

Advanced Maintenance Technology – Rational Operation of Electric Facilities –

Brief Overview

For existing power facilities from power generation to distribution, we promoted development of rational diagnostic maintenance technology applying at the site.

For the power generating facilities, aiming at improving the damage diagnosing technology for aged components and plants, we clarified facts to detect internal creep defect at high accuracy through the tests applying phased array ultrasonic non-destructive inspection method into actual piping. For creep and fatigue damages in boiler water wall tube and balance of heat absorption and combustion in an entire boiler, we developed a program available for actual equipment diagnosis.

For power transmission and distribution facilities, we developed a deterioration estimation method of transformer insulation paper based on thermal history as an on-site diagnostic technology in order to reduce maintenance and renewal costs of the facilities without reducing network reliability for coming mass renewal period. We also developed supporting tools for maintenance and renewal planning of the facilities.

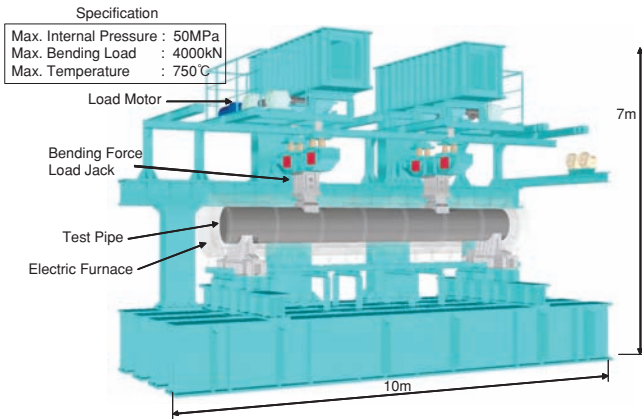
Achievements by Research Theme

Advanced maintenance technology of power generating facilities

- Gas turbine hot gas path parts maintenance
 - Improved semi-automatic software tool to generate a blade numerical analysis model using geometry measuring data by X-ray CT. [M08005]
 - Improved the accuracy of the numerical heat transfer fluid analysis method adaptable for estimating temperature distribution in updated blades with film cooling system and thermal barrier coating (TBC). [M08007; M08017]
- Power generating plant performance diagnostics
 - Increased reliability and convenience of the thermal efficiency analysis program for power generation systems to establish its support systems.
 - Developed boiler condition diagnosis program adaptable for an actual equipment evaluating creep damage of boiler heat exchanger tubes.
 - Expanded heat pump equipment model, etc. into the program to assess energy saving in the total energy at demand side.
- Status diagnostics on power generation components
 - Verified detection accuracy of internal creep damage at weld specimen of actual piping using phased array ultrasonic nondestructive inspection method. [Q08010]
 - Clarified damage factors for the weld heat affected area by an internal pressure bending creep test of actual scale pipe using actual component life assessment experimental facility and structure observations of damaged specimen. [Q08001]

Advanced maintenance technology of power transmission and distribution facilities

- Establishment of maintenance standards for aged power facilities
 - Proposal of diagnostic methods for various power facilities including safety evaluation methods of gas insulated facilities, displacement detection methods of transformer coils, degradation estimation methods of surface coating of power facilities, etc. [H08008; H08010; Q08031]
 - Proposal of remote monitoring and estimation method of leakage current over polymer insulators. [R08017]
- Management measures for power transmission and distribution facilities
 - Development of effect assessment model of cost reduction by appropriate transmission line reinforcement taking relief of expected outage cost and expected transmission congestion cost into account. [Y07031; Y08019]
- Asset management of electricity grid
 - Developed supporting tools for maintenance and renewal plan balanced with plural power apparatuses and studying support tools for leveling power apparatus renewal in power systems. [R08001; R08018]
- Asset management support tools
 - Development of support tools of partial renewal plan of complicated power facility such as GIS by upgrading of the asset management support tools that were already developed in CRIEPI based on the average maintenance cost of those facilities. [H08011]



(a) Bird's-eye view of Bending & Internal Pressure on real structural samples: BIPress

(b) Installation of welded pipe to test facility BIPress

Fig.1 Internal Pressure & Bending Creep Test on Welded Pipe

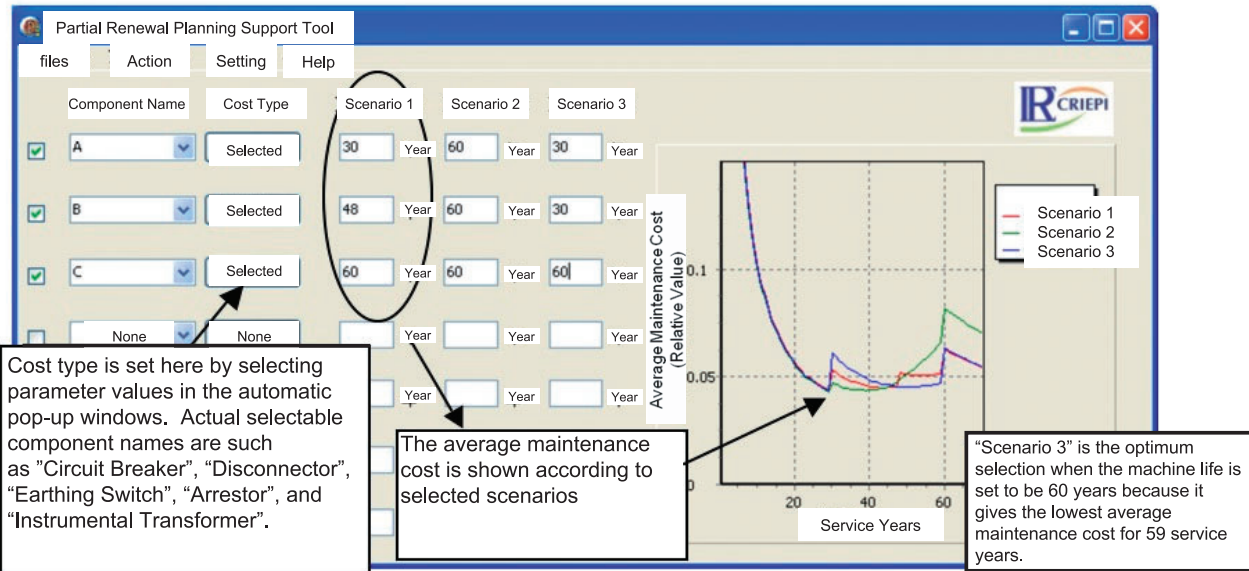


Fig.2 Sample display of Partial Renewal Planning Support Tool (H08011)

Three main components A, B, and C of GIS are selected as shown in the display example of the tool. Each component has different maintenance cost features determined pop-up windows. Scenario 1 sets renewal times for A: 30 years, B: 48 years and V: 60 years and Scenario 2 sets 60 years, 60 years, 60 years, respectively and Scenario 3 sets 30 years, 30 years, 60 years, respectively. With these Scenarios, the minimum average maintenance costs are estimated with the tool.