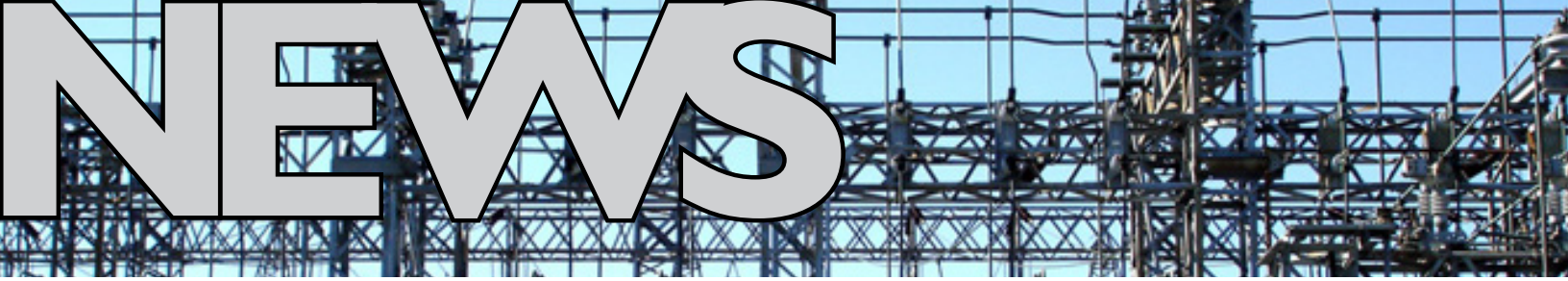
Market Trends Digest

December 2006

NEWTON-EVANS RESEARCH COMPANY



Year-End Multi-Client Report Sale

Through January 15th our readers are invited to take advantage of our Winter Solstice sale of fact-filled, timely energy industry reports. Whether you need one volume or a complete series of reports, we are offering 15% discounts on all current reports to include the following:

The World Market Study of SCADA, Energy Management Systems and Distribution Management Systems in Electric Utilities: 2005-2007

The World Market for Substation Automation and Integration Programs in Electric Utilities: 2005-2007

The Worldwide Study of the Protective Relay Marketplace in Electric Utilities: 2006-2008 (Volumes 1&2 complete; 3&4 to be published by year end)

The North American Market for Supervisory Control and Data Acquisition Systems in Water and Waste Water Utilities: 2006-2007

The World Market for SCADA Systems in Gas & Oil Pipeline Operations and Gas Distribution Utilities: 2006-2007

Client Studies Underway

- Vacuum Circuit Breakers (Vacuum Bottle Monitoring)
- Substation Communications Equipment
- Small SCADA/Substation Monitoring and Control
- T&D Training Services
- T&D Equipment Market Assessments
- Central America, Mexico & Caribbean T&D Market Analysis
- Global Turnkey Control Center Project Outlook
- Global Turnkey Telecommunications Project Outlook

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The Three Gorges Project

A First-Hand Report to Our Readers

by Chuck Newton

During September, 2006, I had the opportunity to spend three weeks in China, touring Beijing, XiAn, and Chongqing; cruising on the Yangtze River and visiting the Three Gorges Project, followed by visits to YiChang, Shanghai, Suzhou, TongLi, Guilin and Hong Kong.

After participating in the China International Conference on Electricity Distribution, and touring the highlights of Beijing, the other work-related highlight of this sojourn was a day spent at the Three Gorges Dam site, truly one of the world's great wonders, and an amazing, brilliant engineering feat. Perhaps to the surprise of some of us in the electric power field, the Three Gorges Project's main objectives have been (1) first and foremost, flood control, followed by (2) power generation (not the reverse, as I had earlier thought) and (3) improved navigation along the Yangtze River, which is the key transportation route to market for billions of dollars worth of Chinese goods each year.

Historical Role of the "Long River"

To better understand the role of this mammoth project in China, one has to appreciate the historical and vital role of the Yangtze River, known to the Chinese as the ChangJiang (or "Long River"). The river converges hundreds of tributaries flowing through 11 Chinese provinces and autonomous regions, and is 6,300 kilometers in length, making it the largest river in China, and the third largest in the world. The river has provided employment, nourishment and transportation to hundreds of millions of Chinese people over thousands of years.

Flood Control Value:

About once per decade, the mighty river has become a scourge rather than a blessing, causing hundreds of thousands of deaths by flooding. Even as recently as the great flood of 1998, more than 3,500 deaths were attributed to the Yangtze floodwaters, along with the loss of five million homes and $30 billion (USD) in economic losses.

While I was on the Yangtze for three-plus days, the river water depth was increasing at the seemingly incredible rate of three feet per day upstream from the Three Gorges dam back upstream to the outskirts of Chongqing. Truly an incredible sight, with the villages and towns that had lined the old shoreline, already largely relocated along with about 1.4 million inhabitants, slowly becoming submerged as I watched. The lower-lying river town sites are already well submerged underwater, and with many additional meters of depth of river water still to be added over the next three years, even more hillside villages and farm sites are to be inundated in what will be the world's largest water reservoir.

As far back as the early 20th century, Dr. Sun Yat-sen, the father of modern China, and a visionary as well, saw the potential for harnessing the sheer potential of the Yangtze at the site of the Three Gorges to provide substantial hydro power generation.

