



Newton-Evans Research Company's

Market Trends Digest

March 2011



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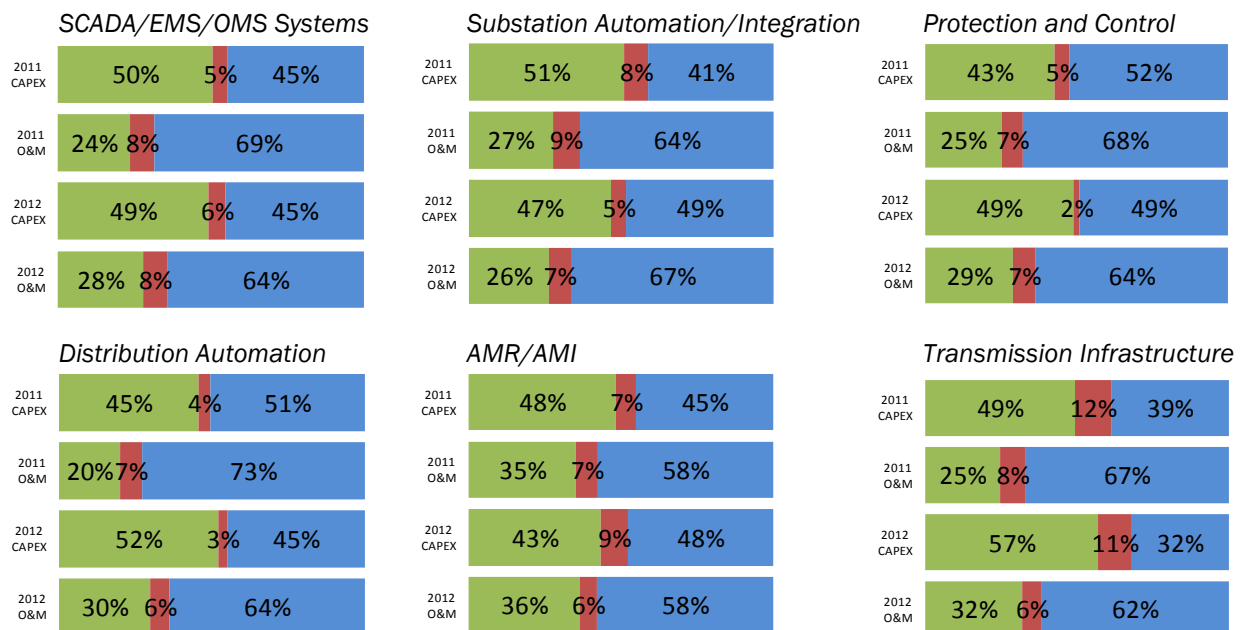
Capital Expenditures, O&M Budget Outlook for Electric Power T&D Investments in 2011: Highlights

Newton-Evans is in the process of updating its biennial study, *Global CAPEX and O&M Expenditure Outlook for Electric Power Transmission and Distribution Investments: 2011-2012 – Funding Outlook for Smart Grid Development* which is based on electric utility survey responses collected during February and March. Over one hundred electric utilities from twenty-six countries have responded. The full report of this study will be available April 1st, but for now, here are some highlights.

Summary of CapEx and O&M changes

Overall, there seem to be no major changes planned for 2011 and 2012 in terms of capital expenditures or O&M budgets with the possible exception of distribution infrastructure, where 15% of respondents indicated a decrease in 2011 and 10% indicated a decrease in 2012. Fifty percent or more of the respondents to this survey said capital expenditures for transmission infrastructure are reported to increase over the next 2 years. (See charts below.)

