GE HARRIS Energy Control Systems

Synergy

Waterloo North Hydro constructs new transformer station

SPRING 2001

Photo courtesy of Kitchener-Waterloo Tourism

An Interview with

An Approach to Justifying and

Stephen Costello

Engineering Supervisor, Stations and Planning

Waterloo North Hydro

Waterloo, ON., Canada

In anticipation of a steady load growth, Waterloo North Hydro is constructing a new 100 MW 230/27.6 kV transformer station in the City of Waterloo. We are eager to have the substation on line by this summer, in time for our seasonal peak load.

When it came to selecting and designing a control system for our new transformer station, our prime motivation was to save money and increase functionality. Following a year long investigation and evaluation of the SCADA/system integration marketplace and trends, it became clear that an investment in substation automation would pay off quickly in terms of installation, operational and maintenance cost savings.

The main goals of this project are to implement a substation control system that will:

- Provide the same or better reliability as traditional protection and control systems
- Integrate with Waterloo North Hydro's existing Quindar SCADA master station
- Integrate with various IEDs (relays, meters, monitors, controllers) to provide traditional protection and control, as well as increased functionality
- Have a flexible design that is transportable to our future projects (by reusing hardware and software architecture)
- Most importantly, achieve the same or increased functionality as compared to traditional systems at a reduced cost.

Waterloo North Hydro

Achieving System Integration

Early on in the planning stages for the project, we determined that we could avoid our previous time-consuming and cost-intensive specification, development and tendering process by directly awarding the control system contract to a preferred vendor. From our preliminary evaluation of available products and technology we compiled a short list of potential suppliers. All indicators pointed to GE Harris Energy Control Systems as the best solution.

The idea of one company providing a complete substation automation system was very appealing. Although equipment vendors profess complete compatibility and integration with other vendors' products, in past experiences we have spent much time and money ourselves troubleshooting communication and integration issues that the vendors would or could not resolve. With General Electric we were attracted by the company's broad offering of products and commitment to provide a turnkey solution and service.

Although we had never worked with GE Harris before, we are a long-time customer of General Electric. GE Industrial Systems has been a valued supplier to Waterloo North Hydro for several past substation projects. And the Power Management division of GE Industrial Systems was a strong candidate for providing intelligent protection relays. We have also been very satisfied with the service and support of VIRELEC LTD., who is a value added reseller of GE Harris.

Like many other regions these days, Ontario's power industry is undergoing deregulation. In this new marketplace any wholesale customer connecting to the bulk electrical system (115, 230 and 500 kV) must provide certain station status and analog points to Ontario's Independent Market Operator (IMO). The IMO is the watchdog for the overall operation of the province's bulk power grid and will eventually run the wholesale electricity "spot market". As it was, at the time we were investigating control system solutions, GE Harris was exclusively specified by the IMO for remote monitoring systems.

The combination of all these factors influenced our decision to proceed with direct negotiations with GE Harris. We went ahead and requested a substation automation proposal from GE Harris to be awarded based on the successful negotiation of technical and commercial requirements. After appraising a few scenarios, we were able to come to an agreement with GE Harris.

The scope of work is defined as follows:

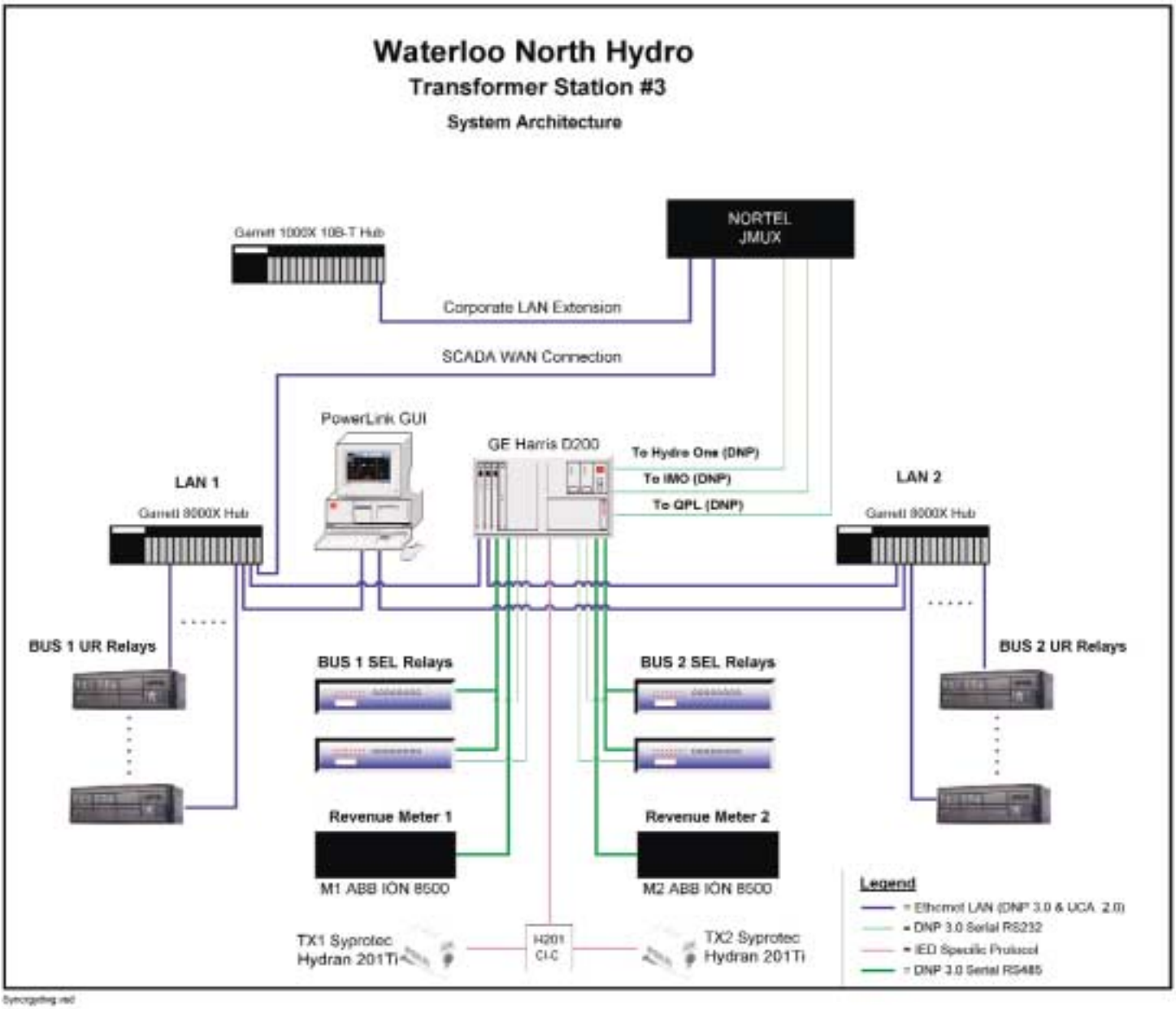
- Design, manufacture, test and deliver control panels (in collaboration with VIRELEC LTD.)
- Design, manufacture, test and deliver remote monitoring system and human-machine interface, integrated with upstream master stations and downstream IEDs (in collaboration with GE Industrial Systems, Stellar Dynamics, a division of GE Harris and VIRELEC LTD.)
- Provide training courses to engineering and station maintenance personnel
- Provide on-site commissioning and start-up assistance.

