QT e-News™

Quanta Technology's Online Newsletter

QUANTA TECHNOLOGY

Volume 1, Issue 4 Autumn 2010

ENERGIZED TRANSMISSION WORK IS SAFE

Training, Robotics and Tight Procedures are Key Factors

Dr. David Elizondo and Hans Candia, PE

Introduction

Energized work (or live-line) practices are increasingly used across the electric utility industry to accommodate needed transmission infrastructure upgrades. These projects support maintenance and repair, aging infrastructure renewal, and additional line capacity to relieve congested corridors and accommodate additional generation. Because of difficulties in obtaining scheduled line outages to perform work de-energized and the need to reuse existing rights-of-way, an increasing amount of maintenance and construction work is being performed while lines remain energized.

Personnel safety is always the biggest concern when performing energized line work. To assure safety, energized transmission work has been traditionally performed on a very limited basis by specially qualified and trained crews that receive meticulous and ongoing training. Each work assignment is rigorously planned and "tail–boarded", so that each member of an energized work crew knows exactly what the tasks are and when they are to be performed by each crew member.

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Impact Studies of Photovoltaic Distributed Generation on Power Distribution Systems

Dr. Julio Romero Agüero

North American utilities are experiencing a growing proliferation of photovoltaic distributed generation (PV-DG) in their distribution systems. Strikingly, this is happening not only in the Southwest, but also in other regions of the USA and Canada, and is being driven by the need to comply with requirements imposed by Renewable Portfolio Standards.

Historically, distribution systems have been designed to be operated in a radial fashion without special considerations for interconnection of PV-DG. The introduction of PV-DG causes impacts that need to be studied in order to evaluate their severity and identify and implement mitigation measures. The large majority of work in this field has centered its attention on studying impacts of conventional DG (reciprocating engines, small hydro, etc.) on the operation and

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Staff Announcements Exciting News!
Look who has come to Quanta!

See Pages 10 & 11

INSIDE THIS ISSUE

Letter from the President

Dear Colleague,

In this QT e-News issue we cover some very important matters facing our industry:

- Energized work practices are increasingly used to enable necessary transmission infrastructure work because of difficulties in obtaining scheduled line outages and the need to reuse existing rights-of-way to strengthen system capacities. David Elizondo and Hans Candia discuss the use of robotic tools to improve both the productivity and safety of field personnel performing energized transmission work.
- The proliferation of photovoltaic arrays being interconnected to distribution systems, which were not designed for imbedded generation, requires careful review by utilities of developers' connection applications. Julio Romero Aguero provides a refresher of the many impacts potentially caused by PVs that need to be carefully studied.
- In previous QT e-News issues we have discussed system planning and operational issues for integrating and handling large amounts of intermittent renewable energy. In this issue our team, comprised of Srijib Mukherjee, Sercan Teleke and Veera Bandaru, discusses a study that evaluated generation ramping to assist in mitigation of intermittent energy fluctuations.

Quanta Technology is pleased that you, our clients, have continued to engage us in a range of important projects. This is enabling us to continue to expand our expertise and staff depth to strengthen our service to you - not many companies in this economic climate can make such a statement. We are pleased to share with you our new staff announcements, several of whom you might recognize.

As always, we encourage your contacting our staff with any questions.

Sincerely, Damir Novosel - President

Frequency Response and Dynamic Power

Balancing Wind & Solar Generation

By: Dr. Srijib Mukherjee, P.E. Dr. Sercan Teleke Veera Bandaru

Large scale deployment of renewable resources introduces significant complexity in performing load balancing and ACE/frequency regulation. Wind and solar energy are intermittent which may diminish rapidly while system load is increasing. This operating condition places an additional burden on conventional resources that are on-line and available for load balancing. This is to meet the challenges surrounding the aspects of uncertainty and variability that come with having variable generation in the system.

There are two major attributes of intermittent generation that notably impact system operations – variability (generation changes according to the availability of the primary fuel - i.e. wind or sunlight), in this case resulting in swings of the plant output) and uncertainty (magnitude and time of the generation output is unpredictable). While variability is more of a function of regulation, uncertainty can be aligned more to the need for ramping requirements.