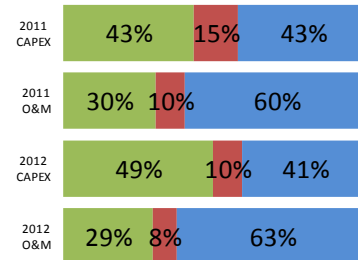
Are your Capital Expenditures, Operations & Maintenance budgets over 2011-2012 **increasing, decreasing, or staying the same?**



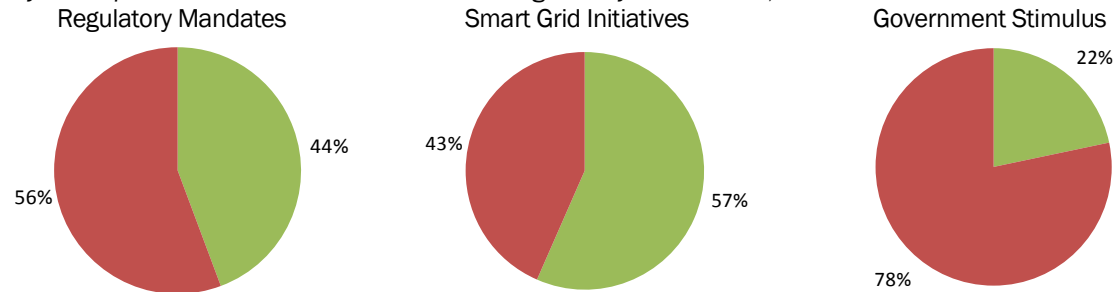
Factors for CapEx and O&M changes

The influence of regulatory mandates on 2011 & 2012 CAPEX and O&M budget increases (or lack of decrease) continues to decline even into 2012. The number of respondents stating that smart grid initiatives are an influence on CAPEX increases went down from 62% to 57%; a minor change. Government stimulus programs are less of a factor on CAPEX and O&M budget increases than they were in previous years.

Distribution Infrastructure



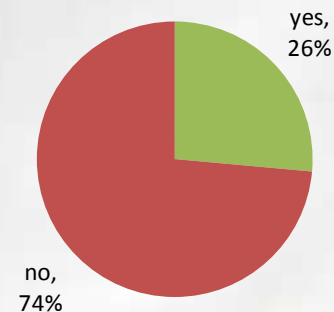
If your response is either an Increase or No Change in any of the above, is this due to



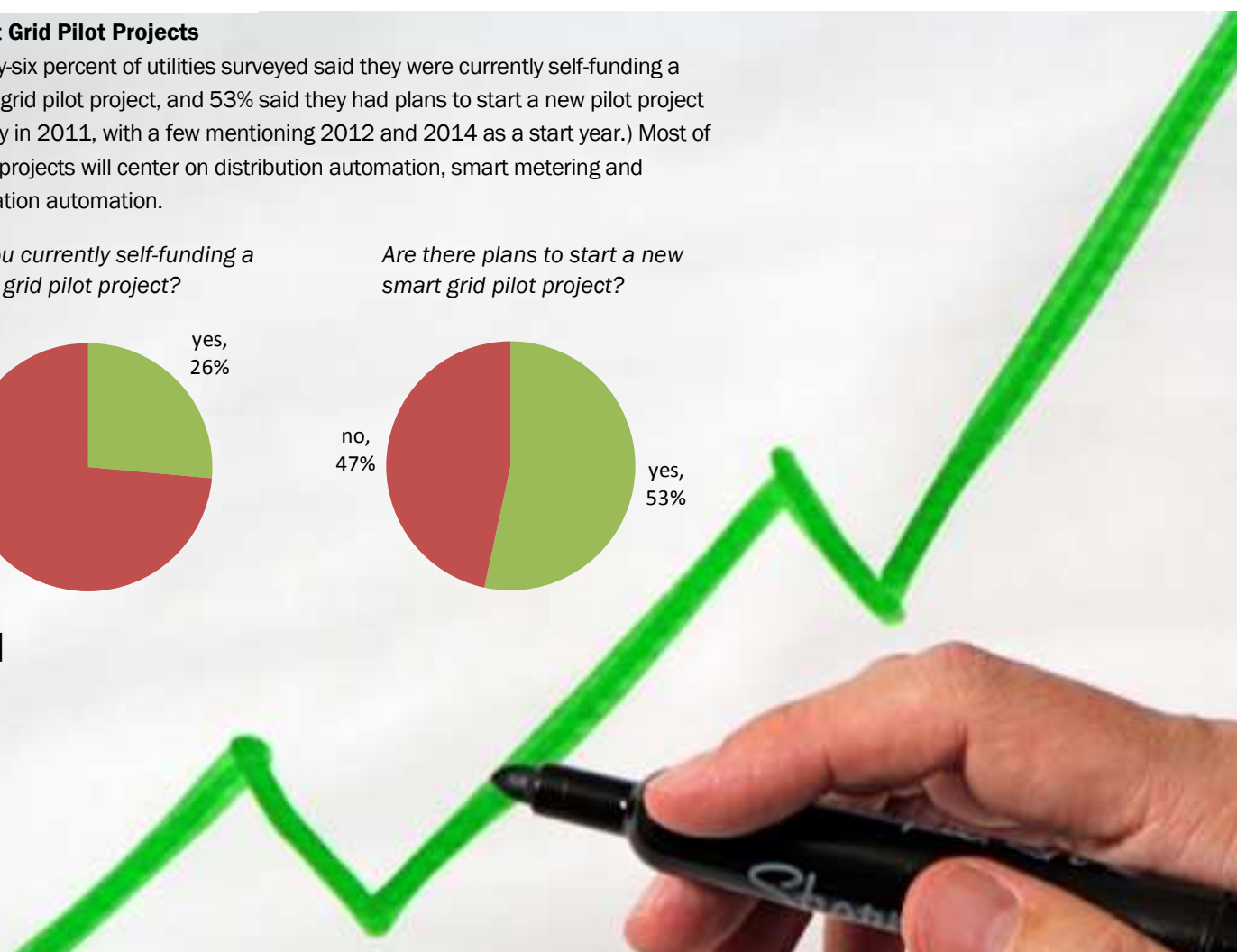
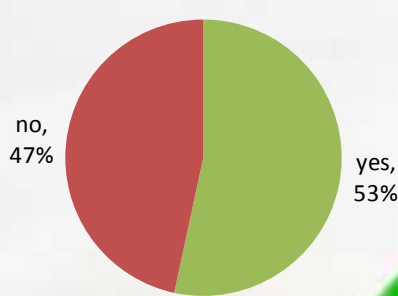
Smart Grid Pilot Projects