Features of our new GE Harris Substation Control System will include:

- GE Harris PC-based PowerLink graphical user interface for local station control
- GE Harris D200 data concentrator for all the substation IEDs
- GE Power Management UR relays connected to the substation Ethernet LAN
- DNP Ethernet substation LAN for fast data access
- Remote access from the control centre over the company SCADA WAN/LAN
- Virtual connection to both UR and SEL relays from anywhere on the SCADA WAN.

Three months into the system development, we are confident with our approach and final decision. By circumventing the tendering process we saved approximately three months on our project timeline. The calculated cost savings alone of doing away with traditional devices such as mimic panels, manual switches, transducers, chart recorders, and other hardwired components justify the substation automation schemes. The system integration will also provide us with added functionality for increased system control. These benefits, together with GE Harris' commitment to meeting our tight deadline have all validated our unique approach to this project.

Stephen Costello, the author, is Engineering Supervisor, Stations and Planning, Waterloo North Hydro.



Global Perspectives

From the desk of Shahrokh Zangeneh

Voice of the Customer

At GE Harris, we pride ourselves in serving our customers with integrity, speed and purpose. One of the areas of focus and concentration for the GE Harris leadership team over the coming weeks and months of 2001 is the voice of the customer.

We have a number of ongoing and rigorous company wide initiatives across both our businesses of Systems and Substation Automation on Digitization and e-business, Six Sigma quality, and Technology Investment. These initiatives are designed to align our businesses in a such a way to better position ourselves in addressing our customer's critical to quality (CTQ) issues. We are in full swing with these initiatives and will be in touch with our customers in due course through Synergy or personal contact to provide full updates throughout the year.

The updates are intended not only to provide details of internal changes but also to better explain and demonstrate how these initiatives affect and benefit you, our customers.

Digitization and e-business

Digitization, simply put, is to change the way we work and to use technology to cut down on repetitive and non-value added tasks in order to apply resources and energy to areas where our customers feel the full value of the work we perform. With e-business, we will open up a whole new method of on line ordering and follow-up capabilities to our customers aimed at reducing cycle times and providing up to the minute accurate information on order status. The on line ordering capabilities will be discussed with our customers through Synergy and one on one contact over the course of the coming weeks.

We believe Digitization and e-business will benefit our customers immensely.

Six Sigma Quality

The feedback from our customers has been that Six Sigma is a great program and that it truly enhances the way we work and serve our customers. This is highly encouraging and Six Sigma will again be a major focus area at GE Harris this year with special focus on deriving and applying measurable benefits for our customers to address their major CTQs more effectively.

Technology Investment

The application of advanced technology is an ongoing objective at GE Harris, and this year is no exception. In fact, we have a great deal of investment in new developments and applications, details on which will be released periodically through Synergy. We plan a number of road shows and seminars this year in major cities across the USA and Canada as well as some global locations to present the latest offerings and technology advancements from GE Harris. The road shows and seminars will be held in a tutorial format and will allow for open forum questions and answers from our customers. We will be sending out invitations and agendas well in advance of holding the events to ensure maximum turnout.

Our efforts, as always, are focussed on providing maximum value through our products, services and major initiatives designed to make us more effective and efficient at serving our customer base. We highly value the opinion and voice of our customers, and thank you all for continuing to provide us with feedback and comments on our products, services and initiatives. On our part, we will continue to solicit feedback and will do our best to keep you informed on any actions taken to address issues raised by our customer community.

