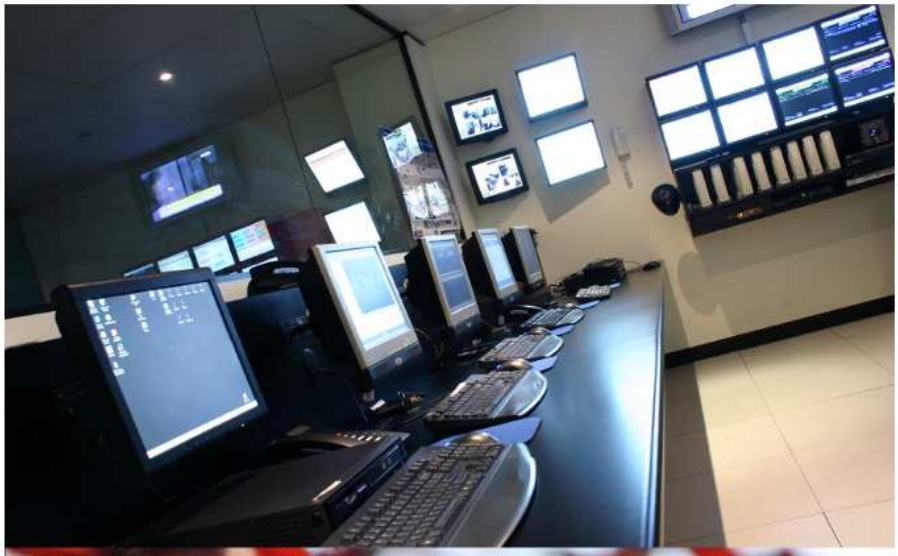
Newton-Evans Research Company's

Market Trends Digest

Nov. 2009



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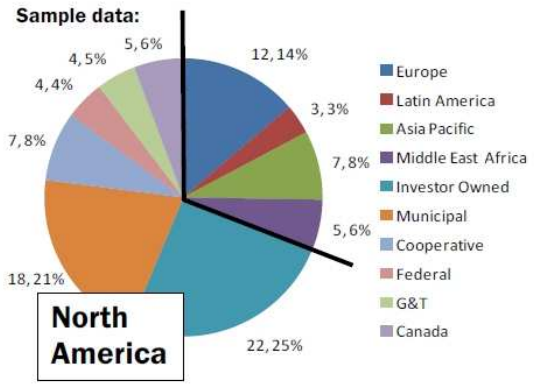
Critical Issues In Protective Relaying: Engineering Perspectives From 24 Countries

The newest study of electric power grid protection and control, published by Newton-Evans Research on October 30, 2009 is now available for on-line purchase. The 81 page report is based on extensive surveys of protection and control engineers and P&C management from around the world. The survey was designed by engineers to include study of key topics of interest to the P&C community. The report is divided into nine sections based on the question groups covered in the study: Section A. Equipment/Device, Section B. Tripping/Control, Section C. Settings/Analysis, Section D. Strategy/Policy, Section E. Miscellaneous, Section F. Testing/Maintenance, Section G. Vendor/Manufacturer, Section H. Distributed Generation. Below is some sample data illustrating the amount of participation from different world regions and types of utilities:

Total Number of Respondents:		87
Total Number of Countries:		24
INTERNATIONAL		
1	Europe	12
2	Latin America	3
3	Asia Pacific	7
4	Middle East Africa	5
US		
1	Investor Owned	22
2	Municipal	18
3	Cooperative	7
4	Federal	4
5	G&T	4
CANADA	Canada	5



One theme that emerges from the varying responses is that there is no particular "right" way or "wrong" way to go about designing and implementing a particular relay scheme. Some utilities design schemes in a certain way, while others do it another way. What our project manager labels "Philosophy of Engineering" is evident in this study, especially in the choices made by P&C engineers as they apply relays to their systems.

This report includes more respondent comments than any previous relay survey conducted by Newton-Evans. We encourage you to read through these list compilations, as there is a wealth of information contained therein. What is a major issue for one engineer is not even a concern for another engineer.

