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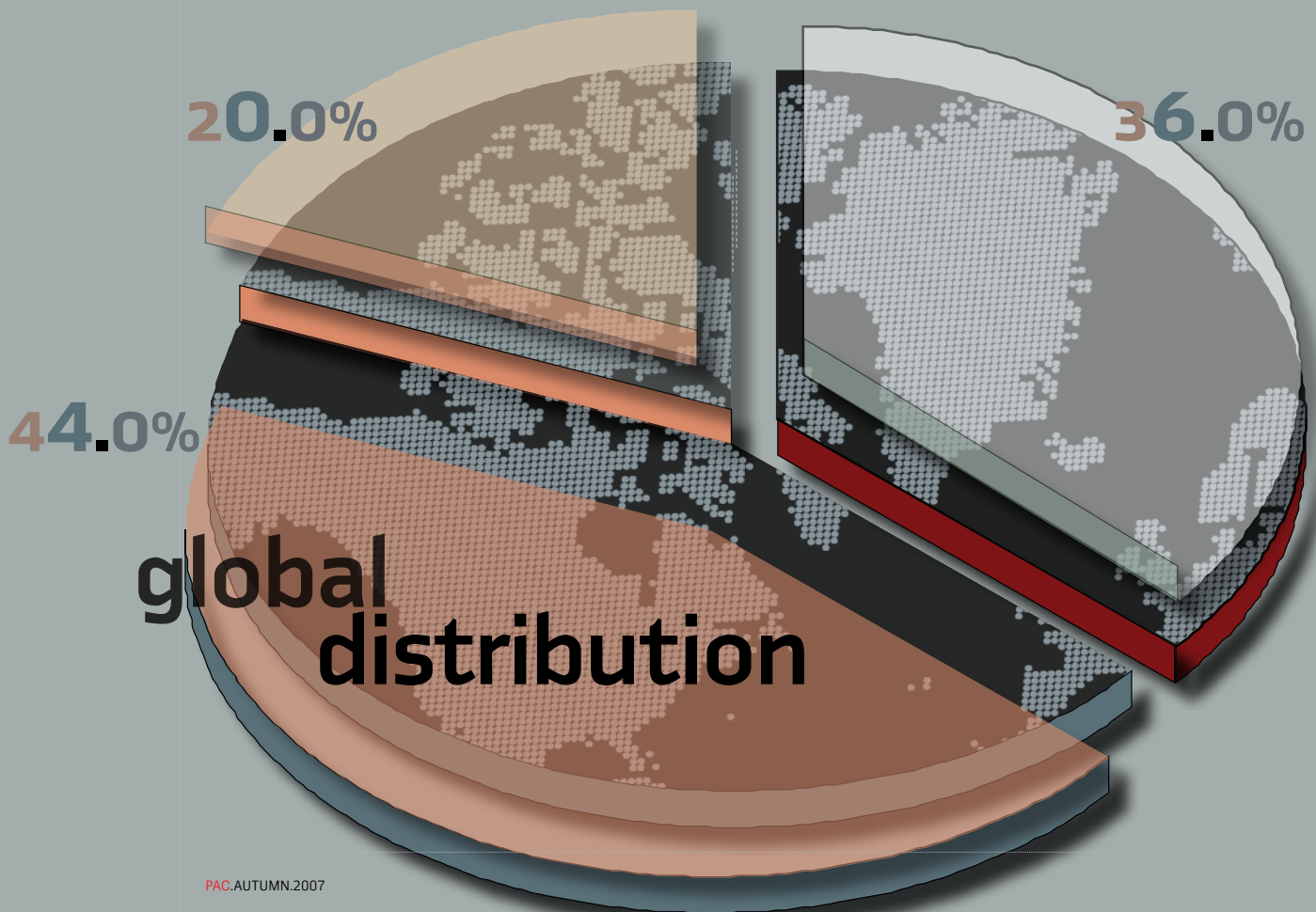
protection

market study

# 2006 - 2008 Protection Relay Study Summary and Highlights

Newton-Evans Research Company is a Maryland-based researcher of technology trends affecting the world's electric, gas and water utility industries. The company has been actively researching global power and energy automation and communications markets on a proprietary and multi-client basis for 29 years. Clients include major suppliers, utilities and consultants active

in automation, instrumentation and real-time computer operations (EMS/SCADA/DMS) and protection and control segments of electric power and gas/oil transmission and distribution.