Research of this nature is required to understand the feasibility of ramp rate limits within the systems conventional generation fleet to meet renewable requirements in 2020 and to determine the additional ramp capability required. Moreover, statistical analysis must be done to characterize the ramp effects and determine the worst hourly changes for the renewable energy penetration.

Introduction

Electric systems must address two unique requirements: the need to maintain a near real-time balance between load and generation, and the need to adjust generation (or load) to manage power flows through individual transmission facilities. Balancing generation and load instantaneously and continuously is difficult because loads and generators are constantly fluctuating. Minute to minute load variability results from the random turning on and off of millions of individual loads. Longer term variability results from predictable factors such as the daily and seasonal load patterns as well as shifting weather patterns.

Regulation is the use of online generation that is equipped with Automatic Generation Control (AGC) that can change output quickly (MW/min) to track moment to moment fluctuations in customer loads and to correct for unintended fluctuations in generation. The objective of regulation is to maintain interconnection frequency by managing the difference between actual and scheduled power between balancing areas and to match supply (generation) to demand (load) in a balancing area.

Load following (ramp capability) is the use of on-line generation, storage or

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ENERGIZED TRANSMISSION WORK IS SAFE

Traditional energized work, direct "bare-hand" by crew members in insulated bucket trucks or via crew member held insulated "hotsticks", has major limitations: (1) the line and apparatus weights are limited to those that can be manually handled and (2) the approach to lines and apparatus from adjacent energized equipment is constrained to OSHA specified safety distances.

An innovative solution to resolve these limitations, which has been developed by Quanta field lineman and patented, is the use of ground-based, insulated, heavy-lift robotic arms that are mounted on boom trucks or cranes. These robotic arms are able to capture and remove energized conductors from their structures, continue to support the energized conductors, and assure safe working areas for lineman while the lines remain energized during the execution of the projects.

This article describes the robotic arm, presents a field project example where these types of robots have been used, and summarizes the factors that influence the justification for use of these robots and further developments in the technology.

Technology Description of Ground-Based Robots

In this article a robot is defined as any remote-controlled device that is able to perform a specific task which involves motion. Manned robots, as its name implies, are robot devices which require human intervention (an operator at ground level) for task execution. In this context, the ground-based robots, which are always ground control devices during the task execution, are considered manned robots. As stated earlier, ground-based robots are designed to remotely capture and control energized conductors and execute tasks that are far above the human capabilities from both the mechanical and electrical stress perspectives.

Line Master™

This robotic arm was developed by Quanta Energized Services to meet the needs of the electrical industry to remotely handle, move and relocate energized conductors of different voltages. It has been used up to 500 kV. The utilization of this type of robotic tool for 765 kV will require minor modifications to cope with the conductor types, weights and spans. The development was driven to address specific live-line projects such as the replacement of rotten poles utilizing the existing holes (especially in rock), re-conductoring of existing transmission lines conductors, and reframing and re-insulating of structures which are typically difficult to execute with traditional live-line tools such as hotsticks.

The robotic arm remotely captures and controls the energized transmission line conductors in a safe and efficient manner. The remote control is implemented by a radio controller device consisting of a portable transmitter and two receivers. The control signal has a unique digital code exchanged between transmitter and receiver which provides protection against other sources of interference. Control of the insulated arm is via hydraulic power provided from a separate hydraulic power source or directly powered from the hydraulic tool ports of a line truck or aerial lift device.

Figure 1: Robotic arm mounted in a truck.

The technology behind the robotic arm is protected by patents that document the details of the boom mountable robotic arm, procedures for energized reconductor work, and methods and apparatus for live conductor stringing and splicing, among other practices.

The robotic arm mounted on a boom truck is shown in Figure 1. The robotic arms can also be mounted on crane vehicles.

The main applications and capabilities of the robotic arms are listed in Table 1.