As one example of utility diversity, it is fascinating to see in Section D: Strategy/Policy Issues the variety of ways Utilities are structured to handle the responsibilities of their Relay Organization, as well as to review the tactics used to attract and retain the next generation of relay engineers. Some Utilities have extensive training programs for young talent, while many do nothing or do not even recognize it as a potential problem.

A few participants were pleased that this survey was unlike the typical P&C research to which many have grown accustomed. The questions asked in this survey cover a wide range of issues that relay engineers deal with on a day-to-day basis.

This report is not an "overview" nor is it a typical "Executive Summary." This Newton-Evans Protective Relay Engineering Perspectives report is an in-depth study of topics currently on the minds of Protection & Control professionals throughout the world. Consequently, Newton-Evans trusts that the extensive comments and detailed charts will yield valuable insights in addition to providing useful information.

A total of 87 individual utility P&C personnel and systems planning officials responded to this questionnaire. Many of the survey questions were definitive choice, i.e. "yes/no," or "pick only one of the following." However, a few questions instructed respondents to "check all that apply." Pie charts represent exclusive choice questions while bar charts represent questions where multiple answers were allowed (for example, "Which of the following criteria do you use…")

Here are some samples of the feedback we received:

1. What criteria do you use for replacing older electromechanical and solid state relays?

Replace upon failure	Replace by age	Replace those serving critical functions	Replace specific relay types based on overall maintenance history	Replace as part of area capital improvements/new construction in nearby system	Other	Total
56	18	27	48	63	13	87
64%	21%	31%	55%	72%	15%	100%

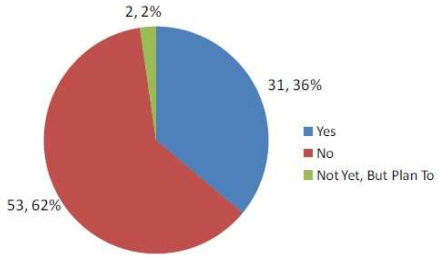
Other criteria mentioned:
Respondent #14 - Our utility has none of these
Respondent #30 - Have replaced some older EM relays on our "larger" substation transformers
Respondent #32 - We have a five-year program to replace all electromechanical and solid-state relays.
Respondent #35 - For distribution feeder class relay schemes, EM relays were replaced as part of a multi-year project to provide SCADA and

enhanced functionality to 100% of the system. The project funded about 100 feeders per year and installations were prioritized by regional operations personnel based on performance history and system impact. To date approximately 1,000 relay schemes have been replaced.
Respondent #64 - Replace when a station is scheduled for a major overhaul, replacing aging major equipment (30+ years old.)
Respondent #66 - Manufacturer Product Advisory may lead to replacement decision based on the overall economic factor, for example "New Standards" have been established by the respective power company.
Respondent #83 - Replacement due to regulatory requirements
Respondent #84 - Capital improvements for upgrade

7. Communications problems may arise as a result of integrating multiple IEDs from various vendors. Have you moved to one vendor to reduce those problems?

Global Summary

Yes	No	Not Yet, But Plan To	Total
31	53	2	86
36%	62%	2%	100%



Comments on Q7:
Respondent #30 - I don't see how we could unless one vendor started making ALL SORTS of substation accessories - LTC control, regulator control, temperature monitor, etc.
Respondent #31 - IEC 61850 will address this. So far relay communications through LAN/WAN is under project construction stage & not commissioned.
Respondent #44 - We don't want to restrict to one vendor; tried satisfactorily in a lab pilot at present.
Respondent #47 - As a small utility, we have limited technical resources to support numerous IED vendors or protocols.
Respondent #51 - We can't choose only one vendor because our company is state owned.
Respondent #56 - Usually one vendor in one substation, many vendors only if necessary
Respondent #59 - Chose SEL relays initially and have not entertained any other manufacturer for multiple reasons; standardization on items such as communication is one reason.
Respondent #66 - Benefits of multi vendor protection and technology

2009 Electric Power T&D Investment Adversely Affected by Economic Downturn

By Charles W. Newton, CEO Newton-Evans Research Company, Inc.