American Involvement:

The example of the Tennessee Valley Authority and the wartime courage of a USBR employee both enjoy a historic role in the development of the Three Gorges Project:

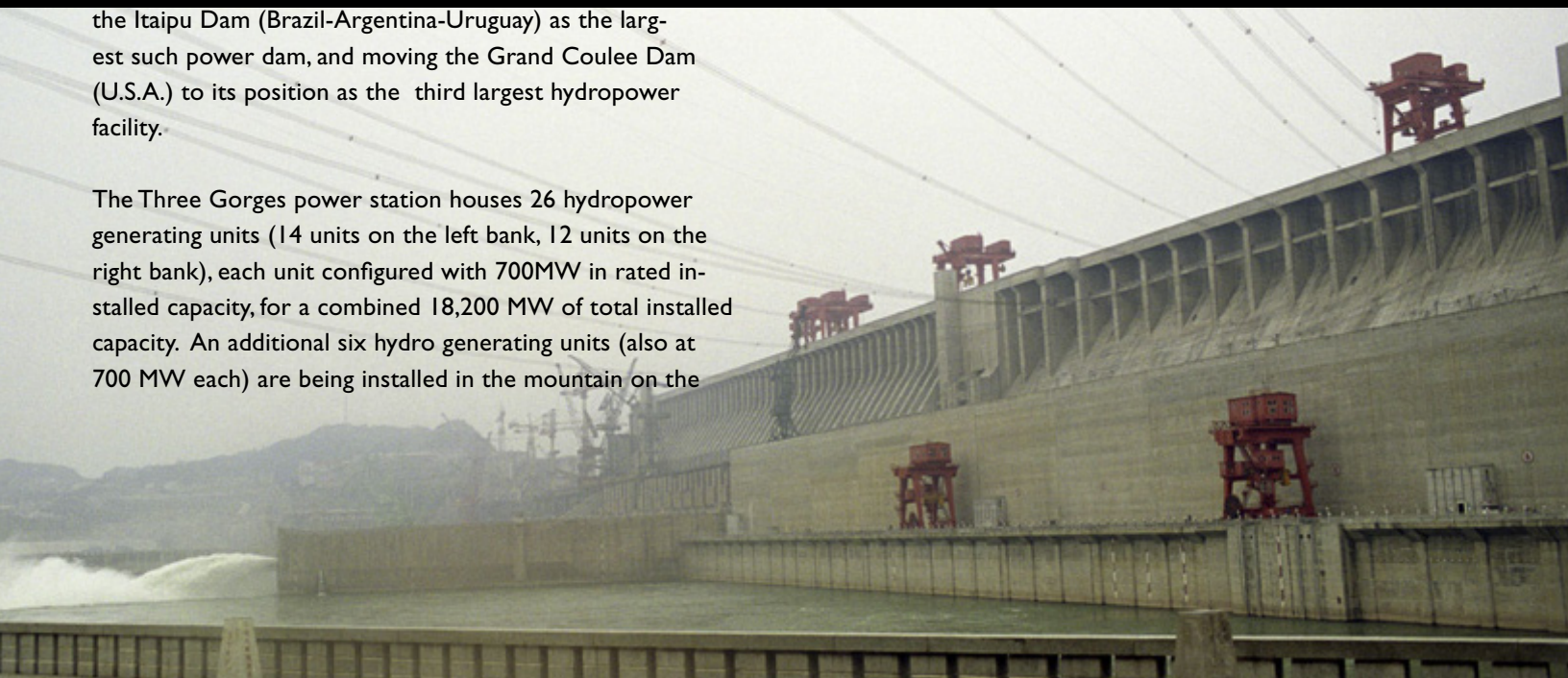
During World War II, the great American dam builder and USBR employee, John Lucian Savage, braved Japanese aerial bombardments at the age of 64 to survey and design the "Yangtze Gorge Dam" at Three Gorges at the request of the Chinese government. Savage also supervised construction of the Hoover Dam and TVA projects and the Columbia Basin Project in Washington State. Also, by this time, the Chinese saw the potential for a TVA-type electric power authority to provide similar benefits to its citizens (low-cost, widely available, highly reliable electric power for rural and smaller urban areas – and protection against flooding of large rivers such as the Tennessee River) as was already being provided by the TVA throughout the multi-state South and South central regions of the United States. The construction of the TVA also resulted in relocation of thousands of families as well as small towns, farms and schoolhouses.

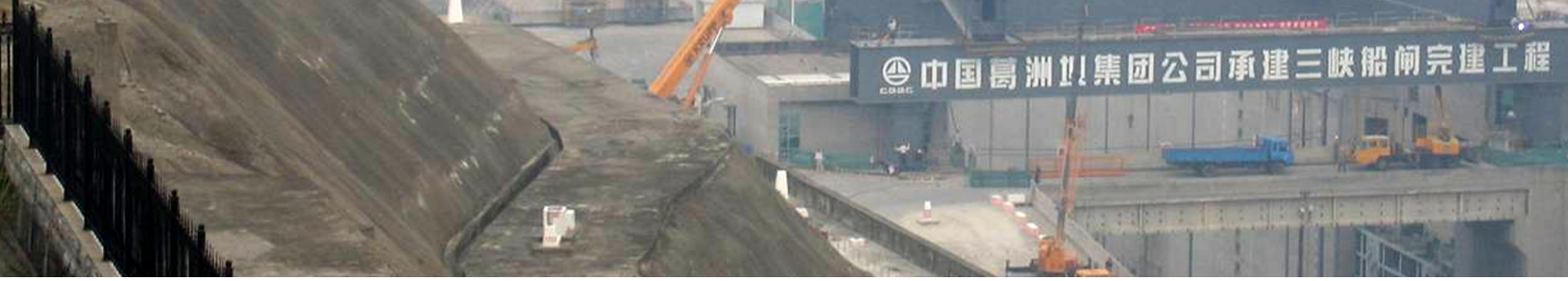
Power generation:
By 2006, the Three Gorges Hydropower Stations have become the largest hydropower facility in the world, replacing the Itaipu Dam (Brazil-Argentina-Uruguay) as the largest such power dam, and moving the Grand Coulee Dam (U.S.A.) to its position as the third largest hydropower facility.

The Three Gorges power station houses 26 hydropower generating units (14 units on the left bank, 12 units on the right bank), each unit configured with 700MW in rated installed capacity, for a combined 18,200 MW of total installed capacity. An additional six hydro generating units (also at 700 MW each) are being installed in the mountain on the right bank of the dam. This brings the total planned capacity up to 32x700 MW units, with a cumulative total installed capacity of 22,400 MW, simply amazing.

The stations are already supplying power to Central China, East Sichuan and Southern China via 500KV DC transmission lines.

Navigation Improvements:
By the time the Three Gorges project is complete, there will be substantial improvements to river traffic, and ocean going ships will be able to go inland from Shanghai all the way to Chongqing, a city not that familiar to many of us in the West, yet a huge and growing mountain city of some 15 million inhabitants. The skyline is almost as impressive as that of Hong Kong and city scenes would remind one somewhat of San Francisco or Vancouver, but with almost constant air pollution caused by the rapid industrialization, and the stagnant summer heat and humidity.