Ref	Application
1	Transmission structure repair and replacement
2	Insulator Replacement
3	Re-conductoring
4	Addition of circuits to structures
5	Selective substation repairs at energized base load generation plants, including nuclear plants
6	Emergency repairs and support for conductors when a new structure is not available in a timely manner

Table 1: Main Applications and capabilities of the robotic arm

Project Example

Years of experience with energized transmission line work using ground-based robots have resulted in key lessons learned. Among the most important lessons is the amount of preparation needed by engineering and construction resources to prepare energized work plans. Also, a multidisciplinary team is required for success. Other disciplines, such as the environmental and safety departments, must be part of the team to ensure project success. A project executed with the assistance of ground-based robots is described next.

230 kV Transmission Structure Replacement

As a result of the increasing demands of electric power supply and reliability, an electric power utility in Florida, decided to invest for larger and stronger transmission assets. The main scope of this project is the replacement of the structure of a 230 kV single circuit transmission line, built in the early 1970's, while the transmission line remained energized. The new structures for the 230 kV transmission line were double-circuit poles, installed over a distance of 21 miles. Figure 2 shows a picture of the existing transmission line,

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ENERGIZED TRANSMISSION WORK IS SAFE

which is primarily constructed of H-frame wood pole structures with porcelain suspension insulators and 954 ACSR conductor.

Figure 2: Existing 230 kV transmission line with H Frame structure.

The new transmission line tower design consists of a single steel pole, with one circuit on each side of the structure in a vertical conductor configuration, as it can be seen in Figure 3.

Figure 3: Visual comparison of the 230 kV single circuit, existing H-frame structure (front) and the 230 kV, double circuit, steel pole structure.

The new design uses the existing right of way and has a reduced tower based foot print when compared to the older H-frame design. The towers have a higher resistance to natural events. The height of the new steel poles is 160 feet (average) of which 40 feet (average) are embedded in the ground to withstand hurricane force winds. The new conductor will be one of the largest single conductor sizes in the US today: 2627 ACSS/TW. This conductor has almost two inches of aluminum surrounding a smaller hardened-steel core.

Figure 4 shows a picture of the single pick robotic arm that has captured the energized conductor above the H frame structure while specialized crews work on the new steel pole at the level of the first pole insulator.

Figure 4: Single pick robotic arm which captured the energized conductor above the H frame structure.

Figure 5 shows a picture of the single-pick robotic arm which moved the energized conductor closer to the new steel pole insulator. This enables specialized crews work with hotsticks to connect the energized conductor to insulators on the new pole.

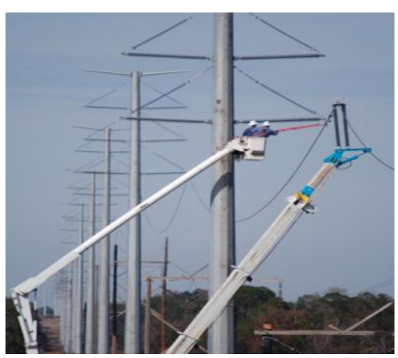

Figure 5: Single pick robotic arm with the energized conductor closer to the new pole insulator.

Based on the factors listed, the use of ground based robots contributed in the increase of energized work in transmission lines and in substations. A methodology to decide the use of ground based robots for energized work is currently under development.

Ref	*Factor*	*Factor Description*
1	*Safety*	*Safety considerations for the job.*
2	*Maintenance activity*	*Specific task to be executed (structure replacement, re-conductoring, etc.)*
3	*Infrastructure condition*	*The condition of the transmission infrastructure, for example, age.*
4	*Asset owner savings*	*Energized work enables the work to be performed when needed without an outage required, for an optimal use of mobilized equipment and crews as jobs could be done in succession.*
5	*Reliability*	*The impact of an outage on the overall system reliability. Common metrics used are: congestion, unserved energy, loss of load probability, cost of serving load, nodal and zonal locational marginal prices (LMPs).*
6	*Public Image*	*Energized work does not disrupt customer service*
7	*Switching Risk*	*Prevents the risk of wrong switching due to grounding requirements*
8	*Fewer Accidents*	*The historical records around the world have shown that work under energized conditions have no safety incidents*

Table 2: Factors that influence the justification of using robots for energized transmission line work

Acknowledgments
The authors of this article thank the contributions of Mr. John White, Jr. from DillardSmith Inc., a Quanta Services Subsidiary.