2009 Electric Power Transmission and Distribution (T&D) Investment has been adversely affected by economic downturn according to a recent Newton-Evans study. In spite of the push for smart grid investments and availability of stimulus funding, some large T&D projects have been scaled back or delayed. Total spending for T&D equipment in the U.S. down 15-25% Year-to-Date.

The majority of the large public and private utilities participating in the most recent Newton-Evans CAPEX Outlook study are poised to continue many of their long-term capital investment programs as had been originally planned back in January of 2008. However, in several instances, these capital intensive projects have been deferred from their initial planned start-up dates for from three to nine months, or even longer, with some plans pushed back late into 2010 or into 2011.

In the June 2009 tracking study released by the Newton-Evans Research Company, a significant majority of the 118 electric power grid officials from 36 countries participating in the CAPEX and O&M budget planning study indicated that capital spending for control systems, substation automation, smart grid-related programs and advanced metering rollouts remain "on the table" albeit with some pushback in timing. However, a number of planned investments for transmission and distribution grid infrastructure components have been deferred for this year, and are not expected to rebound until the third or fourth quarter of 2010. During the summer months interviews with manufacturers confirmed this sentiment.

"In discussions with first tier and second tier manufacturers serving the U.S. market over the past three months, it appears that the first quarter of 2009 was "not too bad" for T&D equipment suppliers and electric power automation systems integrators, in spite of very weak economic performance generally. However, these officials noted somewhat lower (5-10%) to sharply lower (15-25%) bookings for the second and third quarters of this year with cutbacks initiated at major utilities as industrial and commercial demand for electricity softened further and as retail electricity prices eroded somewhat" according to Charles Newton, CEO of Newton-Evans Research Company.

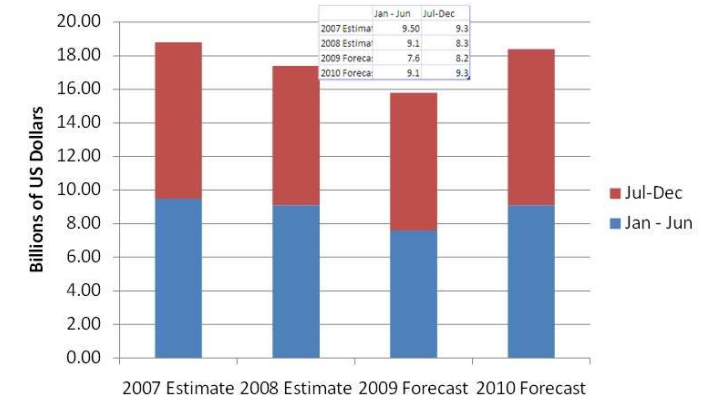
Newton-Evans now believes that T&D grid infrastructure spending for the first nine months of 2009 was down as much as 15%-25% in a number of equipment categories, including distribution transformers, capacitors, industrial switchgear and even several protection and control categories. This was in part a result of the overall 4.4% drop in electricity consumption in the US during the first half of 2009 coupled with an easing of retail electricity prices during the same period, along with lowered industrial purchases. However, Newton-Evans believes that at least some of the delay in equipment order placement may be currently related to the federal stimulus program, with utilities taking a "wait and see" attitude to learn if they are to become recipients of a grant under the ARRA smart grid funding provisions.

Reported to be on the upside during the first nine months of the year was increased spending for some smart grid building blocks, including FACTS devices and large power transformers. However, sales of some automation systems (new and upgraded control center-based systems and substation systems) also seem to be lower on a year-to-date basis. Projects related to advanced metering infrastructure (AMI) initiatives and for substation automation and new or upgraded grid control and monitoring capabilities have not met earlier expectations during the first nine months of the year. Several vendors have pointed up the reverse effect that the ARRA stimulus fund grant proposals have also caused many utilities to take a "wait and see" attitude prior to approaching the capital markets and making commitment of their own funds.

