planning by TEPCO Power Grid, Inc. (system capacity scale of 55 GW)

Overseas

- ◆ Power System Master Plan for the Kingdom of Bhutan (2021)
- ◆ Power Network System Master Plan in Lao People's Democratic Republic
- ◆ Power System Master Plan for the Democratic Socialist Republic of Sri Lanka
- ◆ Project feasibility survey for reactive power management in India (2018)
- ◆ Survey for power system stabilization countermeasures in India (2017)
- ◆ Power System Master Plan for Bangladesh (2016)
- ◆ Formulation of the Black Start Plan for Abu Dhabi (2016)
- ◆ Consideration of Grounding Current for the Design of a Wiring Trough in the Underground Power Transmission Lines of Singapore (2015)

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URL：https://www.tepco.co.jp/en/hd/ourbusiness/consulting/index-e.html