Twenty-six percent of utilities surveyed said they were currently self-funding a smart grid pilot project, and 53% said they had plans to start a new pilot project (mostly in 2011, with a few mentioning 2012 and 2014 as a start year.) Most of these projects will center on distribution automation, smart metering and substation automation.

Are you currently self-funding a smart grid pilot project?



Are there plans to start a new smart grid pilot project?



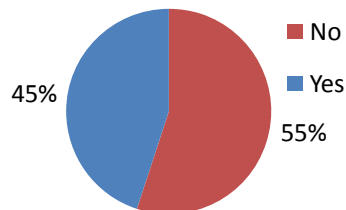
Substation Automation & Integration Programs 2011-2013

The Newton-Evans four-volume report series titled “The World Market for Substation Automation and Integration Programs in Electric Utilities: 2011-2013” is now available on our website along with sample pages and a full table of contents. Here are some summary findings from the study:

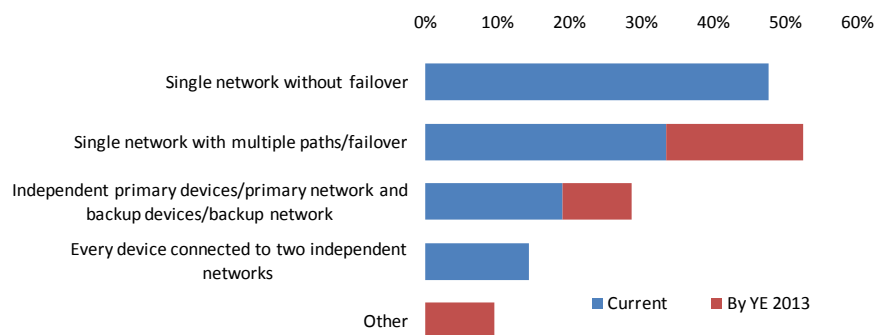
Ethernet switch/router requirements, IEEE 1613, LAN architectures

Out of all international survey respondents, more than half said that ethernet switches and routers do not need to meet the requirements of IEEE 1613. When it comes to current LAN architectures used, approximately 50% of respondents to the international survey use a single network without failover. However, slightly more than 50% indicated that they either currently use multiple paths/failover on a single network or they plan to implement that architecture by year end 2013.