The Three Gorges Project also includes impressive locks and a ship elevator. First is a dual-channel five-step series of ship locks which will enable the passage upriver and downriver of ships up to 10,000 tons. The ship elevator will lift ships of up to 3,000 tons the full height of the dam in about 45 minutes.

Summary:

All in all, it seems to this observer, that there are many more benefits to this amazing and breath-taking technical achievement as there are associated long-term costs or risks to the Chinese nation. Initially, the estimates were that the electricity produced by the Three Gorges would satisfy about 10-15% of the country's electric power requirements, and I believe that this estimate is now down to four percent. This fall-off is not due to any down-sizing of the Three Gorges, but to the continually increasing demand for electricity throughout Central and Eastern China, and the huge increases in consumption over the past 14 years since the project first got underway.

While there are going to be ongoing discussions concerning sedimentation, environmental protection, and geological considerations, and relocation requirements, these questions have been addressed and considered in the construction of the dam and the oversight organizations that are in place today. I think that America's own TVA has set a good example and continues to address similar concerns and that example seems to be actively on the minds of the developers of the Three Gorges Project.

CIGRÉ again stage the World's Largest International Conference on High Voltage Electric Systems

by Gerry George, Research Associate

The 41st CIGRÉ Biennial Session traditionally staged in the last week in August was held in Paris from 27th August to 1st September 2006 and this year it attracted a record number of delegates (2,600). Travelling from some 73 countries they were all keen to benefit from the wealth of technical knowledge and industry experience presented at this major Conference. CIGRÉ has an international membership and reputation within the Electric Power Industry as being a key representative organization able to address the structural changes, promote new innovative technologies and influence the world's institutions and decision-makers responsible for the industry' legislation and policies on all energy issues. With international attention currently focussed on the environment and the diminishing energy resources the Conference Programme updated the delegates on these key issues and the solutions now available by presenting the application and benefits of the latest technologies.

The CIGRÉ 41st 'Conference and the Exhibition was held in the excellently appointed and conveniently located Palais des Congrés, which is situated in north-west Paris in close proximity to the Arc de Triomphe and the Champs Elysées.

CIGRÉ Opening Ceremony and Reception

Mr. Yves Filion (CIGRÉ President) presided over the Opening Ceremony on Sunday afternoon 27th August 2006 and welcomed the Keynote Speaker, André Caille, (President of the World Energy Council).
In his Address, Mr. Caille presented the 1,500 – 2,000 delegates in attendance a review of the world's energy sector, selecting the development, maintenance and operation of large electricity grids to provide accessibility and reliability of supply as the "key" to the industry's future.

Energy leaders around the world share a common vision of the energy sector " that the growth in energy demand will continue for decades" and demand forecasts that take into consideration every form of energy efficiency and efficiency improvements in the industry will increase as follows:
"Global energy demand will grow by 50% before 2030, by 100% before 2015," and "Power demand will grow by 100% before 2030." Meeting these demands is a must as access to energy services is a pre-requisite for improved education and health care but this mission raises two fundamental questions, namely, Are there sufficient primary resources to satisfy this demand? and, What is the required level of investment in the energy sector?

On energy resources, the answer is " yes " with experts predicting oil reserves to withstand a moderate

increase in demand for decades. Also, natural gas consumption, the 'fuel of choice' based on identified reserves can increase by a factor of two and similar long-range forecasts apply to 'coal the next clean fossil fuel' as there are substantial reserves in China, India, Russia, Canada and the USA. The nuclear industry remains positive about the future as actual production could increase four times and still last some 1,000 years.

Supporters of hydropower have identified undeveloped potential resources in China, India, Brazil, Africa and North America and to date only one third of this potential resource has been developed. On renewable resources, wind power, which is supported by ecologists, has a potential energy resource larger than hydropower. Resource availability is therefore not an issue; the need is, to create the conditions for increased energy production without increasing the level of CO2 in the atmosphere. On investment, current forecasts indicate a need to invest 17 trillion US$ by 2030 a figure that requires annual investment to increase three-fold to ensure the CO2 level remains at an acceptable level and that the existing energy resources can be evenly distributed via pipelines and transmission lines. This will require stable and predictable prices for prime energy resources limiting government intervention on market prices.

Mr. Caille concluded his Address to CIGRE delegates on an encouraging note, saying " Technology development has taken the world where it is now, and technology will take it where we are going. CIGRÉ has an important role to play and I am convinced the CIGRÉ community will rise to this challenge".

Technical Programme

The five-day Technical Programme started on Monday with the Opening Panel a full-day Opening Panel on the impact of 'Natural Phenomena on the Operation of Power Systems' and the workshop on 'Large Disturbances'. Statistics confirm that between 1970 and 2005 there has been a five-fold increase in catastrophic events, man-made events having increased from 55 (1970) to 250 (2005) and natural disasters, from 30 (1970) to150 (2005).

Presenters from the USA, Sweden, Japan, Germany, Canada and Sweden detailed the impact on their power systems due to storms, ice, snow and high winds all resulting in damaged assets and loss of supply to customers. In August 2006, in Tokyo, 1.4 million households lost supply for an hour when a crane on a barge made contact with a 275 kV double circuit transmission line. Summer heat wave conditions in France and Poland gave transmission system operators significant supply demand balance problems whilst the long dry summers in South Africa created transmission line flashovers. To illustrate man-made events examples of widespread outages, in Northern Ireland and the Irish Republic and also in Brazil contributors highlighted the need to design Special Protection Schemes (SPS) for a high level of security.
Each presentation included a full report of the extent of damage, restoration process, remedial action including fundamental design changes required on system design and to system components. A summary of the strengths and weaknesses identified as a result of theses major system outages concluded each presentation.

A common theme in all presentations was the reaction of the public, press and government, from 'understanding' if linked to climatic conditions, but 'critically severe' if the outage was judged to be preventable. To ensure a positive outcome the need for accurate and timely information to all stakeholders is therefore essential and as important as the system restoration process. These particular sessions always attract the majority of delegates and for the afternoon Session, a video-link was established to a second Conference Hall to accommodate the large number of delegates wishing to benefit from the varied presentations.