Shahrokh Zangeneh

Vice President, Strategic Marketing

and Growth Initiatives

GE Harris

Innovative Solutions For

GE Harris once again participated in the DistribuTECH® 2001 Conference and Exhibition, one of the industry's leading international conferences on information technology, distribution automation, and competitive business strategies. The conference was held February 2nd - 8th 2001 in San Diego, CA.

The Family of GE Businesses

This year's dynamic display presented GE products, services, and technologies for managing T&D network assets. GE Harris Energy Control Systems, as well as GE Smallworld, GE Distributed Power, GE Syprotec and GE Power Management demonstrated their innovative offerings for transmission and distribution. The GE Harris Cyber-Café provided delegates with access to the World Wide Web via SUN® Microsystems products and assistance.

Substation Automation & Monitoring

- Integrated Substation Monitoring, Diagnostics, and Control of Substation Primary Equipment
- Multi-functional IEDs and Relays
- Remote Monitoring Devices and Sensors for Performance Conditions in Transformers, Load Tap Changers, and Circuit Breakers
- Expert Services in Design, Engineering, Repair, and Installation

T&D Control/SCADA Systems

- Energy Management Systems for High Voltage Transmission
- Distributed Management Systems for Low Voltage Distribution

Network Management Systems

- Spatial Technology for Asset Management
- Trouble Call and Outage Management
- Mobile Work Force Management

Distributed Power

- Engine-based Power Plants from 0.3 to 10 MW
- Fueled by Natural Gas, Bio Gas, Special Gases, Diesel Fuel, and Heavy Fuel
- Environmentally Friendly

GE Harris Energy Control Systems presented a selection of abstracts at DistribuTECH's Conference and Solutions Exchange Exhibition. Some of our staff also participated as panelists and moderators – a summary of these topics follows.

DNP3 and UCA™ 2.0 MMS – Friends or Foes? – *Grant Gilchrist, Team Leader; Open Systems Communications.*

Both protocols have their benefits and can co-exist within a utility. It's not a matter of choosing one over the other, but implementing a solution that meets both the short term and long term communications

Tomorrow. Today!

requirements of communications in the evolving utility environment.

Integration of Real-Time Data with Mainstream Business Applications – *Jeff Meyers, Global Product Manager.*

Integrating real-time data with mainstream information technology will allow utilities to streamline business processes, provide timely response to customer service issues, increase productivity and lower costs.

Extending IED Functionality with Embedded Web Technology – *Deryk Yuill, Manager, Platform Development.*

The emergence of the World Wide Web as a major force in computing and information technology is certainly not news. Over the last decade it has permeated most aspects of business and society, and is still gaining momentum. A more recent trend is the penetration of this technology into the world of embedded devices. This technology provides some real benefit to the utility, in terms of ease of use and reduced operational costs.

Benefits of UCA™ 2.0 for Substation Automation – *Ron Farquharson, Product Manager.*

A solution to providing lower capital and operational costs is the utility communication architecture (UCA™) that is evolving to an IEC standard.

Technology Solutions for an Aging Infrastructure – *Ron Farquharson and Brian Sparling, Product Managers*

Addressing the current as well as forthcoming condition assessment tools and technology solutions for improving reliability and addressing maintenance issues for major substation equipment. The growing concern over unforced outages is addressed with intelligent network systems that monitor and integrate the control of substations. Substation control systems can be integrated with apparatus condition monitoring, expert system predictive and condition based maintenance programs, remote access via computer networks, self-diagnostics and automation tools.

See you at the next show!

- If you are interested in any of the above topics and would like to receive a copy of an itemized abstract, please contact Petra Lamoureux via email: **petra.lamoureux@ps.ge.com** or by phone at 403.214.4568.

Petra Lamoureux

Marketing Communications

Calgary, AB., Canada

Systems Announcement

In order to refocus the business and improve our ability to execute on our primary metrics of Customer Responsiveness, On-Time Delivery, Employee Satisfaction and Business Profitability, I am pleased to announce the following changes to the Systems organization.

Ko-Chih Liu

Ko-Chih Liu is named General Manager, Engineering. He will be a member of the Systems Leadership Team and will report directly to me in my role as acting VP, Systems. The majority of our software engineers around the world will become a part of this organization. Engineers will be assigned to the Customer Programs team and the Products team on a project-by-project basis and, with cooperation from project team leaders, will be moved freely among those groups. The Engineering leadership team, reporting to Ko-Chih, will be structured around four Centers of Excellence (COEs) for software engineering.

Matt Margut

Matt Margut is named Manager, Customer Programs. He will be a member of the Systems Leadership Team and will report directly to me. All Program Managers will report to Matt. Matt's team will be responsible for execution of all customer programs by utilizing resources from the Engineering organization on a project-by-project basis. They will share schedule responsibility with the Engineering COE leaders and will work with them to optimize our resource levels and methods of execution. Finally, Matt's team will continue to manage all customer relationships during the execution phase of their programs.

Ron Larson

Ron Larson is named Manager, Products. He will be a member of the Systems Leadership Team and will report directly to me. Ron and his team will lead all New Product Introduction (NPI) programs and product development activities by utilizing resources from the Engineering organization on a project-by-project basis and will own all Systems products for GE Harris. They will also be responsible for the milestones and cost budget of each NPI program and will share schedule responsibility with the Engineering COE leaders.

Alwyn Wood

Alwyn Wood is named Manager, Global Services. She will be a member of the Systems Leadership Team and will report directly to me. Alwyn's team will be fully dedicated to the growth and management of our worldwide customer service activities and operations, including support and maintenance, warranty, upgrades/add-ons and training. Having a separate Global Services team will promote greater focus on our customer base, and recognizes the importance of our ongoing long-term relationships.