Must Ethernet switches/routers meet requirements of IEEE 1613?



Substation Ethernet LAN architectures



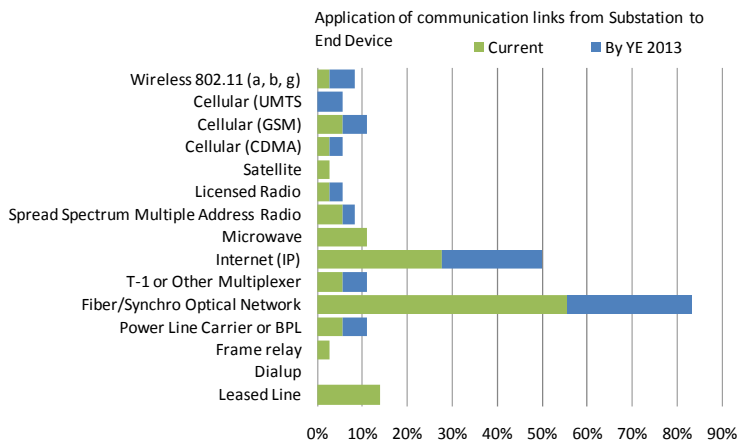
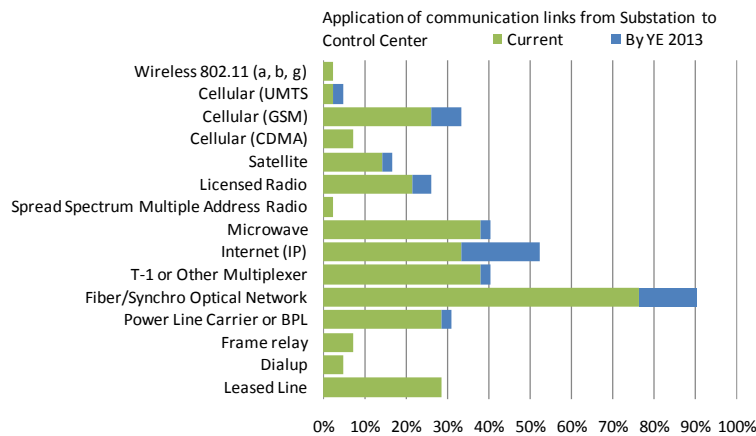
Protocol within the substation, between substations, and from the substation to the external host or network

Within the Substation, IEC 60870-5-103 was the most frequently used protocol (40%). IEC 61850 (31%) fell close to serial protocols Modbus (31%) and DNP3 (33%), however, 24% indicated that they plan on implementing IEC 61850 within the substation by YE 2013. If that becomes the case, IEC 61850 will become the most used protocol by far.

From the substation to an external host, IEC 60870-5-101 is currently used by 45% of all 42 respondents. This is followed by IEC 60870-5-104 (29%), Other TCP/IP (26%), and DNP3 LAN (21%). Another 10%-12% of international utilities in this sample plan to add C37.118, IEC 61850, IEC 61850 Edition 2, and IEC 60870-5-104 by YE 2013.

Application of communication links from substation to control center and from the substation to the end device

Ninety percent of respondents to the international survey indicated that they either currently use or plan to use fiber/synchro optical networks by year end 2013 to establish communication between the substation and control center. Nineteen percent said they plan on implementing internet (IP) by year end 2013. Microwave, T-1 and GSM cellular are three other communication links used for this task that are frequently cited in this study. For communication links between the substation and the end device, fiber/synchro optical networks was again the most used by a large margin: 87% currently use and 13% plan to implement fiber/synchro. Internet (IP) was also frequently mentioned. Use/plans for use of the other types of communication links was not as widespread.