## The Worldwide Study of the Protective Relay

### Marketplace in Electric Utilities: 2006 - 2008

ON A WORLDWIDE BASIS, THE ANNUAL MARKET FOR MEDIUM and high voltage protective relaying products and equipment currently exceeds the \$1 billion level as we move further into the 21st century. Only a portion of the total market for protective relays is made up of the world's electric utilities directly, with significant indirect sales made to industrial companies, to OEM suppliers that integrate relays into other equipment used by utilities and industrial/commercial end-users, and to independent power producers.

Global protective relay manufacturing and sales leaders include ABB, Areva T&D, GE, and Siemens, with these four corporations enjoying combined T&D protective relay sales of more than \$600 million in markets outside of North America. Newton-Evans estimates that ABB is the world leader, followed by Siemens and then, Areva T&D. Hitachi and TM T&D of Japan are significant suppliers of protective relays to Asian and Pacific region utilities, with estimated combined sales of more than \$100 million.

There are at least 15 additional commercial protective relay suppliers serving power utilities in one or more world regional markets. The Volume Four report in this Newton-Evans research program series includes profiles of many of the smaller companies seeking to compete in this global billion dollar protective relay marketplace.

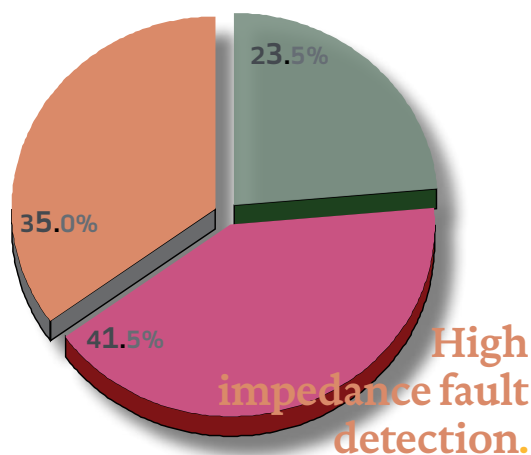
In addition to these commercial suppliers, "captive" or "grey" (subsidized) markets in some developing nations enable in-country manufacturers in these markets to supply protective relay products worth more than \$200 million equivalent spending on commercial grade protective relays. Some companies in Russia, Eastern Europe, China and India continue to benefit from special restrictive considerations and government subsidies to serve the home country market at somewhat below true commercial pricing levels.

Chinese companies such as EPRI China, NARI, Xuji Electric, Hangzhi Machinery and Electronics, Benxi, Tianjin Huarong Relay Company, Shanghai Relays, Beijing Relays and AII Electric are now supplying utility and commercial-grade protective relays throughout China. India too has homegrown industry suppliers led by firms such as Ashida and Control and Switchgear Group. Russia and Eastern Europe are served not only by Western European companies, several of which have teamed with local producers to open relay production facilities in these countries. Some important local suppliers include Radio Relay (Ukraine); All-Russia R&D Institute for Relays; Koncar (Croatia) and several others.

North American utilities participating in the 2006 study of protective relay usage and trends account for more than 30% of all North American electricity customers and industry revenues, far exceeding the participation levels in earlier studies conducted in 1996, 1999 and 2002. American

## 1 North America

Ranking of 3 attributes for high impedance fault-detection



|   |
|---|
| ■ Security - trip for true high impedance events including non-detection of some events           |
| ■ Dependability-trip for true high impedance events including some potential false detections     |
| ○ Our company is not interested in technology advancements for detection of high-impedance faults |
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and Canadian utilities participating in the earlier 2002 survey represented approximately 17% of the estimated total of North American customers, and 15.6% of North American-wide electric utility revenues.

The participating utilities in this current study have relay purchase plans that indicate as many as 13,350 relays will be purchased over the 2006-2008 time frames. It appears that investor-owned utilities will dominate purchases of relays in somewhat lower rates (60%-70% of utility industry totals) than one would expect, given that this group dominates the power supply industry generally (73-77% of total utility customers, revenues, production capacity, transmission lines, etc.). Importantly the findings in the study suggest that the North American market demand may exceed 40,000 units over the 36 months covered by the study.