Rita Patterson

Rita Patterson's role is being expanded to include all marketing and bid management activities for the business. As a result, she will serve that expanded capacity as General Manager, Marketing & Commercial Operations and will report directly to me.

This new organization structure is geared towards improving our speed and efficiency by empowering the Systems Leadership Team and the members of their organizations. Our focus is on improving all aspects of how we operate, driving Six Sigma and Digitization throughout the business, and improving the four key metrics I mentioned in my introductory paragraph.

Jay Freeland

President and

Chief Operating Officer

Melbourne, FL., USA

TechCon 2001

Mesa AZ, February 2001

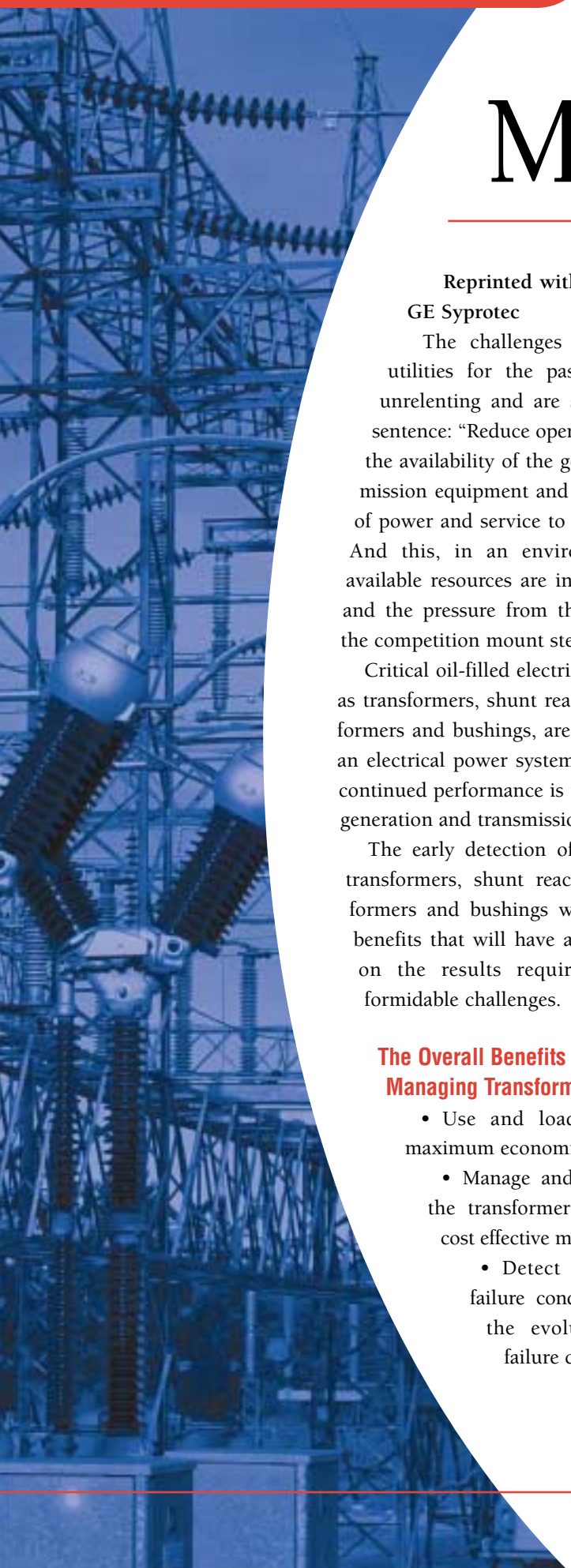
TechCon2001 is an annual conference providing a technical program that offers innovative ideas and information that can be applied to maintaining the health and welfare of high-voltage electrical equipment. This conference, attended by approximately 300 utility engineers, spanned two and a half days and focused on real-life applications of technologies in the world of monitoring and diagnostics for transformers and circuit breakers.

Representatives of GE Harris and GE Syprotec attended the conference, and participated in a one-day exhibit where we discussed applications of our combined technologies. The combined technologies provide solutions to the problems of failure detection, equipment life extension and their integration into a complete substation automation package.

Reinforcing this solution, there were a number of papers where the application of the HYDRAN® technology by GE Syprotec was reported to have been instrumental in detecting abnormal behavior of transformers.

It is becoming apparent from discussions with a number of utility engineers that there is a growing awareness of the need for an integrated solution for data and information from the equipment. It must be made available to maintenance and operations engineers in a timely manner, and the existing, or upgraded communications systems is the vehicle to do it.

Brian Sparling
Product Manager, iSM&D
Calgary, AB., Canada



Managing the Life

Reprinted with the permission of GE Syprotec

The challenges facing the electric utilities for the past years have been unrelenting and are summed up in one sentence: "Reduce operating costs, enhance the availability of the generating and transmission equipment and improve the supply of power and service to the customer base." And this, in an environment where the available resources are inexorably decreasing and the pressure from the shareholders and the competition mount steadily.

Critical oil-filled electrical equipment, such as transformers, shunt reactors, current transformers and bushings, are critical elements of an electrical power system. Their reliable and continued performance is the key to profitable generation and transmission.

The early detection of incipient faults in transformers, shunt reactors, current transformers and bushings will create economic benefits that will have a measurable impact on the results required to meet these formidable challenges.