The core of the CIGRÉ 2006 Technical Programme started on Tuesday 29th August with the following four-track technical subject programme.:

Date	*Special Subject (No. of papers)*
Aug. 29	A1: Rotating Electrical Machines (25) B5: Protection and Automation (28) C1: System Development and Economics (31) B1: Insulated Cables (26)
Aug. 30	B3: Substations (21) D1: Materials & Emerging Technologies (24) C3: System Environmental Performance (14) C2: System Operation and Control (27)
Aug 31	A3: High Voltage Equipment (25) B4: HVDC and Power Electronics (27) C4: System Technical Performance (24) C6: Distribution Systems & Dispersed Generation (27)
Sep. 1	B2: Overhead Lines (30) D2: Information Systems and Telecommunications (18) C5: Electricity Markets and Regulation (26) A2: Transformers (27)

A brief summary of some of the key issues presented in each of the Special Subject Sessions follow:
A1 - Rotating Electrical Machines - this subject attracted international interest linked to machine design, service experience, life-cycle assessment and machines for distributed generation applications. Design changes discussed were linked to stator cooling comparing the merits of hydrogen with air and water and the impact on O & M costs. Popular asset management tools now in use to assess reliability include Ultra-Violet camera tests and Partial Discharge measurement but difficulties still exist in forecasting overall life expectancy. Studies on the preferential wind generator suggest that the most suitable machines for operation under disturbance conditions are the doubly-fed induction and multi-pole synchronous generators.

B5 – Protection and Automation – the papers were discussed under two Preferential Subjects, namely, the impact of IEC 61850 and protection systems and substation automation for major disturbances. The application of IEC 61850 is rapidly gaining international status with utilities and manufacturers from some ten countries presenting papers on projects installed and their operating experience. Similarly, keen interest was shown in the special protection and automation schemes to prevent widespread and cascade tripping. Installations employing phasor measurement and wide area monitoring that give indications of a possible outage are now on the increase judging from the papers discussed from Mexico, Italy, Switzerland, Brazil and Hong Kong.

C1 System Development & Economics – this subject attracted the highest number of papers selected for discussion with contributors from across the world. Addressing 'drivers in capital investment decisions and power system design' for which 15 papers were selected, the issues raised included the planning link between gas and electricity networks, failures in the regulatory system relating to investment and the problems created by wind energy projects. Examples of renewable Energy transmission Plans in Portugal and Texas were presented as good example case studies. Key issues to come out of the Preferential Subject, 'replacement/refurbishment of assets and security of supply' were that most utilities have developed condition indices for the majority of transmission assets.

Primarily influenced by utilization and ageing, it is imperative that quality data is available for asset replacement decisions.

B1 – Insulated Cables – this subject attracted some 300 delegates to contribute to the discussion on the 26 papers being considered as three Preferential Subjects. Cable and jointing technologies continue to progress with 3-core submarine cable AC projects being both larger and longer than previously. For many utilities prefabricated joints are now the preferential option. The first 420 kV XLPE submarine insulated cable has been installed, these projects now being able to benefit from satellite positioning systems (GPS) and the remote operated vehicles (ROV's) now used to install and protect these cables. The status of superconducting cables was reported and although the technical challenges of short length installations have been met, the cost of HTS cable systems remains the greatest challenge.

The question of cable system operation and maintenance centred on thermal monitoring, it was concluded that the optical fibre within the conductor was the best option. Although partial discharge monitoring is widely used it remains difficult to obtain data to justify cable replacement or estimate the remaining life of the cable. The final Session considered a few examples of the Gas Insulated Line (GIL) systems developed for use in densely populated areas and where high capacity circuits are required.

B3 – Substations – the first Preferential Subject considering, the lifetime management of substations attracted most interest, including reports that SF6 gas leakage rates were still generally low. However, utilities were encouraged to regularly monitor the gas density in accordance with the CIGRÉ Guide on the subject. On the question of life-cycle strategies, authors and delegates presented differences in approach. In Japan, condition based maintenance (CBM) is used to extend equipment service life whilst in Sweden state-of-the-art technologies are used to justify when necessary the complete replacement of substations. Powerlink Queensland (Australia) also opt for the 100% renewal policy deciding for each substation, whether to use the existing site or an adjacent site if available. REE (Spain) have with manufacturers help developed standard GIS modules suitable for substation applications up to 400 kV giving them the opportunity to re-design the system using modules that are easier and faster to install than traditional equipment. Hence, there are no standardised solutions on life- cycle assessment and asset replacement.

D1 – Materials and Emerging Technologies – the merits of off-line and on-line measurement of partial discharge (PD) dominated the first Session. Based on the selected papers and contributions it was generally agreed that by analyzing the PD data, it is possible detect the presence of insulation failure and monitor insulation ageing. The discussion concluded that there was a need for a general recommendation supported by CIGRE/IEC organizations for all involved in on-site testing. On the subject of material issues in emerging technologies, the increasing application of the acoustic emission (AE) detection method for power transformer diagnosis and the possibility for quantitative analysis was discussed. The application of AE together with dissolved gas analysis (DGA) and other partial detection techniques could result in the localization of flaws. Highlighted were the new material applications for transformers, e.g. low viscosity silicone liquid and gas insulated transformers.

C3 – System Environmental Performance – attracted 14 papers but the interest in this subject created a number of contributions simulating a lively discussion period. The effects of embedded generation on the French power system, CO2 allowances and green certificates dominated the first Session, but the merits of dispersed generation able to provide a sustainable supply of energy to populations in remote areas was not overlooked. The economic implications and growing environmental constraints on the design of power systems introduced a number of regulatory issues. In Slovenia, the transmission system operator (TSO) make an annual payment of 160 Million Euro compensation (3,000 Euro per tower) and 4,000 Euro/km right-of-way (ROW) whilst in France, local authorities requesting underground cable in place of proposed overhead line circuits pay 50% of the additional cost. The economic implication of the growing environmental constraints appears to show no sign of diminishing.