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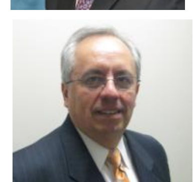

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Impact Studies of Photovoltaic Distributed Generation on Power Distribution Systems

planning of distribution systems. It is worth noting that conventional DG is not intermittent in nature. As a result, most of the impacts can be investigated through steady-state analyses. Due to the volatility caused by clouding phenomenon, PV-DG has an intermittent output that can have significant impacts on volt-VAR control, power quality and protection systems, among others. Some of these impacts can only be investigated through dynamic/transient studies. Given the complexity of such studies and the fact that the proliferation of this type of DG is fairly new, the body of work in this field is less abundant, impacts and mitigation measures are more difficult to identify, and utilities are less prepared to deal with them. Furthermore, for the particular case of small-scale PV generation (e.g., residential and small commercial), uncertainty about the location and timeline of market penetration and the potential interaction with Plug-in Hybrid Electric Vehicles (PHEVs) increase the complexity of this problem.

Impact studies provide utilities with guidelines, standards, tools and processes to manage the expected steady-state and dynamic transient impacts of PV-DG. More significantly, they identify mitigation measures for any problems discovered, and determine their respective costs.

Impact studies can be of local or system-wide scope. Local scope studies address impacts of PV-DG on specific feeders or substations. These studies usually have the objective of identifying impacts and mitigation measures for interconnection of utility-scale PV-DG (installed capacity greater than 1 MW). Thus, they tend to be deterministic in nature, since: a) it is feasible to evaluate impacts under a variety of feeder loading and solar radiation conditions, and b) the location and characteristics of large PV-DG are commonly known in advance by utilities. System-wide scope studies address impacts on the overall utility power distribution system under a set of scenarios of growing market penetration. These studies have to deal with uncertainty about the location, timeline and characteristics (e.g., installed capacity) of PV-DG. They must consider a mix of different types of PV-DG, with an important component of small-scale (residential) units. More importantly, it may not be feasible from an economic standpoint to evaluate impacts on all utility feeders; thus, this requires using approaches such as identifying and studying a set of characteristic feeders only. Finally, system-wide studies may entail taking into account potential interaction effects with PHEVs and other technologies such as distributed storage.

Some of the most common expected impacts of PV-DG on the distribution system are:

a) Reverse power flow: proliferation of PV-DG can lead to reverse power flow conditions at section, feeder and substation level. Reverse power flow can negatively impact protection coordination and operation of line voltage regulators.

b) Voltage rise and voltage variations (dynamic and steady state): some of the most notorious impacts of PV-DG are voltage rise and voltage variations due to output intermittency. Both impacts grow as the penetration level of PV-DG increases, and they are particularly evident and problematic when large PV-DG units are connected near the end of long lightly-loaded feeders. Figure 1 shows an example of the impact of PV-DG on feeder voltage profile. On the dynamic side, sudden disconnection of PV-DG (islanding) can lead to Temporary Over-Voltage (TOV) that can impact distribution and customer equipment.

c) Interaction with capacitor banks, LTCs and line voltage regulators: voltage rise and voltage fluctuation have a direct impact on feeder voltage profiles, which can lead to recurrent operation of LTCs, line voltage regulators and voltage-controlled capacitor banks. This may cause additional voltage fluctuations and require performing more frequent maintenance on these equipments.

d) Reactive power fluctuations: frequent switching (on-off) of voltage-controlled capacitor banks and operation of LTCs and line voltage regulators lead to reactive power flow fluctuations. If the penetration level of PV-DG is large and widespread this may also impact sub-transmission and transmission systems. Figure 2 shows an example of reactive power fluctuation on a distribution feeder: this is due to the operation of a voltage-controlled capacitor bank caused by PV-DG driven voltage rise.

e) Impacts on overcurrent and overvoltage protection systems: PV-DG may cause misoperation of protective devices and operation of surge arresters (due to TOV during islanding conditions).

f) Power Quality: harmonic injection and interaction among PV-DG and PHEV inverters may increase feeder Total Harmonic Distortion (THD). PV-DG intermittency may lead to voltage fluctuations and flicker above visibility and irritability curves defined by IEEE 519-1992 Standard.

g) Voltage unbalance: significant proliferation of single-phase (residential type) PV-DG may impact feeder voltage unbalance.

h) Modification of feeder power factor: PV-DG units are typically operated at or very close to unity power factor. For large penetration levels this can modify the feeder or substation power factor, which may have economic impacts for utilities that are required by ISOs to maintain power factor within predefined limits.