The Overall Benefits of Monitoring and Managing Transformers

- Use and load transformers for maximum economical efficiency.
- Manage and extend the life of the transformer with efficient and cost effective maintenance.
- Detect the first signs of failure conditions and monitor the evolution of on-going failure conditions.
- Reduce, and possibly eliminate, unscheduled outages and failures.

Many gradually evolving incipient fault conditions in transformers have detectable symptoms that indicate problems. One of these symptoms is the production of dissolved combustible gases in oil.

Dissolved Combustible Gases in Oil

Dielectric oil and solid cellulose dielectric insulation (paper) materials will break down under thermal and electrical stresses. This

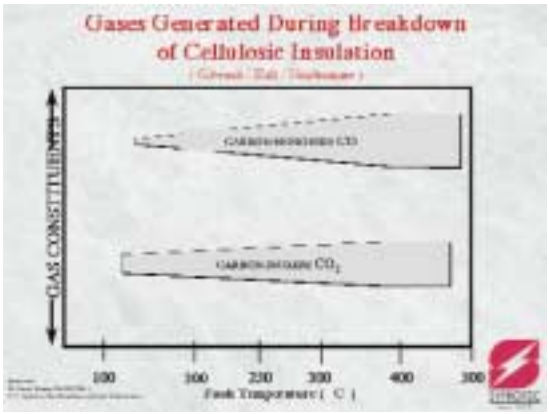


Figure 1

process will produce gases of varying concentrations relating to the stresses applied to these materials. These gases will dissolve in the oil. The nature and concentration of the gases sampled and analyzed are indicative of the nature and severity of the fault in the transformer. The changes in the production of each gas and their rate of production are very important factors in the determination of the fault(s) involved and the evolution of the fault(s). Some specific gases are recognized as being indicative of certain types of faults.

# of Power Transformers

Degradation of Oil-Impregnated Cellulose

The thermal degradation of oil-impregnated cellulose will produce carbon monoxide and carbon dioxide (Figure 1). Hot spots in the windings, on insulated leads and in areas where pressboard and cellulose components and spacers are used will produce both of these gases.

Degradation of Dielectric Oil

The degradation of the oil through *abnormal* dissipation of energy within the transformer can be detected from the gases produced. The energy released through fault processes such as over heating, partial discharge (or corona) and arcing will cause characteristic gases to be formed by the chemical degradation of the oil molecules. The detection of these gaseous products allows for not only the identification of the fault process, but also for the monitoring of the fault process.

These degradation products have come to be known as fault gases. These gases include hydrogen, as well as hydrocarbon gases, methane, ethane, ethylene and acetylene. It is important to note that each of these gases has a characteristic energy required for its formation. As a result the individual gases can be related to a specific fault process (Figure 2).

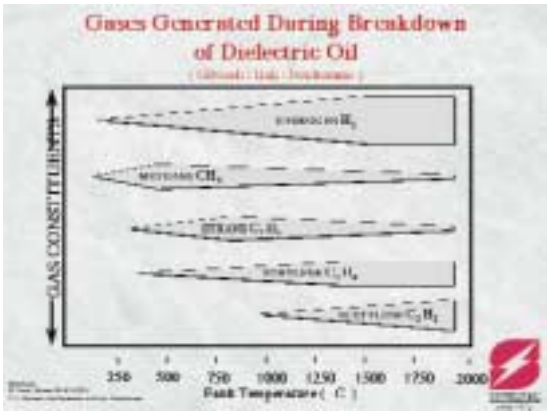


Figure 2

Early Detection on Oil-Filled Transformers

Regularly scheduled and periodic use of the DGA (Dissolved Gas Analysis) method on a transformer population usually reveals that 90% of the sampled units are behaving in a satisfactory manner. The balance of the units sampled may be suspect and therefore closely watched. A transformer is behaving satisfactorily when it has not deviated from its previously established baseline, equilibrium point or fingerprint. A normal and constant gas level for one transformer may be very high for another. Each transformer has its own unique ***normal gassing pattern.*** It is the ***change*** in gassing levels, and, equally important, the ***rate of change*** in gassing levels, that causes a problem unit to stand out from the others.

A DGA represents only a 5 minute data window, or ***snapshot in time,*** on the condition of a transformer. It CANNOT and WILL NOT guarantee that a good report means that the *status quo* will be maintained until the next DGA is performed.

If a DGA is applied on a six or twelve month schedule, there is a markedly long period of time during which the well known, proven and well-established fault characteristics (fault gases) of the transformer are *not* being monitored at all. A serious problem could easily start and go undetected for days, weeks, or even months and evolve into a catastrophic failure with no warning. All of this could occur after a good DGA, and before the next scheduled DGA!

It would seem that in order for a DGA program to be truly effective, one of two changes must be made;

1) Either DGA needs to be performed on a much more regular basis, approaching the unrealistic schedule of once per day;

OR

2) There needs to be a cost-effective and reliable real-time ***gas trending trigger*** or early warning signal which effectively ***bridges the time-gap*** between regularly scheduled DGAs.

System Protection versus Transformer Protection

Power transformers represent the 2nd or 3rd most costly replacement component on any electric power system. For years the feeling was that power transformers never fail... they last forever! Consequently, well established protection schemes involving transformers emphasized *System Protection* rather than *true* transformer protection. As standard practice, devices such as transformer differential relays, sudden pressure relays and gas accumulation relays are utilized to isolate the transformer from the power system in the event of a transformer failure. The emphasis has been on *protecting the power system from the transformer* rather than *protecting the transformer itself.*

Protective devices such as over current, over voltage and over temperature relays are also applied (and need to continue to be applied) in order to keep the transformer within its designed operational limits. Not one of these devices sense or detect serious problems evolving from the dielectric stress (breakdown of the insulation system), which is the fundamental failure mode of any transformer. Based on current and reliable fault gas sensing technology, and the fact that there is an aging transformer population in higher risk categories, it is time to re-think how the transformers can be protected from themselves.