C2 - System Operation & Control – system reliability and security criteria together with transmission limits not only involve technical and economic aspects but they encompass social and political issues. Power systems throughout the world use the N-1 security standard, adopting higher levels of security in special situations or to accommodate scheduled outages. Security and quality of supply standards now require consistent application to ensure all customers receive equal treatment. Successful application of software able to minimise system congestion costs has deferred reinforcement of transmission systems. On power system operation and control, contributors reported many new applications probably due to the increasing number of large disturbances and the need to optimize the load transfer capacity of the system. Wide Area Monitoring (WAM) and Phasor Measure Units (PMU) have been developed to give early warning messages to Control Centres and some applications are already in operation. Various aspects linked to the ability of Control Centres to handle system emergencies were presented and particular interest was shown on the training of control centre staff and the energy management systems (EMS) used to co-ordinate the actions of different Control Centres.

A3 - High Voltage Equipment – discussion on the merits of installing disconnecting circuit breakers (DCB's) and the performance of composite insulators dominated the first Session. A number of favourable reports were presented detailing the reduced areas required for switchyards, reduced maintenance etc… but concern was expressed by contributors from the USA and Northern Ireland as Safety Rules required a visible point of isolation this not being possible when DCB's are installed. Excellent service records were presented from Australia and New Zealand on the performance of equipment composite insulators with only four reported failures on the 3,000 units installed since 1992. Utility contributors from The Netherlands, Italy, France and India also contributed similar high performance reports.
The use of transmission line surge arresters available for voltages up to 800 kV was presented: NGK reported an effective performance level of 97% on a 500 kV transmission line in Japan, and ABB reported favourably on the discharge of lightning strikes on a 420 kV Finland to Russia transmission line.

B4 – HVDC and Power Electronics – the 27 papers selected for this Session included a number of projects illustrating the application of HVDC transmission systems. Among the key projects discussed was the de-icing project at Hydro Quebec TransEnergie, the REE (Spain) feasibility studies on the planned HVDC link between the mainland and the island of Mallorca and HVDC at 800 kV in Sweden. The second Session gave delegates the opportunity to appreciate the benefits of HVDC and to receive performance reports on some of the world's major projects in operation.

C4 - System Technical Performance – The first part of the discussion centred on the performance of transmission lines due to lightning disturbances and the various methodologies used to simulate lightning and the effects on insulation co-ordination. Evidence suggests that the geometrical disposition of the conduc-

tors has a significant effect on the circuit failure rates. EMC and EMF assessment and mitigation papers reviewed the research studies undertaken by some utilities to obtain a better understanding of the problems but no significant new information was presented. The final Session was spent discussing power quality, the monitoring projects that utilities have in place and the application of industry standards as perceived by customers.

C6 - Distribution Systems and Dispersed Generation – the papers submitted for this subject presented a wide spectrum of issues that a large number of delegates appreciated. Significantly, European and National directives are assisting a considerable number of renewable projects in Europe as Distribution Network Operators (DNO's) have to accept all Dispersed Generation (DG) and Renewable Energy Resources (RES) generation at fixed rates. In addition to sharing utility experience and the commercial issues associated with DG and RES, a study was on Hydrogen Energy Storage was reported, a technology that at present is too expensive to adopt. During the session on Demand Management (DM) and Demand Response (DR) it was apparent that the field trials introducing ecological incentives and hourly tariffs for domestic customers conducted by the German utility MVV Energy have produced positive results. This proved to be one of a number of well received pilot projects initiated by utilities that are currently in progress.

B2 – Overhead Lines – it is not surprising that this subject attract a high number of papers in view of the fact that all transmission systems comprise over 90% overhead lines. The first session covered the new developments associated with the information systems and survey techniques required to increase line load transfer capacity and for asset management decisions. This was followed by a series of contributions from Europe, South America and South Africa on new line designs and performance assessment techniques, with the final session covering new components, live-line working and the diagnostic equipment available for testing conductors and corrosion.
The Japanese development whereby an unmanned helicopter that has been developed for transmission line inspection naturally captured delegates interest although further development work is still required.

D2 - Information Systems and Telecommunications – the contributions for the first session of the discussion on this subject outlined the supporting equipment and reliability assessments conducted on their information systems and telecommunication facilities to ensure availability in the event of a major system disturbance. This was followed by a review and discussion of the increasing use of IT in electricity utilities, information systems, power line communications, control centre architecture and addressing an increase concern, cyber security.

C5 - Electricity Markets and Regulation – the discussions on this subject were linked to the role of Industry Regulators and Regulations followed by Electricity Markets and Market designs. With contributions from around the world it was soon apparent that deregulation which had a common goal, to un-bundle the electricity business and introduce competition, the models used to achieve these twin objectives vary. Hence this knowledge sharing session created considerable interest for those delegates still experiencing the status and culture change. Similarly, the second session highlighted the key issues linked to energy markets, capacity payments, tariff structures in addition to the models being established in Iran and Russia where competitive markets are not yet in operation.

A2 – Transformers – there was considerable interest in this subject judging from the number of delegates in attendance this probably being linked to the need to maximise the life of this asset. From the many contributions presented in the first session expert opinion on the interpretation and value of diagnostic test results as a means of estimating residual life varied. Information shared on both transformers and on-line tap-changers indicated that many utilities have assets well over 40 years still in operation. Condition and time-based maintenance strategies are still used for transformers, but for tap-changers, type and/or number of operations often dictate the time intervals between maintenance. Various contributions were given on the repair, often on site of faulty transformers and it was surprising to note that a number of transformers installed on major interconnection projects failed in service following a relatively short period of operation.

The increasing use of phase shifting transformers (PST) was discussed in the second session and in addition to the papers received a number of contributors outlined the relative merits when interconnecting asynchronous systems. Also included was a contribution on alternative solution to the PST, the variable frequency transformer (VFT) now in successful operation on the Hydro-Quebec TransEnergie transmission system.

Technical Exhibition

During the past ten years the number of Exhibitors representing the world's leading manufacturers and service providers who meet and satisfy the demands of the electricity utilities has continued to increase and this year a record number of Exhibitors (101) participated in the CIGRÉ 2006 Exhibition. With capital investment levels in the industry increasing rapidly this five-day event was a showcase of the latest products, new technologies and solutions. With the world's leading plant and cable manufacturers, small specialist companies, utilities, consultants and research institutions present delegates took full advantage from being in a position to benefit from hands-on-experience and discussion with the industry experts.