In 2006, the electro-mechanical segment of the worldwide market continues to be significant, but remains "flat" at about \$35-40 million for North America, and about \$100 million to \$150 million worldwide. In North America, ABB and GE share the bulk of the electro-mechanical relay market segment.

Keep in mind that the electric power utility market for protective relaying products forms only about 60% of the

### BIOGRAPHY

Charles W. Newton is the President of Newton-Evans Research Company. Prior to forming the Company in 1978, Chuck spent five years as an applications planning manager with General Electric's Information Services business. Earlier, from 1969-1973, Chuck was a product manager with Control Data Corporation's OCR Division. While at CDC, Chuck chaired a work group and subcommittee of the ANSI X.25 Committee on OCR Standards. Chuck's professional memberships include CIGRE, IEEE Power Engineering Society, ENTELEC, UTC, AMRA, AWWA, AMA, CASRO and others.

total protective relay market, with additional unit shipments going to OEMs for integration into panel-based systems and to independent power producers (IPPs) - including cogeneration facilities and merchant power plants - as well as to industrial and commercial power generators, and commercial and industrial end-users of electricity.

Average Percentage of Digital Relays in Installed Base and Planned for New and Retrofit Applications Purchases:

The 2006 survey has found that from 31% ((bus differential relays) to 65% (small generator relays) of the installed base of protective relays in U.S. utilities is now comprised of digital relays. Percentages of new purchases tend to be dominated by digital purchases; however, significant opportunity (more than \$30 million) still exists in North America for electro-mechanical units, with from two percent to 18% of some units still being bought as electromechanical units. Almost all new motor protection relays planned for purchase (98%) are likely to be digital; this rate drops to only 82% for bus differential units.

The mid-2004 study had earlier found that from 23% (for bus differential relays) on up to 43% (for large generator relays) of the installed base of relays is now comprised of digital units. As a percent of new purchases, the 2004 study has found that from 79% (for bus differential units) to 96% (transmission line differential units) are likely to be digital units.

Earlier, depending upon application, from 12% to 23% of the installed base of relays were digital by mid-1999. By mid-2002, this had increased from a range of 15% to 43%, depending upon application.

Security Enhancements for Remote Access to Digital Relays Installations:

**North America:** In the 2006 study, the use of multiple passwords continues to dominate the approaches taken to enhance security of remote access to digital relays. This is indicated by 56 of 102 (55%) respondents to this question. User logging per NERC CIP requirements was cited by nearly 30%, while 20% indicated "user authentication" also per NERC CIP. Fourteen utilities were now using encryption, a jump upward from weak responses in several related studies. Only a handful was using "callback confirmation" or automatic random password setting.

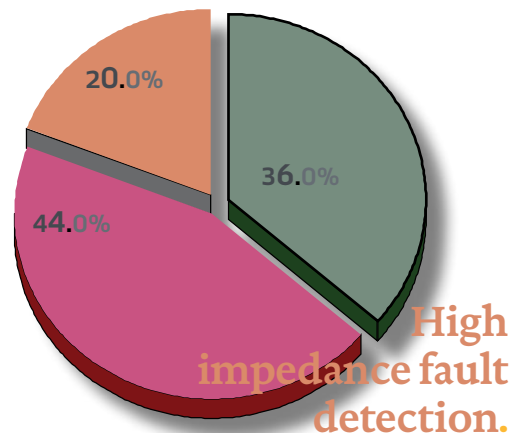
In 2004, the use of multiple (multi-tier) passwords for gaining remote access to installed digital relays was widely indicated by respondents, with a few firms using automatic random password setting. Only one utility was using callback confirmation procedures to further enhance security.

By 2004, 80% of all utilities surveyed were making use of multiple passwords, and this high rate extended to all types and sizes of utilities, with larger utilities even more likely to be using multiple passwords to enhance relay access security. See Figure 3.

**International:** Respondents were again requested to indicate which of six specific security enhancement measures were being used to remotely access digital relays.

## 2 International

Ranking of 3 attributes for high impedance fault-detection



|   |   |
|---|---|
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Overall just over one half indicated they were performing user logging procedures (per NERC CIP). Nearly 40% were doing user authentication, while nearly one third were employing multiple password schemes.

Respondents from the Middle East, Latin America and Europe were more likely to be employing user logging measures than were the Asia Pacific respondents. These Asia-Pacific respondents were likely to be using user authentication measures to a much greater degree than were their counterparts elsewhere.