How often... to Guarantee... Maximum Transformer Protection?

How often should a DGA be performed to guarantee maximum transformer protection? If the reliance is on the DGA technique alone, then the answer that makes the most sense is ***more often than the fastest evolving transformer failure mode.***

The following case demonstrates this.

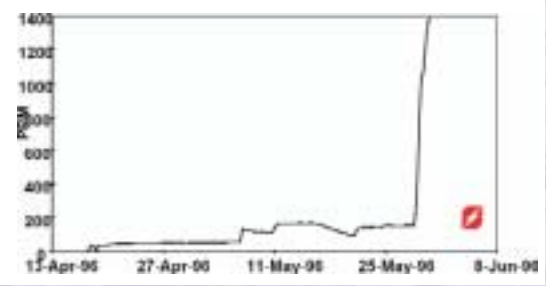


Figure 3

The transformer had a GE Syprotec HYDRAN® 201R Modeli, on-line gas monitoring system, installed in April 1996. During the first month of operation the transformer exhibited normal gassing behavior, (that is to say, a flat baseline of dissolved combustible gases). Shortly after a thunderstorm, the HYDRAN® 201R Modeli detected a small increase in gases. Two weeks after this, the circuit breaker associated with the transformer failed to clear a fault, which of course puts a severe stress on the insulation system. A few weeks after these two stressful events, the HYDRAN® 201R Modeli, detected a rapid increase in combustible gases. The rate of change was in the order of 1000PPM in 24 hours. None of the normal "transformer protection" relays operated. The HYDRAN® 201R Model, provided the alarm that something drastic was occurring inside the tank.

The transformer was immediately removed from service, and upon inspection in a repair shop, the fault was found to be a puncture through the barrier between the LV windings and the core. This puncture was felt to have been initiated by the two external events, and the final path to ground for the discharge took a couple of weeks to appear in the form of rapidly increasing dissolved gases.

It is easy to see that events such as this can go undetected, and have the potential for catastrophic failure, without the early warning that the HYDRAN® 201R Modeli provided.

Conclusion

Very simply stated, ***any critical*** transformer that does not feature continuous on-line fault gas monitoring as part of its standard protection scheme is at risk of an unexpected failure.

Direct and indirect costs of a transformer failure, damage to surrounding equipment and high replacement costs are many times greater than the installed cost of a fault gas monitoring system. The other aspect is one of safety as it relates to operating personnel in the area of the transformer, should it fail catastrophically.

Whether included in new transformer specifications, or installed on existing transformers, continuous on-line fault gas monitoring will provide some assurance and the protection necessary to successfully bridge the time-gap between regularly scheduled DGAs.

Originally authored by Brian Sparling while at GE Syprotec, where he had worked for the past six years. Brian has since relocated to Calgary as the Product Manager, integrated Substation Monitoring and Diagnostics for GE Harris.

Oldest Customer Renews and Upgrades ENMAC

WESTERN POWER DISTRIBUTION

GE Harris Energy Control Systems UK Ltd and Western Power Distribution (WPD) are extending a relationship started in 1992. WPD has awarded GE Harris an infrastructure and ENMAC system refresh contract valued at approximately £2.4m.

This extended contract replaces the old IBM infrastructure in its recently acquired Hyder plc business based in Wales, upgrades the ENMAC system and implements ENMAC Trouble Call System (TCS).

Additionally, WPD have contracted with GE Harris Canada, to replace and upgrade the existing RTUs in their Welsh acquisition at a cost of approximately £1.6m.

WPD is responsible for the distribution system covering the South West of England and South Wales – a wide geographic area of 26,000 sq. kilometres. It provides services to approximately 2.4 million customers across this area.

Under the extension, GE Harris provided a new hardware infrastructure to replace the ageing IBM RS6000 at its St Mellons centre with servers that match the WPD current server population. It also renewed SCADA FEP management equipment and provision of new clients to manage TCS in district offices around South Wales. The implementation of 300 RTUs will take place over 2001 supported by GE Harris, Canada.

In addition to porting the ENMAC system from the existing servers, GE Harris has worked in partnership with WPD to implement TCS in South Wales, so that WPD can meet its own high customer focus and regulatory expectations.

The project implementation cycle started in mid October 2000 and the upgrade system went live in early March 2001. The partnership between WPD and GE Harris has been of benefit to both companies, but more importantly, delivery of a customer-focused service to the South Wales customer base has been achieved in an aggressive timescale to meet WPD requirements.

Laurie Wallace

Program Manager

Livingston, West Lothian, Scotland

Applications to autom optimize T&D operat

Electrical utilities are just as cost-conscious as any other corporation today. Increased competition, narrow margins and regulatory changes demand efficiency at every level of the business. From our ever-growing library of automation, SCADA and communications software, we can tailor solutions to help streamline your transmission and distribution system operations that should result in lowering your installation, operations and maintenance costs. For example, you can:

1. Eliminate site visits by remotely accessing and programming devices from a central station.
2. Extend equipment life by collecting accurate and relevant operating data for just-in-time maintenance.
3. Improve the quality of service with enhanced system reliability, and speed up response times with better alarms, indications and diagnostics.
4. Make more informed business decisions by sharing data and reports company-wide with standardized file formats and common databases.