The cable manufacturers, Nexans, Prysmian, Silec, Brugg were available to discuss and show the cables employed on the latest major land and submarine HVAC and HVDC cable projects. NKT Cables in a joint venture with Southwire presented high temperature superconductor (HTS) technology with the first TRIAX (three phases in a single cable superconducting cable and ABB, the HVDC light cable used successfully for underground land and submarine cable projects. With the industry now adopting a standard protocol in accordance with IEC 61850, ABB, Siemens and AREVA, the latter who launched the e-terravision automation and information system all had very impressive demonstrations of the system that is rapidly being installed by utilities. New products on show to attract utilities included:

- 3M's Aluminium Conductor Composite Reinforced (ACCR) that can increase the circuit load transfer capacity of existing transmission lines by a factor of 2 to 3 without infringing the ground clearance specification.
- The delta-shaped 3-phase low-loss transformer offered by Hexaformer AB from Sweden available in capacities up to 2,500 kVA being installed by Vattenfall.
- Kelman's latest range on-line (Transfix) and portable equipment (TransportX) used by utilities for sampling transformer oil i.e. Dissolved Gas Analysis (DGA).

Advances in technology displayed included the Siemens software that enables them to manufacture low-noise power transformers, compact EHV switchgear and the complete range of surge arresters, while Toshiba chose to focus on Gas Insulated Switchgear (GIS) and transformers (GIT). AREVA T & D presented their services as they are now in a position to offer utilities a complete solution from design through to management. ABB were on hand to discuss their complete product range particularly those linked to HVDC and FACTS systems in

addition to displaying the latest transformer tap-changer equipped with vacuum interrupters which is currently being tested. A number of the larger utilities, Hydro-Quebec, Manitoba-Hydro, EDF, Statnett SF and Iberdrola had Stands who together with consultants like PB Power are now able to offer a complete range of engineering services were Exhibitors.

The delegates interest in design software, EMS and DMS, network simulation studies etc were well served by RTDS Technologies (Canada), EFACEC Group (Portugal) and KEPCO/KEPRI (Korea), and for research and testing KEMA, NaREC, CESI, SINTEF, TransiNor and IPH GmbH were in attendance. Interest in asset management continues to expand and the latest test and diagnostic equipment was on display. Now available for checking the composition of SF6 Gas (G.A.S.Germany), on-line recording of transformer winding temperature (Opsens Inc.Canada) and cable partial discharge (Baur, Austria) plus a range of diagnostic test equipment and testing services from Doble Engineering (USA).

Finally, to improve the management and maintenance of transmission lines the four exhibitors offered a complete range of mapping and inspection services namely, Opten (Russia), Network Mapping (UK), Albatroz Engenharia s.a. (Portugal) and Fugro (France).

This brief review provides confirmation that the Exhibition is now an important and integral part of the CIGRÉ Biennial Sessions as Exhibitors take the opportunity to present a product and services showcase that is complementary to the technologies presented and discussed in the Technical Sessions.

Summary

CIGRÉ's General Sessions are renowned for their unique and convivial atmosphere that engenders friendship and equality among all attendees. This undoubtedly encourages the exchange of technical expertise and industry experience at all levels throughout the six-day programme. Jean Kowal, (CIGRÉ's General Secretary) who with the Secretarial team is responsible for managing the event, summarized the 41st General Session by saying it was,

"Record breaking in terms of the number of delegates and Exhibitors attending."

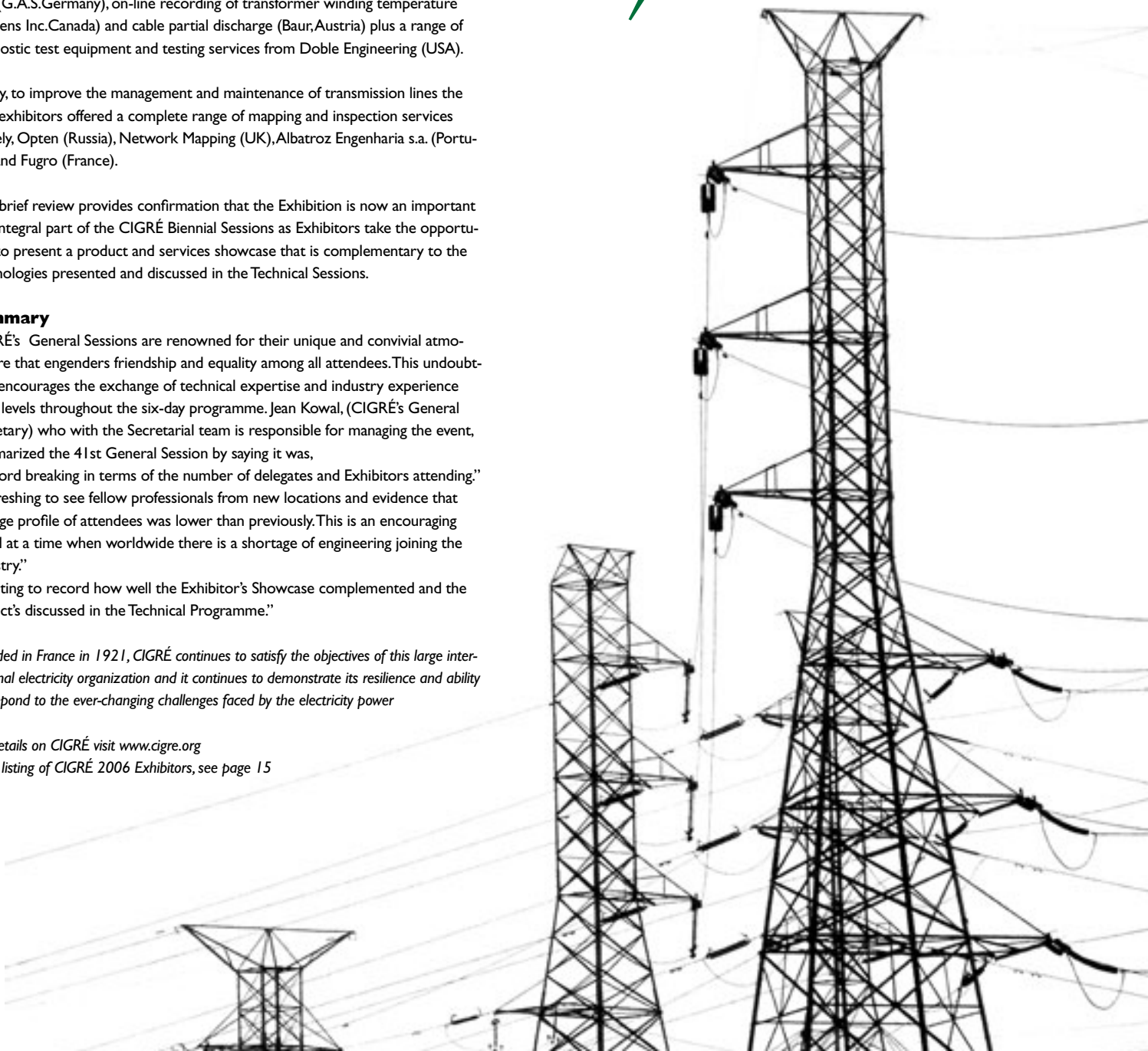
"Refreshing to see fellow professionals from new locations and evidence that the age profile of attendees was lower than previously. This is an encouraging trend at a time when worldwide there is a shortage of engineering joining the industry."