There were several mentions of "other" approaches being taken to enhance security of remote access to relays, including SCADA alarms for incorrect passwords, not allowing web access to relay data, and simply not allowing ANY remote access to digital relays. See Figure 4.

### 6A. Most Important Features of a High-Impedance Fault Detection Solution

This is a new question in the 2006 Survey.

**North America:** Three possible responses were supplied to survey participants. The most frequently cited response was "dependability - trip (or alarm) for true high impedance events including some potential

false detections.” This reply was mentioned by 43% of the respondent base.

Nearly one quarter of the group (22%) indicated that “security” was most important “only trip (or alarm) for true high impedance events including non-detection of some events.”

Thirty five percent of the respondents indicated that “our company is not interested in technology advancements for detection of high-impedance faults” and were sent on to question 9 in the survey.

The group which answered either dependability or security was asked to complete part 8b. See Figure 1.

Seventy two respondents replied to the question of most important surfaces required to ensure the proper operation of high-impedance fault detection. Listed surfaces included: asphalt, concrete, soil, grass, gravel, sand, snow and trees.

The most frequently mentioned (in order of mentions) surfaces were: asphalt (65% mention rate); trees and concrete (both at 39%); sand (29%); soil and grass (both at 28%), gravel (22%) and snow (19%). See Figure 6.

**International:** Respondents were asked to indicate “what is more important in a high-impedance fault detection solution (i.e., downed conductor detection)?” and were provided with three alternate responses. First, “security-only trip (or alarm) for true high impedance events including non-detection for some events.” Secondly, “Dependability – trip (or alarm) for true high impedance events including some potentially false detections.” Thirdly “Our company/utility is not interested in technology advancements for detection of high-impedance faults.” The summary findings indicate that 44% of the officials

answering opted for “dependability” over “security” for high-impedance fault detection solutions. Only about one-in-five indicated that their company was not interested in technology advancements for detection of high-impedance faults. See Figure 2.

A follow-on question (6B) requested information about surfaces that are important for proper operation of high impedance fault detection. Respondents were given eight alternative surface conditions (asphalt, concrete, soil, grass, gravel, sand, snow or trees). Trees were indicated by the majority (70%) as being important, with soil next (40%) and asphalt and grass following (33%). See Figure 7.

**11A. Plans to Embrace IEC 61850: North American Study:**

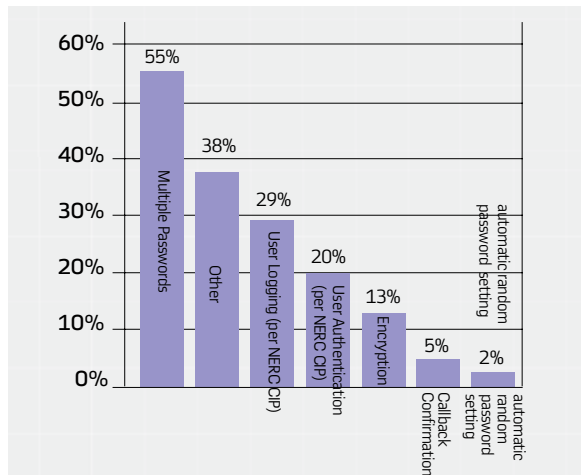
In the mid-2006 study, utility protection and control officials were requested to indicate whether their utility had already or was planning to embrace IEC 61850 in the near future. If not, the reasons for not moving to use of the IEC protocol was requested.

A total of 17 officials indicated that their utility had plans to embrace the IEC 61850 protocol in the near future, and seven others indicated that their utility had already done so. However, 86 officials indicated that they were not likely to embrace the IEC protocol for one or more reasons. The reasons given included: 37 officials indicated that they would continue to use currently implemented protocols; 24 who stated that “the advantages of moving to IEC 61850 were “not that great.” Twenty officials stated their belief that “some vendors have not implemented the protocol” and another 19 officials provided other reasons for not having plans to move to IEC 61850.