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Frequency Response and Dynamic Power

Balancing Wind & Solar Generation

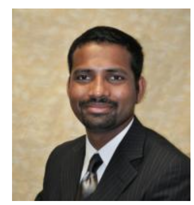
load equipment to track inter and intra hour changes in customer load. Load following differs from regulation in three important respects. First, it occurs over longer time intervals than does regulation. Second, the load following patterns of individual customers is highly correlated with each other (predictable), whereas regulation patterns are highly uncorrelated (random). Third, load-following changes are often predictable (example: weather dependence of load) and have similar day to day patterns.

The increased penetration of renewable energy sources to any system will impact regulation and load following, necessitate increased reserve capacity, and increase the need for more dispatchable ramping capability from the resources on the system.

Ramp Impact Analysis

There are three critical issues surrounding ramp capability: 1) Does it physically exist? 2) Can it be utilized? 3) Will it increase cost when it is utilized? Ramping can be extracted from the energy market, but there are times the energy market may not be able to provide the ramping capability. With increased variable generation penetration, ramp capability can be exacerbated. More wind increases gaps between net demand at peak and off-peak periods. This occurs due to maximum wind generation levels occurring during off-peak hours and then reducing during the morning which is opposite of the daily load pattern.

Figure 1, below, shows a typical power output for wind, load and solar during a summer day. It is seen that as the load rises during the daytime, wind power output drops significantly. This pattern increases the need for more dispatchable ramping capability from the resources on the system that provide this ramping capability. Conventional generation resources are scheduled by unit commitment and economic dispatch rules to deliver the lowest cost of energy produced. When variable resources such as wind and solar are introduced into the grid at higher levels, the imprecision of day-ahead forecasting can create ramp up issues where reserve capacity must be deployed to follow the load and leading to sub-optimal generation being used while driving up costs.



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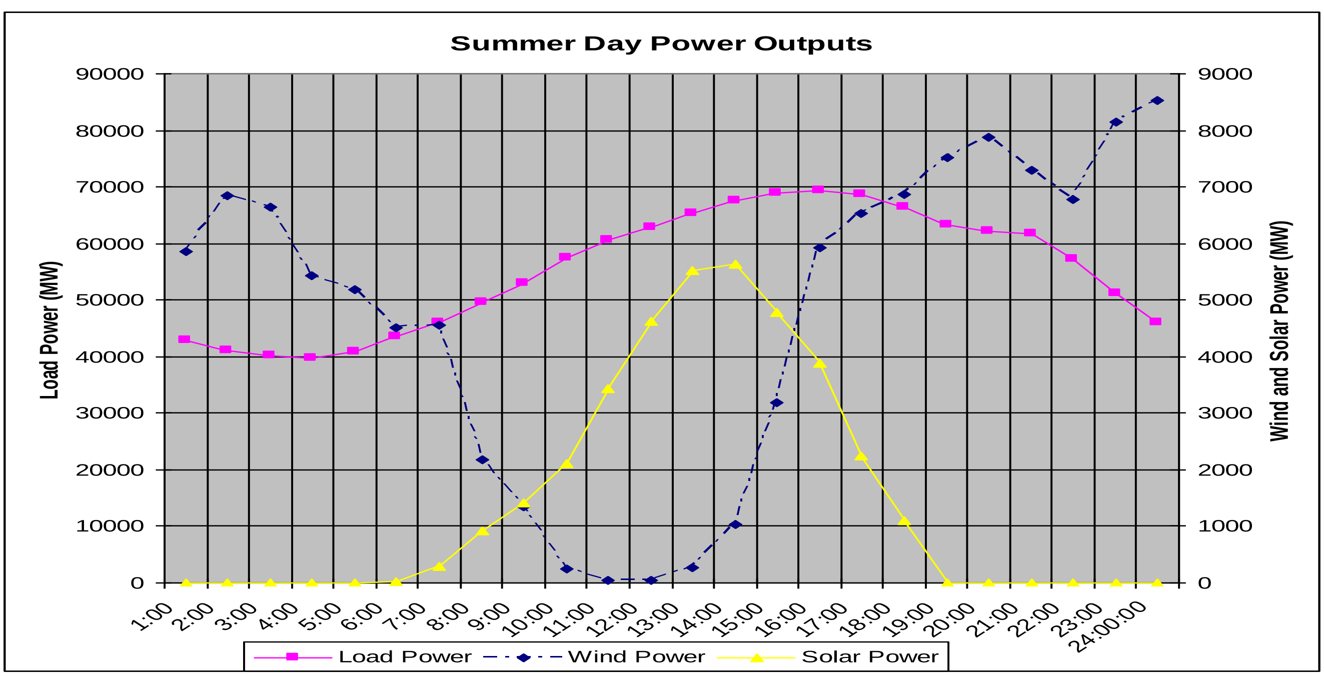