Automatic Voltage Control

Automatic voltage control provides a complete solution for monitoring and controlling busbars, transformers, and tertiary reactors. This sophisticated application automatically monitors and controls groups of transformers to maintain a steady LV voltage based on user defined targets and settings. The automatic tap change control mechanism provides automatic load balancing across connected transformers and predictive algorithms to determine LV tap effects before the tap takes place! Busbar connections are continuously monitored for dynamic reaction to changes in switching arrangements. Tertiary reactor connections are automatically monitored and considered when predicting voltage changes due to LV transformer tapping. Automatic control can be switched out remotely to allow manual transformer control whenever needed.

Virtual Connection

Gain a single point of access to a substation either locally or remotely. Log into Wesmaint, run configuration programs for a targeted IED, or access any IED in the substation with a direct interface. This access, called the virtual connection, may be established with any configured communication port. You will save visits to the substation for routine operations and maintenance procedures resulting in time and cost savings to your utility.

Capacitor Bank Control

You can gain an effective 1 MVAR of reactive support during peak loading periods on a given distribution unit (transformer and feeders associated with that transformer) simply through the more efficient use of already installed banks. The automated capacitor system controls reactive power flow at selected substations to reduce transmission losses and improve system efficiency. This substation-based scheme works with new or existing capacitor banks to reduce demand for generation, release transformer capacities, improve voltage regulation, and reduce voltage complaints.

Enhanced Load Shed Control

During an overload crisis situation, you can count on our enhanced load shed control program to maintain system

ate and ions

operation within stable limits. The GE Harris system can rapidly shed load at select locations by removing one or more feeders from service by disconnecting the feeder's breakers. Once the system is stable again, the breaker can be closed by a command from the master station or by an operator through Wesmaint or by some other special application.

Auto-Restoration

Ideal for large commercial or industrial facilities that rely on a constant power supply, our auto-restoration scheme can reduce outages to less than a minute. This load transfer scheme will automatically locate and isolate faults on a feeder, qualify the ability to restore load based on substation and feeder data then quickly restore power to unfaulted sections by supplying power from another source. System operators are kept informed of switch operations.

We offer many other applications that will allow you to pass along cost-savings and service improvements to your customers. For more information, email us at geharris@ps.ge.com or visit our web site at www.gepower.com/geharrisenergy/.

Virtual Substation

Imagine having access to all the necessary information you need from a substation with the "click" of a mouse on your personal computer. Whether you are a SCADA Engineer, Protection Engineer, Maintenance Technician or Planning Engineer, the specific information you are looking for can be as close to you as your Web browser.

Presenting GE Harris' Virtual Substation, efficiently putting timely information into the hands of the people who need it, when they need it, where they need it. With the ease of a Web browser, access Virtual Substation to;

- View graphical one line diagrams with real-time data
- View graphic trends of real-time and historian substation data
- View detailed substation alarms with the optional ability to send alarm messages via Email, pager, or to wireless-enabled personal data assistants ((PDA) e.g. Palm Pilot).
- Perform post disturbance analysis of substation equipment operation through "sequence of events" data
- View and analyze digital fault waveforms from devices such as the D25 Multifunction IED.
- Monitor primary equipment such as substation transformers and breakers
- Generate reports using up to date substation data
- Securely configure substation IEDs, view status and extract historical information

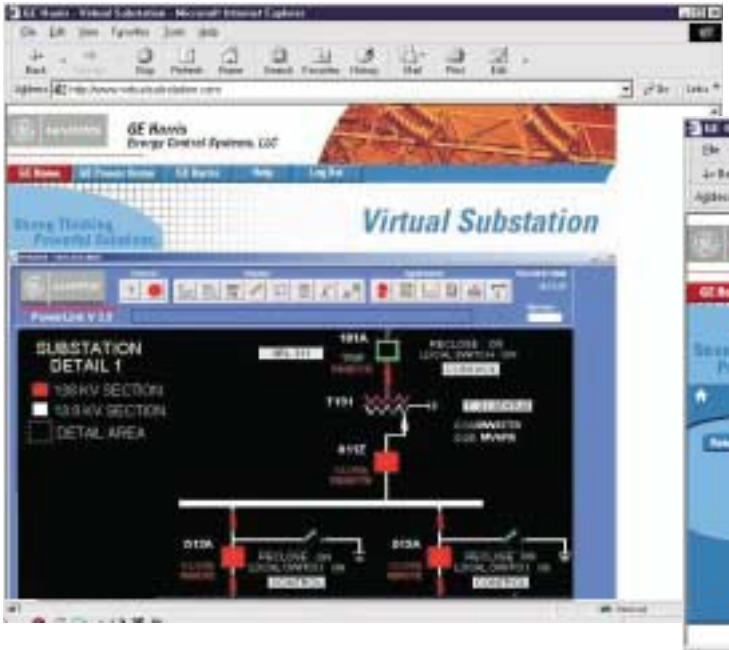
The Virtual Substation server can be tailored to fit a utility's specific needs. Use of passwords, authentication and encryption ensure that only qualified users have the ability to view data, or perform functions for which they have been authorized. The Virtual Substation's true client/server technology provides a single point for application management and control; applications changes occur on the server side with no effort required by the client.