**3 North America**

Enhancement to security of remote access to digital relays

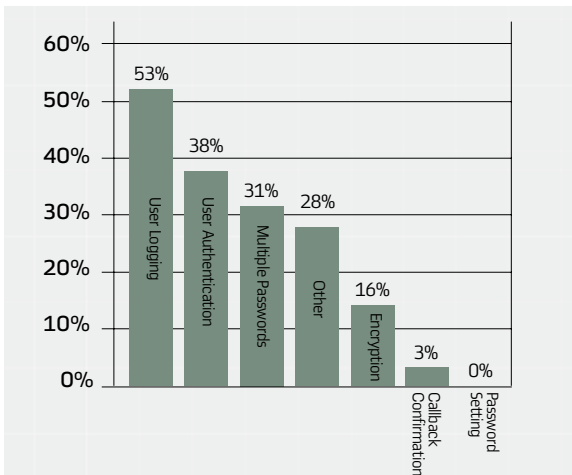
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**4 International**

Enhancement to security of remote access to digital relays

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There were 24 eligible utilities to reply to this portion of question 11 combining users of IEC 61850 with those planning to migrate to IEC 61850. Seventeen of the 24 officials responded with the statement that the protocol simply offered “greater flexibility.” Sixteen of the 23 replied that one reason for their decision to move to or plan to migrate to IEC 61850 was premised on the “single protocol/tool to setup for multiple vendor products” while 12 cited the “cost reduction and faster substation configuration.”

Five others cited “ease of implementation of the protocol.”

**International Study:**

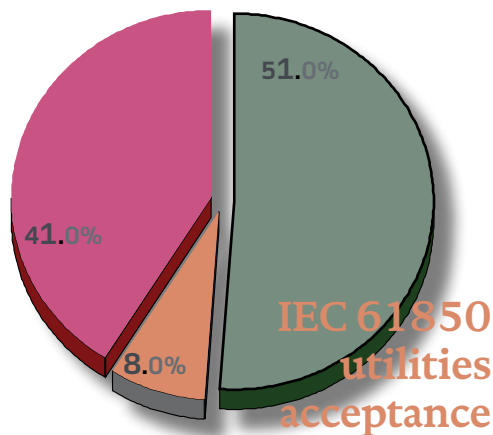
Respondents from 40 countries were asked to indicate whether they plan to use IEC 61850, whether they already use it, or whether they do not use it and had no plans to do so. Overall, one half (51%) of the group of 37 utilities indicated having plans to implement IEC 61850. Only three already were using this protocol, while 41A% had no plans to use IEC 61850 in the near future.

Two of three Latin American respondents cited plans to use the IEC 61850 protocol, along with 58% of Asia-Pacific respondents and 57% of Africa-Middle East respondents. Only 40% of the European respondents concurred with such plans, while three European utilities claimed to have already implemented the protocol.

When those utility officials with no plans to adopt IEC 61850 were asked “why not” the responses included these: 43% cited plans to continue using current protocols, while 21% stated that the relay vendors have not implemented the protocol, and two stating that “the advantages are not that great” to embrace the IEC 61850 protocol in the near future. Another group had several other reasons for not using the protocol. Those utilities that have adopted the IEC 61850 protocol and those with plans to do so were asked why they

**5 International**

Percent of utilities planning to embrace IEC 61850 in the near future

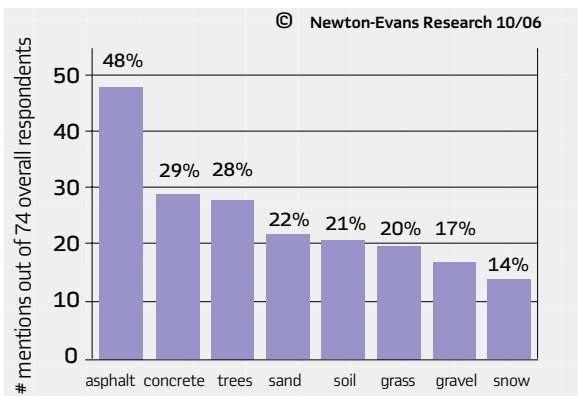


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had adopted/planned to adopt the protocol. The major reason was the move to “a single protocol/tool to setup for multiple vendor products.” “Greater flexibility” was especially important to the Asia/Pacific respondents (67% cited this). “Ease of implementation” was cited by nearly one half of all respondents, with the Asia-Pacific subgroup especially supportive of this reason (56%). Cost reduction was an important factor cited by 44% overall and by 56% of the Asia-pacific subgroup.

**6 North America**

Important surfaces for proper operation of high-impedance fault detection



**7 International**

Important surfaces for proper operation of high-impedance fault detection