Figure 1

Quanta Technology is pleased to announce that **Dr. Julio Romero Agüero** was recently designated as an Editor of IEEE Transactions on Smart Grid. One of his responsibilities, in collaboration with a distinguished group of Guest Editors, is organizing a Special Issue on *"Applications of Smart Grid Technologies on Power Distribution Systems".*

CALL FOR PAPERS - IEEE TRANSACTIONS ON SMART GRID

Special Issue on "Application of Smart Grid Technologies on Power Distribution Systems"

The objective of this special issue is to address, discuss, and present novel applications of smart grid technologies on power distribution systems, including but not limited to:

- Application of smart control technologies for mitigating impacts of PHEVs and implementing V2G strategies
- Application of smart grid technologies for integration of intermittent DG and implementation of microgrids
- Applications of distributed storage and FACTS devices
- Application of Advanced DMS, AMI, and state estimation algorithms for real-time operation of distribution systems
- Applications of Advanced Distribution Automation (ADA) technologies
- Applications of adaptive protection systems, single-phase tripping, pulse reclosing, etc
- Applications of smart grid technologies for optimal operation and control of distribution systems

The articles in this special issue will emphasize the application of these technologies and methodologies from the distribution system perspective, with special attention to mitigating impacts of new loads, integrating Distributed Energy Resources (DER), optimizing operation and control, and improving efficiency and reliability.

Submission Guidelines

This special issue solicits original work that must not be under consideration for publication in other venues. Two-page extended abstracts are solicited for the first round of reviews. Authors of selected abstracts will be invited to submit the full papers in the second round. Authors should refer to the IEEE Transactions on Smart Grid author guidelines at http://www.ieee-pes.org/publications/information-for-authors for information about content and formatting of submissions. Please submit a PDF version of the abstracts including a cover letter with author contact information via e-mail to julio@quanta-technology.com before the deadlines.

Important Dates

Nov 20th, 2010: Deadline for extended abstract submission
Jan 20th, 2011: Completion for first-round of reviews
Jun 20th, 2011: Deadline for full paper submission
Oct 20th, 2011: Final decision notification
Nov 20th, 2011: Publication materials due

Guest Editorial Board

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QUANTA TECHNOLOGY GOES INTERNATIONAL

Office Opens in Rotterdam, Netherlands, August 1, 2010

Quanta Services and Quanta Technology have opened their first international Quanta office in Rotterdam, The Netherlands/Europe. Quanta Technology Europe will be extending the Quanta Technology offering to European customers: utility and industry transmission and distribution grid owners as well as to eg. governments and regulators. Their challenges are similar as in the USA and many other regions in the world: environmental issues; carbon reduction; quality of supply; customer minutes lost; efficiency improvement; congestion management; integration of renewable; smart grids; preparing for electric vehicle charging; ageing infra-structures etc.

