DISTRIBUTION SYSTEMS TESTING, APPLICATION, AND RESEARCH

Electric Utilities in Partnership to Promote Practical Distribution System Research

Overview

Distribution Systems Testing, Application, and Research (DSTAR) is a consortium of electric utilities sharing the results of distribution research. During its 15 years of existence, DSTAR has focused on providing its member utilities with results that are directly applicable to everyday distribution system design, operation, and maintenance.

DSTAR offers utilities a cost-effective and responsive means of addressing urgent problems that require near-term solutions. By cooperatively funding the research with other utilities, each member utility substantially leverages its research investment.

DSTAR Research

DSTAR research projects have covered a wide range of distribution topics, many of which fall into the following technical areas:

- Transformer loading and economic evaluation.
- Overvoltage protection of transformers and underground distribution systems.
- Cable accessory performance.
- Cable ampacity.
- Overcurrent protection coordination.
- Distribution engineering software tool development.

The results of each project are put into a form, which can be directly used by distribution engineers, including

- Definitive guidelines for system design, operating, and protection practices
- Evaluations of equipment technologies and application practices
- User-friendly software tools tailored for the distribution engineer's needs

DSTAR research often involves field testing, maximizing relevance of results.

DSTAR Provides Savings

DSTAR projects are designed to save member utilities money by allowing them to operate more efficiently, more reliably, and more safely. Some examples of how DSTAR results have produced savings for member utilities are described below:

- ☆ DSTAR-developed software allows utilities to procure and apply transformers, considering the transformer life and economic impacts of loading practices. Intentional transformer overloading, when implemented correctly, can save a large amount of transformer investment. This software also allows utilities to optimize a procurement plan, which optimizes total owning cost within the constraints of a fixed first-cost budget, as well as other economic optimization processes.
- ☆ Concerns about ferroresonant overvoltages have motivated some utilities to add internal switches in their three-phase padmounted transformers so that phase-by-phase switching can be avoided. Other utilities have specified more costly triplex-core transformers to avoid ferroresonance. Pioneering DSTAR research has shed much new information about this complex phenomenon, including the fact that

many types of metal-oxide arresters can limit these overvoltages for some time without failure. DSTAR has produced guidelines specifying applications where arresters can safely eliminate ferroresonant overvoltage concerns. As a result, member utilities have been able to reduce the costs of their transformers.

- While there are standards governing the lid-retention capability of poletop distribution transformers for internal faults, there are no similar standards governing the integrity of padmounted transformer tanks. Many utilities have applied poletop criteria to padmounted applications, resulting in application of current-limiting fuses. Testing performed by DSTAR has shown this practice is excessively conservative. Fault current I-t curves have been developed, saving member utilities the cost of many unnecessary current-limiting fuse applications.

DSTAR Software

Distribution engineering is dominated by many routine functions, which must be accomplished quickly and efficiently. Many existing power engineering software products on the market are complicated and require significant training to use. In the current environment of limited staffing, there is a need for user-friendly software to support efficient distribution engineering processes.

This need has been addressed by several recent and current DSTAR projects. In fact, software tool development is a major focus of current DSTAR activity.

Some of the software tools developed, or under development by DSTAR are described in the on this page.

DSTAR Organization

DSTAR research activities are conceived and directed by the member utilities. Member utility representatives are chosen as the overseers for each project, providing guidance and liaison with the contractor. Projects review meetings are held twice per year to update members on progress and to provide an opportunity for the membership-at-large to direct the course of the research.

DSTAR Software Tools

DSTAR Distribution Engineering Toolbox – multi-functional collection of programs to calculate overhead line guy and anchor tensions, pole loading, sags, and clearances; transformer loading, voltage regulation, and cable pulling tension.

CEPS – Cable Electrical Parameters Software – calculate cable parameters such as impedance, short-circuit withstand, charging current, ampacity, etc.

SEDS – Secondary Electrical Design Software – allows designer to graphically layout secondary systems, select transformers and cable sizes, and evaluate performance for voltage regulation, flicker, cable loading, and short-circuit currents.

TOCS – Transformer Owning Cost Software – economically evaluates thermal performance and insulation life of transformers. Optimizes transformer procurement and application.

GSVIC – Graphic Secondary Voltage Imbalance Calculator – calculate secondary voltage imbalance due to single-phase loading and dissimilar transformer units in various three-phase bank connections.

XDERATE – Cable ampacity derating for cable crossings, short-distance parallel sections, and taps in and out of padmounted equipment.

TS/RDS – Distribution Transformer Scrap/Repair Decision Program – generates economic criteria for deciding if a returned transformer should be refurbished or scrapped.

CLPUSS – Cold-Load Pickup Software – calculates time-current curves to use for overcurrent protective device coordination with currents following restoration of feeder outages.

The individual research projects sponsored by DSTAR are bundled into consecutive research programs. Each program consists of four to six independent research projects, covering diverse topics. Membership is on a program basis; participants in a given program receive the deliverables for all projects included in that program. Each project group is performed over a one or two year period, with each individual utility contributing $30,000 to support the effort.

In addition to providing the most leverage of the utilities' research investment, the cooperative arrangement has the positive result of making utilities aware of exposing utilities to a wider range of practices and approaches to distribution engineering challenges.

For Further Information

For more information on DSTAR, and the projects included in the current research program, please visit us on the Web at ***http://www.dstar.org***, or call Devin Van Zandt, DSTAR Program Manager, at (518) 385-9066.