To see samples and/or Tables of Contents from this report series, visit our website and download the .pdf:

http://www.newton-evans.com/SSA2011_Samples.zip



The Future Role of IEC 61850 in North America

While much of the world community of electric utilities has now begun active implementation of IEC 61850, the international standard system of protocols for substation communications, it is no secret that North America and some Asia-Pacific and Latin American countries have been slow to “hop on the bandwagon” and take advantage of implementing the IEC standard 10-part offering.

There are several reasons for this lag between technology development and standardization versus the speed of electric utility adoption here in the United States and Canada. Even major North American utilities (aside from AEP) are typically smaller than many of their international counterparts (like EDF, UES, ESKOM, CFE, ENEL, EDP, and many others). Secondly, capital and human resources have been stretched over the past 24-30 months, in a difficult economic and operating environment. Thirdly, there have been no national or trans-national policy directives that carry as much weight as those we see in Europe and elsewhere. On the other hand, NERC has however, recently issued some statements about the viability and desirability of IEC 61850 in promoting grid reliability.

Repeated Newton-Evans Research surveys have found that, for the most part, North American utilities plan to stick with DNP 3 as a substation protocol of choice over the next few years. In fact, during the 1990's DNP 3 came to serve as the “beautiful rose” among the thorns of a multitude of proprietary protocols that had been in use for decades. Currently, there is a recognizable pattern of migration from serial communications based use of DNP 3, to LAN-based use of DNP 3.

Do we get by with a Beautiful rose or can we afford a full bouquet of flowers?

Well, if DNP 3 is a beautiful rose, then dare we make the analogy that IEC 61850 may well be a full and lovely spring bouquet, offering an array of communications-centered data handling services for the increasingly complex substation environment? The only problem with this analogy is that most utilities cannot today arrange flowers very well, but can certainly pick and choose from among the ten parts of IEC 61850, such as GOOSE messaging, process bus, and even SCL. See Figure 1.

While the global manufacturers of substation equipment and devices desperately seek a universal substation communications platform in order to advance a single approach that will simplify research and development, product planning, and equipment marketing, the end user community continues to attempt to get a grasp on understanding the new technology and what it means for future operations, as well as what it entails for current involvement in terms of education, planning and testing.

IEC 61850 in North America

2011

Still in “embryonic” status- moving to “emerging”

Large utilities investigating, experimenting with at least some modules. Many using GOOSE, Process Bus

A few (<100) 61850 substation automation rollouts underway. Majority of new substations being planned for 2011-2013 will include at least some 61850 components/modules.

20+ major utilities now belong to UCA2 User Group (could be viewed as the North American 61850 fan club”)

Use of Third Party Services for Education, Initial Round of Consulting, training and Support

2013

In the “developing market” phase

Field deployments underway. Perhaps 350-500 substations operating with 61850. Majority will be “new construction” with most of these EHV and HV substations.

Mapping of DNP 3 into IEC 61850 will enable mid-size utilities to realize some benefits for DA comms coming into the substation. GOOSE messaging will be widely used.

Use of Third Party Services expands to additional Field engineering, installation and equipment/communications testing services,

DNP 3 will continue to dominate the growing “DA” communications installations and will continue to be implemented in MV substations. DNP 3 continues to evolve with active User Group.

Each of the major, mid-size and even the smaller firms that manufacture T&D equipment and devices for substations now provide optional IEC 61850 compatibility. Many also provide consulting and training services and some can perform multi-vendor integration activities if requested. Mainstream T&D consulting engineering services firms offer a range of 61850 consulting and planning services. 61850 specialist firms such as SISCO and ENERNEX rank alongside the stalwarts KEMA and QANTA when it comes to 61850 expertise. There are a number of testing and support services now available from firms such as Kinectrics, a leading T&D services firm based in Toronto (profiled elsewhere in this edition of MTD), Triangle Microworks in Raleigh,

NettedAutomation in Karlsruhe, Germany, STRI AB in Sweden, Kalkitech in Bangalore, India, and SystemCorp and RutvaTech in Australia.

Karl-Heinz Schwartz, perhaps the most recognizable name among a number of long-term proponents of IEC 61850, writes a well-read blog on 61850 as well as operates NettedAutomation.