"Exciting to record how well the Exhibitor's Showcase complemented and the subject's discussed in the Technical Programme."

Founded in France in 1921, CIGRÉ continues to satisfy the objectives of this large international electricity organization and it continues to demonstrate its resilience and ability to respond to the ever-changing challenges faced by the electricity power

For details on CIGRÉ visit www.cigre.org

For a listing of CIGRÉ 2006 Exhibitors, see page 15



Technology Transforming Distribution

by Chuck Newton

The term distribution automation can be applied to many aspects of the electric power delivery system, from the control center to the substation, to the feeders and indeed to the customer revenue meters. As the Institute of Electrical and Electronics Engineers defines, distribution automation (DA) is "a system that enables an electric utility to remotely monitor, coordinate and operate distribution components in a real-time mode from remote locations."

DA has been discussed, written about and worked on for more than a quarter century, and even further back in time, if we include the early days of computer-based Supervisory Control and Data Acquisition (SCADA) technology, dating from the late 1960s. Even today, we often hear about the coming "self-healing grid." However, given the level of investment and attentiveness of utility management being paid to the distribution network, as measured by study after study, a self-healing grid actually coming to fruition is many years away.

Today, the DA field can encompass any and all aspects of a distribution network automation scheme, from the control center-based SCADA and distribution management system on out to the substation, where RTUs, PLCs, power meters, digital relays, bay controllers and a myriad of communicating devices now help operate, monitor and control power flow and measurement in the medium-voltage ranges. Today, one will also find transformer monitors at the nation's critical substations.

Beyond the substation fence, further down into the primary and secondary network, we now find reclosers, capacitors, pole-top RTUs, automated OH switches, automated feeders, line reclosers and associated smart controls. Meanwhile, things have not stood still at the customer premises either. Automation of the revenue metering function has occurred at many millions of points in the country's 135 million metered customer locations.

DA Components

Fundamentally, there are three components of a system-wide distribution automation system. These include: control center-based control and monitoring systems, including distribution SCADA or distribution management systems; the data communications infrastructure and methodology required to acquire and transmit operating data to and from various network points in addition to substations; and the various distribution automation field equipment, ranging from remote terminal units to intelligent electronic devices required to measure, monitor, control and meter power flow. Taken together, expenditures for this wide range of electric power grid distribution automation activity exceed $1 billion dollars each year.

Rationale for DA

System operators can more efficiently monitor and control power delivery functions in real time if they have field automation assistance. Field devices such as circuit breakers, reclosers, switches, capacitors, transformers and even substation batteries can all be monitored remotely. Operators can also remotely measure voltage, current, power factor, as well as overall demand and load flows. Taken together, this information provides systems operations with the current conditions of the power delivery system, and this knowledge directly affects the efficiency with which the power delivery system works. Adjustments to optimize operating efficiencies are more easily made, and increases in power delivery reliability are provided. When system failures occur, automation of the distribution network implies a much enhanced ability to pinpoint outage locations and causes and to restore power swiftly, thus minimizing the frequency and duration of unplanned power outages.

Budgeting for DA

Even though utilities are forced to operate with a keen eye to the bottom line, it makes little sense to continue overlooking the need to reinvest in our aging electric power delivery infra-

structure. This becomes especially important as thousands of our aging senior operations and engineering people are about to retire from the industry during 2006 -2012. These are the personnel who could "duct tape" the system's cracks and keep it tweaked and running.

Today, the need for greater investment in distribution automation systems and equipment is growing. Unfortunately, the actual investment levels continue to slacken, despite passage of the recent energy legislation, some of which is focused on reliability measures. Disinvesting in an aging infrastructure of our nation's electric transmission and delivery system portends some rough sledding for the continued reliability of our energy delivery system in the near future.

More than a billion dollars is spent currently on the combined sales of control systems, smart field gear, communications services and equipment, IEDs and RTUs, automated metering subsystems and other DA-related equipment; however, this is quite insufficient to strengthen or even maintain our power delivery system that brings in revenues approaching $300 billion. We cannot move from shipping 3,500 billion kilowatt-hours today to a Department of Energy forecast of more than 5,000 billion kilowatt-hours in another 15 years with the same infrastructure. It simply cannot be done.