The QT Office in Europe will be headed up by Bas Kruimer who has been actively involved in the T&D market during his career working with ABB, KEMA and Dutch utility, Eneco, and its infra-structure company, Joulz. In the T&D consulting area Mr. Kruimer has been cooperating with many of the Quanta Technology advisors in last few years.

Quanta Technology experts in Europe and the US offer their T&D expertise and extensive experience in the areas of planning, operations and asset management to customers in Europe to help solve above challenges.

Quanta Technology has also been active with T&D customers in Caribbean, Latin America (Brazil, Peru, Colombia, etc.), Southern Africa, Far East (India and China) and Australia.

AEP, MidAmerican Transmission Joint Venture Completes SMARTransmission Study

Editor's Note: This news release of Oct 12, 2010 is reprinted courtesy of ETA.

Electric Transmission America (ETA), a transmission joint venture between subsidiaries of **American Electric Power** (NYSE: AEP) and **MidAmerican Energy Holdings Company**, today released the Phase Two report for a study of transmission needed in the Upper Midwest to support renewable energy development and transport that energy to population and electricity load centers. ETA sponsored the study along with **American Transmission Company**, **Exelon Corp**. (NYSE:EXC), **NorthWestern Energy** (NYSE:NWE), **Xcel Energy** (NYSE:XEL) and **MidAmerican Energy Company**, a subsidiary of MidAmerican Energy Holdings Company.

The Strategic Midwest Area Renewable transmission Study (SMARTransmission Study) sponsors retained **Quanta Technology, LLC** to evaluate extra-high voltage transmission alternatives for new transmission development in the Upper Midwest. Quanta evaluated transmission alternatives designed to support the integration of 56.8 gigawatts (GW) of nameplate wind generation within the study area, including North Dakota, South Dakota, Minnesota, Iowa, Wisconsin, Illinois, Indiana, Nebraska, Missouri, Michigan and Ohio. This translates into enough energy to power more than 15 million households.

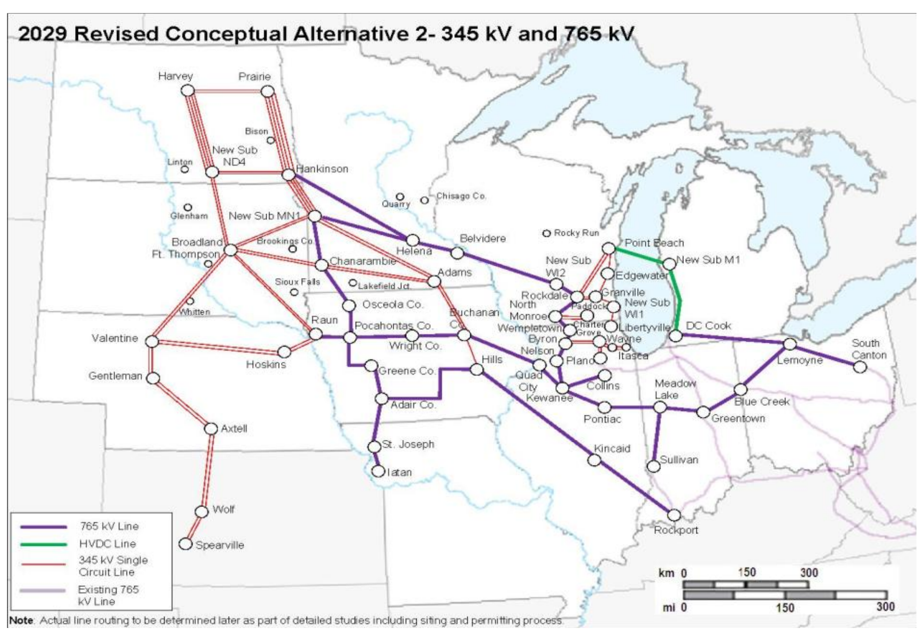
Phase Two of the study determined that the conceptual transmission overlays identified in the first phase of the study would have similar economic and environmental impacts.The alternatives include a conceptual overlay that totals nearly 8,000 miles and uses primarily 765-kilovolt (kV) extra-high voltage (EHV) transmission lines, one that totals over 7,600 miles and includes both 765-kV and high-voltage, direct-current (HVDC) lines, and one (below) totaling more than 8,600 miles that combines over 4,400 miles of 345- kV and 3,900 miles of 765-kV transmission lines. Both SMARTransmission reports can be downloaded at www.smartstudy.biz.