Near-Term Outlook:
Some utilities will clearly benefit from some of the smart grid-related and renewables integration projects under government stimulus funding provisions, while others will proceed in 2010 using their own sources of capital. AMI and related in-residence portions of smart grid will likely benefit from an uptick in spending by utilities that are awarded stimulus funds.

The total amount of capital spending for transmission and distribution of electricity by electric power utilities around the world for each year during the 2006, 2007 and 2008 periods were estimated by Newton-Evans to be in the range of $85-$105 billion. The 2009 global outlook is trending toward the very low end of that range. In the United States, annual capital investment in T&D equipment and systems has ranged from $15-20 billion in recent years. In 2009, Newton-Evans forecasts U.S. CAPEX investment in T&D will be in the $16-$17 billion range.

CAPEX Investment in U.S. Electric Power Transmission and Distribution (T&D) Equipment and Systems



As stated in the Newton-Evans' latest CAPEX tracking study, "In its July 2009 release, the U.S. Department of Energy's EIA unit foresees only a 0.8% rise in electricity demand in the U.S. for 2010, following a likely 2.3% decrease in demand anticipated for 2009. When coupled with the International Energy Agency's forecast of a 3.5% drop in global demand for electricity in 2009, this information supports the cautious investment outlook we are seeing here and abroad since our last survey in December. Two regional exceptions include some Asia-Pacific countries and some portions of the Middle East. These regions continue to grow their electric power infrastructure more rapidly than other areas.

If industrial demand for electricity picks up even moderately by mid-2010, the outlay for CAPEX investment in distribution equipment and systems will likely reflect some increase by late 2010. Such an increase in demand would likely result in additional billions of dollars committed for smart grid and infrastructure investments going into 2011 and beyond. Transmission equipment sales also will benefit from a pickup in demand but more importantly, will be reliant on federal and state level approvals of siting arrangements and transmission line construction authorization. The federal level approvals have been significant early this year, but state-level reviews have been fraught with challenges, holding up several projects.

The next Newton-Evans CAPEX tracking study for the global electric power industry will be underway in November, 2009, with results available in January, 2010.

Newton-Evans Research Collaborates with the U.S. Department of Energy's Idaho National Laboratory: National SCADA Test Bed Substation Automation Evaluation

Department of Energy Office of Electricity Delivery and Energy Reliability (DOE-OE) National Supervisory Control and Data Acquisition (SCADA) Test Bed (NSTB) program commissioned a study by the Idaho National Laboratory (INL) NSTB Program in Fiscal Year (FY) 2009 to evaluate security of substation automation in the electricity industry.

Increased awareness of the potential for cyber attack has recently resulted in improved cyber security practices associated with the electrical power grid. However, the level of practical understanding and deployment of cyber security practices has not been evenly applied across all business sectors. Much of the focus has been centered on information technology business centers and control rooms.

A new report prepared by the Department of Energy's Idaho National Laboratories explores the current level of substation automation, communication, and cyber security protection deployed in electrical substations throughout existing utilities in the United States. This report documents the evaluation of substation automation implementation and associated vulnerabilities. This evaluation used research conducted by Newton-Evans Research Company for some of its observations and results. The Newton-Evans Report assisted in the determination of what is the state of substation automation in North American electric utilities. Idaho National Laboratory cyber security experts aided in the determination of what cyber vulnerabilities may pose a threat to electrical substations. This report includes cyber vulnerabilities as well as recommended mitigations. It also describes specific cyber issues found in typical substation automation configurations within the electric utility industry.

The evaluation report was performed over a 5-month period starting in October 2008. In order to determine the level of automation deployed in North American utility substations, INL used the Newton-Evans Research Company survey, The World Market for Substation Automation and Integration Programs in Electric Utilities: 2008-2010, Volume I North American Market,1 for some of its data. Research showed the level of

substation automation varies widely. The survey respondents were comprised of investor-owned utilities, public power, and rural electric cooperatives, including Canadian entities.