However, the level of investment as a percent of national electric power sales is miniscule, and a sense of urgency to upgrade the electric power T&D infrastructure does not exist among most of our top utility executives, nor can it be found within the ranks of the largest power delivery utilities. DA in general continues to be a "hard sell" upwards within the utility organization. Why this is the case is somewhat perplexing, but it comes down to a few points: ·

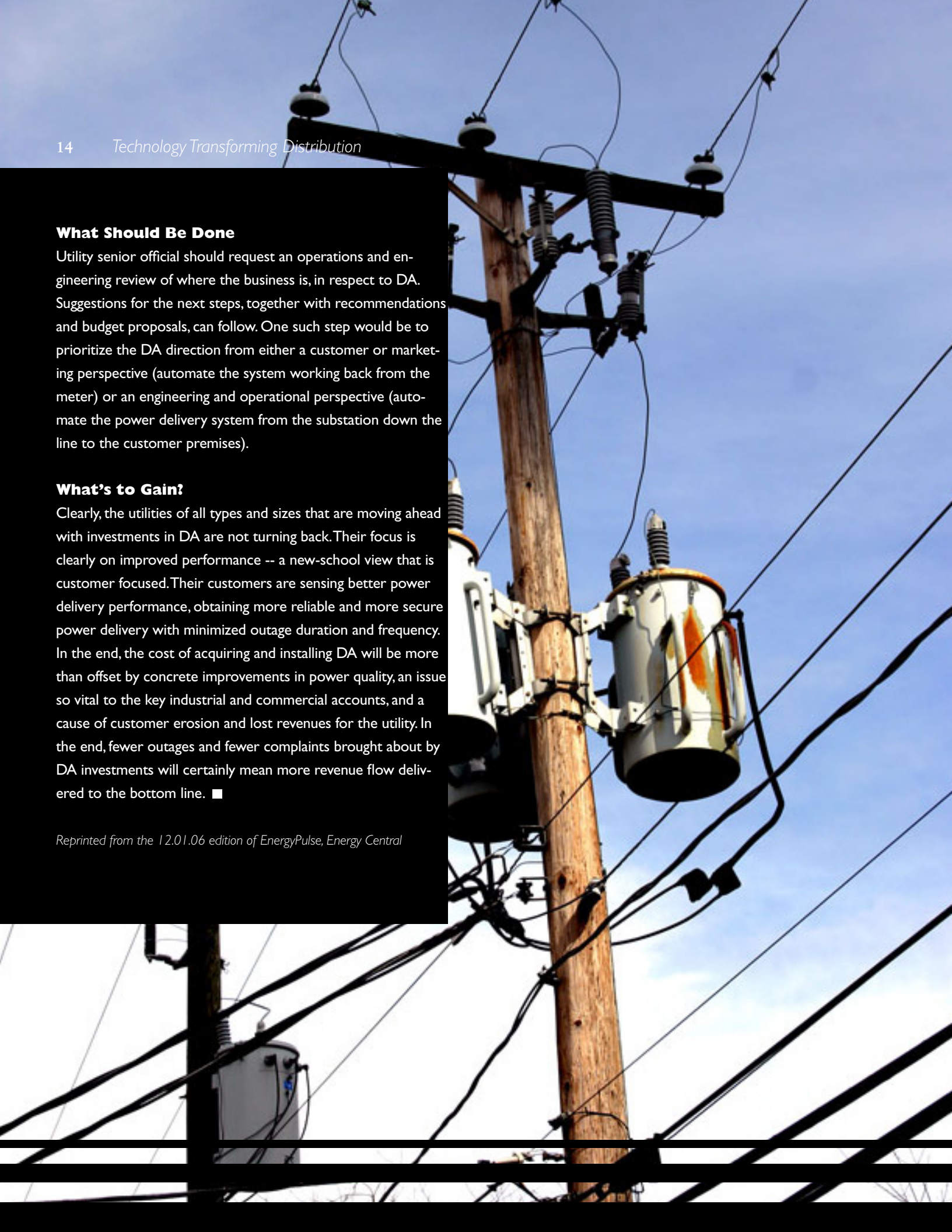
- Near-term cost avoidance;
- Business mentality that suggests "if it ain't broke, don't fix it!";
- Competing with other utility budget priorities; and
- "We're piloting some DA now!" (And probably have been for 20 years!)

However, some hopeful signs are out there. Automated metering systems continue to win new customers. More field automation-ready gear is being installed, yet it is more difficult, more cumbersome and perhaps more expensive to retrofit and upgrade the existing distribution grid -- some of which is now a century old -- than it is to start afresh, as developing nations can do in their greenfields approach to development of an electric power grid.

We simply cannot secure our nation's electric energy future without a dependable and reliable transmission grid and distribution network.

One development that has spurred increases in DA-related spending has been the promulgation in several states of performance-based (or, conversely, penalty-based) rates. Studies have observed significant 10 to 15 percent increases in distribution infrastructure and automation spending in those states and in those rate cases where utilities have sought and obtained rate structures based on their performance. Performance measures used for PBR cases have been qualitative (frequency and number of complaints to the PSC) and quantitative (using one or more of the de facto standard measures such as SAID, SAIFI and CAIFI).

You might ask "What has DA got to do with PBRs?" Well, there is no better way in the minds of many utility officials to improve performance of the distribution network, the cause of most unplanned outages, than to implement some level of automation systems and subsystems to more effectively cope with determination of location, isolation of the incident and restoration of service to the affected areas. It simply does not matter whether the work begins with or continues with integrating communications and automating functions within the substation, or whether the program will begin with feeder automation, or sectionalizing techniques or an AMR program using meters that can sense and report back status of power delivery to the customer site.



What Should Be Done

Utility senior official should request an operations and engineering review of where the business is, in respect to DA. Suggestions for the next steps, together with recommendations and budget proposals, can follow. One such step would be to prioritize the DA direction from either a customer or marketing perspective (automate the system working back from the meter) or an engineering and operational perspective (automate the power delivery system from the substation down the line to the customer premises).

What's to Gain?

Clearly, the utilities of all types and sizes that are moving ahead with investments in DA are not turning back. Their focus is clearly on improved performance -- a new-school view that is customer focused. Their customers are sensing better power delivery performance, obtaining more reliable and more secure power delivery with minimized outage duration and frequency. In the end, the cost of acquiring and installing DA will be more than offset by concrete improvements in power quality, an issue so vital to the key industrial and commercial accounts, and a cause of customer erosion and lost revenues for the utility. In the end, fewer outages and fewer complaints brought about by DA investments will certainly mean more revenue flow delivered to the bottom line. ■

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