The flexible and scaleable architecture enables the Virtual Substation to reside internally within a utility's corporate intranet, or alternatively it can be hosted externally by GE Harris. The Virtual Substation is now available, for our online demo. Contact Charlie Lew at 403-214-4473 or by e-mail at charlie.lew@ps.ge.com.

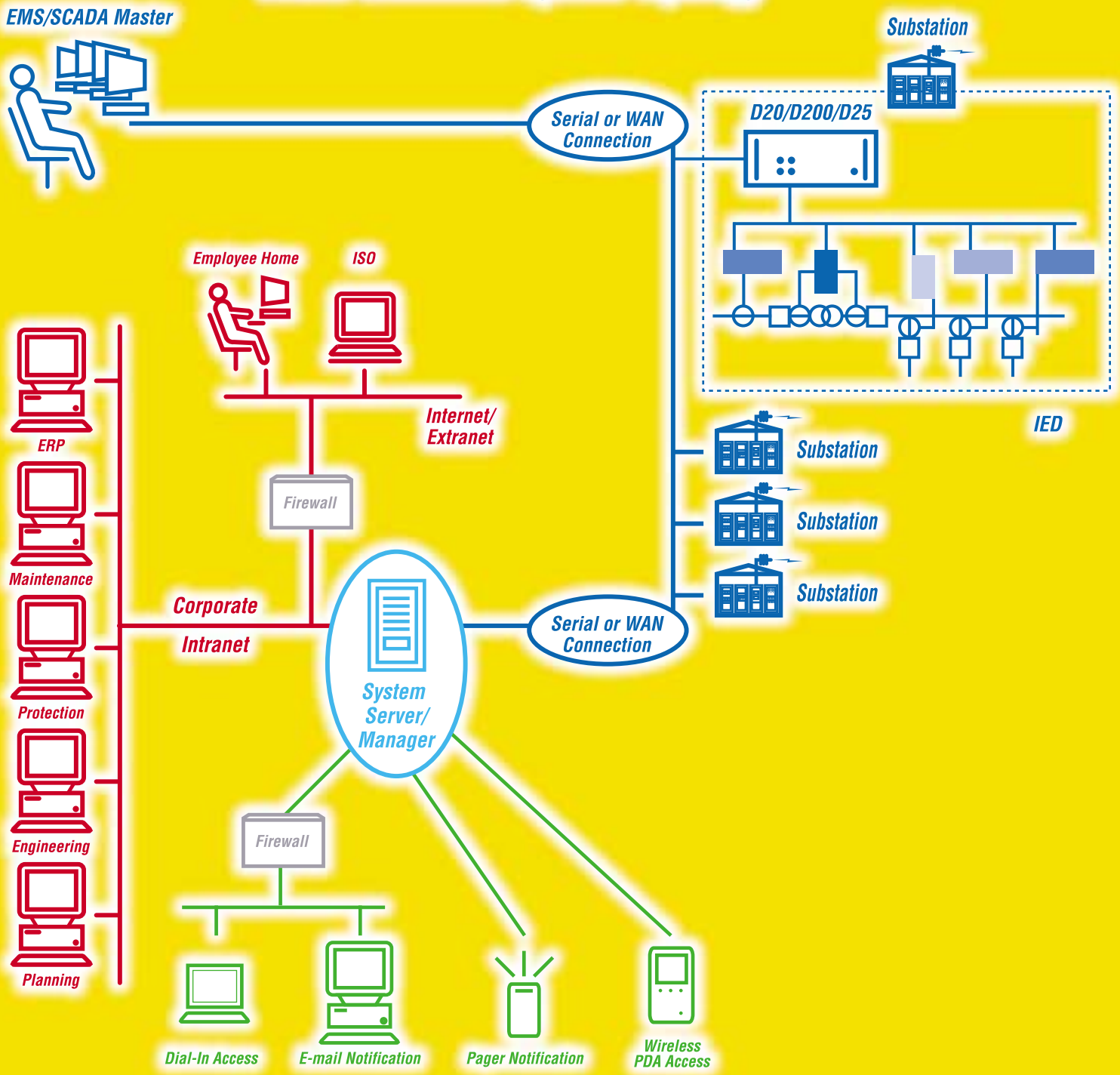
Charlie Lew

Product Manager

Calgary, AB., Canada



Virtual Substation System Topology



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Company Name	Location	Country
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WATERLOO NORTH HYDRO INC	WATERLOO, ON	CANADA
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Steve Goldstone

Training Program Manager

Calgary, AB., Canada

Course Name	Dates
DNP3 Protocol Training	*February 1 & 2 / May 17 & 18 / September 20 & 21*
Powerlink	*February 12 - 16 / June 4 - 8 / August 13 - 17*
D20 Hardware & ConfigPro 4.xx	*February 26 - March 2 / June 25 - 29 / July 30 - August 3 / October 1 - 5*
D25 Hardware & ConfigPro 4.xx	*March 19 - 23 / April 16 - 20 / June 18 - 22 / August 20 - 24*
Integrated Substation Control System (iSCS) Introduction	*March 26 - 30 / July 16 - 20 / November 12 - 16*
Integrated Substation Control System (iSCS) Advanced	*May 28 - June 1 / September 24 - 28 / December 3 - 7*
Logiclinx™	*May 14 - 16 / July 23 - 25 / November 21 - 23*
D20 Software Development System (SDS)	*April 30 - May 11 / October 29 - November 9*
DART Hardware & Configuration	*September 4 & 5 / November 19 & 20*
Prologic	*April 9 - 11 / September 17 - 19*

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