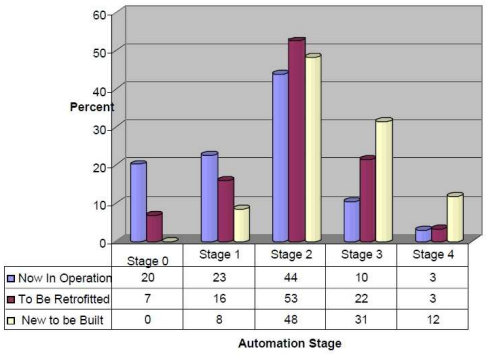
The data from this report indicates the level of substation automation varied a great deal depending on type of substation, type of utility, the size of the utility, and survey question interpretation. Overall, 81% of transmission substations had some level of automation, while 57% of distribution type substations had some level of automation. The level of automation ranged from Stage 1 to Stage 4, with Stage 1: Most equipment manually operated through local switching. Some programmable Intelligent Electronic Devices (IED) implemented, but no communications with central control room other than some monitoring; Stage 2: Some electromechanical devices remain. Installed IEDs are integrated, using two-way serial communications capability and no substation LAN, allowing monitoring and control from the central control room; Stage 3: Some electromechanical devices remain. Installed IEDs are integrated, using two-way serial and/or LAN communications allowing monitoring and control from the central control room; and Stage 4: Installed IEDs are integrated, using LAN communications. Applications are run at the substation level to automate various substation functions with full control from the central control room.

Smaller rural electric cooperatives tended to have more deployed automation than investor-owned utilities and public municipalities as they have a smaller number of substations to upgrade. A significant number of substations in the larger investor-owned utilities had no automation at all. Rural electric cooperatives are generally smaller requiring less expense to provide an increased level of substation automation. In addition, rural electric cooperatives generally cover a larger area per meter base; therefore, a higher level of substation automation is more easily justified economically.

Another observation of this study was that utility personnel had excellent security awareness of measures that are required as well as published "best practice guides." Smaller utilities not part of the "bulk electric system" closely followed the Critical Infrastructure Protection (CIP) 002–009 Standards.

Research showed that there were many different vendors supplying equipment depending on which substation automation device was used. In an application where many of the devices connected are from different vendors, they may or may not share similar vulnerabilities; however some vulnerabilities tend to be common across these devices, which require the application of protective schemes to reduce their vulnerability footprint in system installation.

As seen below, most transmission substations fall into the Stage 2 category. This is true for both existing substations and those planned to be retrofitted or built new. Not surprisingly, new substations are more likely to be integrated at Stages 3 or 4 than existing or retrofit substations.



	Stage 0	Stage 1	Stage 2	Stage 3	Stage 4
Now In Operation	20	23	44	10	3
To Be Retrofitted	7	16	53	22	3
New to be Built	0	8	48	31	12

The consequence of an aggressor gaining cyber access to automated systems and networks is their ability to usurp monitoring and control of control system connected equipment. Once a foothold is established at the substation level, further migration into the central control room network could provide the aggressor with access to the entire utility system.

There is significant proactive effort within the industry and utilities to implement security in their respective electrical substations. Utilities are in a continual process of migration from older electromechanical relays to newer, modern microprocessor-based relays. In addition, they are also upgrading other substation automation devices to the latest technology. This process requires continued emphasis on implementation of cyber security as required by regulations, standards, and best practices. It is projected that this modernization process will continue until such time that older relays and other substation automation devices have been replaced according to individual company automation standards.

The results of this study imply that substation automation for electrical substations is standard now for utilities, and implementation will continue. Therefore, the need for applicable standardized cyber security implementation practices is also required.

Cyber security must be implemented for substation automation equipment using the cradle-to-grave philosophy. From the equipment specification stage to the equipment disposal stage, cyber security is a necessity for this industry sector. To protect electrical substations from cyber threats, mere compliance to applicable standards or other methods will not be sufficient. A proactive best practice model using latest industry technology and vendor implementation must be used.

The 83 page report will be available to interested readers soon, and Newton-Evans will provide a link from its website to the report once it becomes available.

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