When one looks at the number of utilities in North America that belong to IEC 61850-related associations, it seems far from impressive, with perhaps 25-40 major utilities now active with 61850 technical staff education, involved with consultants, attending workshops, setting up testing facilities, and piloting with new construction. However, we must note the fact that these relatively few utilities account for nearly one-half of the North American customer base, operate about 25% of all EHV/HV transmission substations and about the same percentage of distribution (MV) substations.

While today there are only a relative handful of fully implemented 61850 substations throughout North America, these numbers will increase over the next several years as new substation construction picks up to pre-recessionary levels. However, the resources available to retrofit existing substations are limited, and the North American electric power market is mature, with slow growth in demand currently being experienced. North American (and other regional) utilities will continue to rely on DNP 3 for years to come for substation communications and for substation-to-control center communications. What we expect to see within three or four years is a mapping of DNP 3 into IEC 61850 to enable some of the features available from the latter suite.

Will new substations in North America be designed with IEC 61850?

A lot will depend on the robustness of the electric power industry during the next two-three years. If substation construction activity picks up to its pre-recession levels, we will see hundreds of new HV and MV substations added to the grid, either as net new substations, or as replacements for older undersized substations.

How large a market for 61850 exists in North America?

Based on the data shown in Figure 2, there are almost 70,000 utility-operated EHV, HV and MV substations in the three North American/NAFTA countries, with country-by-country allocations provided in the figure. This total, plus the annual addition of a few hundred substations per year,

comprise the TAM (total addressable market). The current “served market” is very small relative to the TAM.

Figure 2 then represents Newton-Evans composite view of 61850 long-term, high-side potential for substations in the three NAFTA countries.

Our view on 61850 implementations is based on these observations:

- The bulk of North American implementations of 61850 during the 2011 through 2013 years will be related to new construction. Retrofit activities will be relegated to some EHV and HV substations. These will likely include substations that are to be equipped with synchrophasor technology. Rollouts of multiple substation 61850 retrofits (5-10 or more over the 2011-2013 years) will occur include from one-to-four utilities in each NERC region.
- Most of the early implementations will be EHV and HV substations.
- Several utilities will adopt one or two of the ten 61850 modules (e.g., especially GOOSE messaging).
- Mapping/translation of 61850 protocols for data transmission to control center installations will likely be in DNP 3 and IEC61850 format, while data from DA field installed devices will arrive at many substations in DNP 3 format. Also, keep in mind that only about 35% of utilities plan to route DA data through substation-based systems. (See Newton-Evans’ 2010 DA report). Other utilities will route directly to the control center. Still others will drive more DA decision-making to pole-top, pad-mount processor-equipped devices.
- Canada and Mexico will likely move at a somewhat faster pace than will their US counterparts in 61850 adoption and implementations (due to a number of factors including limited number of utilities; utility structure; regulatory differences; capital availability).

Figure 2: Substation TAM in North America

| | Transmission Substations | % of Totals | Distribution Substations | % of Totals | % of NAM Transmission Procurements 2010-2014 | % of NAM Distribution Procurements 2010-2014 |
|------------------|---------------------------------|--------------------|---------------------------------|--------------------|---|---|
| Mexico | 645 | 4% | 1,240 | 2% | 4% | 4% |
| Canada | 1,525 | 9% | 5,020 | 10% | 13% | 12% |
| USA | 15,700 | 88% | 45,700 | 88% | 83% | 84% |
| NAM TOTAL | 17,870 | 100% | 51,960 | 100% | 100% | 100% |

Figure 3: IEC 61850 Table of Component Modules

| | |
|---------------|--|
| IEC 61850-1 | Introduction and overview |
| IEC 61850-2 | Glossary |
| IEC 61850-3 | General requirements |
| IEC 61850-4 | System and project management |
| IEC 61850-5 | Communication requirements for functions and device models |
| IEC 61850-6 | Configuration description language for communication in electrical substations related to IEDs |
| IEC 61850-7 | Basic communication structure for substation and feeder equipment |
| IEC 61850-7-1 | Principles and models |
| IEC 61850-7-2 | Abstract communication service interface (ACSI) |
| IEC 61850-7-3 | Common Data Classes |
| IEC 61850-7-4 | Compatible logical node classes and data classes |
| IEC 61850-8 | Specific communication service mapping (SCSM) |
| IEC 61850-8-1 | Mappings to MMS (ISO/IEC9506-1 and ISO/IEC 9506-2) |
| IEC 61850-9 | Specific communication service mapping (SCSM) |
| IEC 61850-9-1 | Sampled values over serial unidirectional multidrop point to point link |
| IEC 61850-9-2 | Sampled values over ISO/IEC 8802-3 |
| IEC 61850-10 | Conformance testing |



Some Regional Hotbeds of 61850 Activities in North America

Three geographic areas of significant activity supporting IEC 61850 development in North America include Raleigh, North Carolina; Silicon Valley, California; and, Toronto, Ontario.

Raleigh is North American home to two of the global giants in substation-based equipment and automation (ABB and Siemens) as well as to Triangle Microworks, active with both DNP 3 and 61850 consulting services. Several automated metering companies (including Elster, Sensus and Tantalus) are also based here.

Silicon Valley is home to EPRI, CISCO, INTEL and an array of other technology giants all investigating the merits of IEC 61850 for electric power as adaptations for other industries. The three major utilities in California are looking here for solutions and services to help them on the road to 61850 implementations in the near future.

Toronto is just as important for the future of IEC 61850 in North America, as are the other two centers, being home to GE Digital Energy, a global leader in substation automation and protection and control; RuggedCom, the worldwide leader in 61850-compatible substation switching and routing; and Kinectrics, a leading provider of T&D services, including an array of 61850 services.

Kinectrics: Life Cycle Management Solutions For The Electricity Industry

The category leader in testing, inspection and certification for generation and T&D

Kinectrics is an eleven-year-old company which provides specialized services and technology for the electric generation (nuclear, hydro, fossil, and distributed generation), transmission, and distribution industries. Formerly the research and development arm of Ontario Hydro, Kinectrics is a \$90 million company with over 400 employees. Acquired by Vision Capital Limited of London, England, in September 2006, the company is poised for aggressive growth fueled by a commitment of financial investment, as well as announcements by the government of Ontario, which expects to invest in

power generation, transmission, and energy saving throughout the province. With 60 percent of its business coming from the province of Ontario, its former owner remains its biggest customer. But the company is growing its U.S. and international business, and with 150+ customers to-date, it continues to diversify. Korea, is Kinectrics largest trading partner outside of North America while several business opportunities are being explored in India and Saudi Arabia. Worldwide environmental concerns are also creating huge opportunities for Kinectrics, according to company president David Harris.

Kinects Power Line Communication (PLC) technology is considered one of Kinectrics' most exciting areas of investment. Power Line Communication is a rapidly emerging technology providing communication links over existing power transmission and distribution networks. Kinects technology is unique in that it enables information to be sent in either direction, and through the distribution transformer, without modification. Smart metering, in particular, is one of a handful of applications for Kinects PLC, the company's patented, advanced, low-cost way of sending digital data.

Kinectrics has established the world's first IEC 61850 Interoperability Lab designed to help clients meet a new set of global standards in Substation Automation and, achieve significant savings with in-house integration and a "plug and work" approach. Interoperability testing services covering IEC 61850, IEC 61970 and IEC 61968 allows Kinectrics' vendors and utilities to discover potential product and performance issues in advance, enabling them to avoid costly issues and problems during integration, operation and maintenance phases. Their Interoperability Testing Lab offers full-scope testing for Substation Automation Systems, EMS, and DMS systems and is equipped with:

- State-of-the-art Omicron CMC 256 and CMC 356 test sets
- Three-rack Real Time Digital Simulator (RTDS) with GTNET capabilities
- Software suites for GOOSE and message generation and analysis
- Common Information Model (CIM) testing
- Background traffic simulation
- Protocol analysis

With expertise based on several decades of R&D and field experience in protection and control systems, Kinectrics is uniquely qualified to offer full scope, one-stop-shop services to meet interoperability testing needs as utilities move to IEC 61850 based substation automation systems.