"Determining the level of transmission needed to achieve the renewable energy goals of the Midwest ISO states and their neighbors was the focus of this landmark study. The SMARTransmission study evaluated a variety of transmission options and presents three conceptual transmission expansion plans that would be capable of reliably transporting nearly 57 gigawatts of wind-generated power to load centers in the eastern part of the study area," said Lisa Barton, ETA president.

The SMARTransmission study's goal was to develop a 20-year transmission plan that ensures reliable electricity transport, provides an efficient transmission system to integrate new generation and foster efficient markets, minimizes environmental impacts, and supports state and national energy policies. The study was designed to incorporate a high level of stakeholder input, including representatives from investor-owned utilities, state utility commissions, the Federal Energy Regulatory Commission, municipalities and wind developers.

"Throughout the study process, we've met with representatives from the regional transmission organizations, including Midwest Independent Transmission System Operator, PJM Interconnection, the Mid-Continent Area Power Pool and the Southwest Power Pool, to ensure they understood the intent and focus of the study. We will share the final report with them so that the SMARTransmission study results can be considered in their long-term transmission planning processes," Barton said.

ETA is a joint venture between subsidiaries of AEP and MidAmerican Energy Holdings Company to build and own electric transmission assets. The joint venture is a 50-50 partnership organized to identify and invest in high-voltage transmission projects (345 kV or higher) located in North America outside of the Electric Reliability Council of Texas (ERCOT). The two companies also have an existing joint venture agreement to build transmission in ERCOT. ETA's current joint venture projects include Prairie Wind Transmission in Kansas and Tallgrass Transmission in Oklahoma.



Smart Study Phase 2, Conceptual EHV Transmission Overlay Alternative 2

Quanta Technology acknowledges contributions to this project from Tom Gentile, Senior Director - tgentile@quanta-technology.com

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Impact Studies of Photovoltaic Distributed Generation on Power Distribution Systems

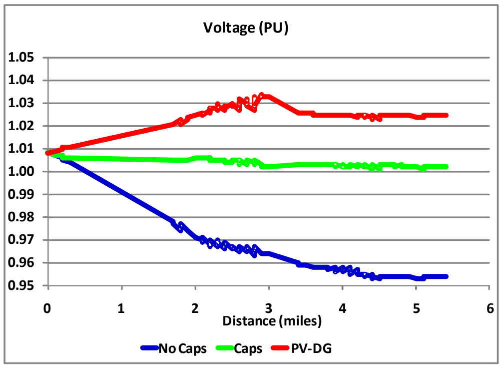

Figure 1 – Feeder voltage profile before and after PV-DG interconnection.

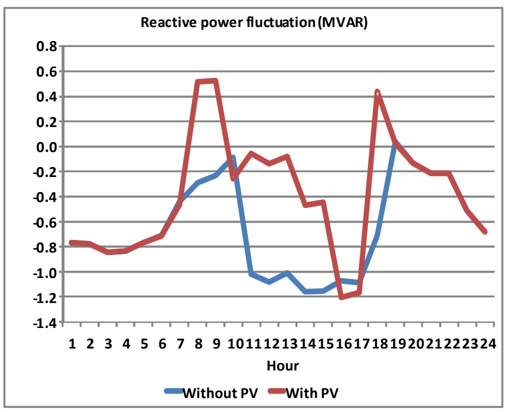

Figure 2 – Reactive power flow fluctuation

Figure 3 summarizes a generalized approach for conducting both, local and system-wide PV-DG impact studies. The red blocks describe steady-state analyses and the blue blocks present dynamic/transient studies. It is worth noting that these studies are complementary and synergetic. Steady-state studies can be conducted using commercial distribution software. However, they may require analyzing numerous combinations of PV-DG output and feeder loading conditions. This can be a time-consuming task if automated tools able to implement batch processes are not available.

Dynamic/transient studies on the other side involve using specialized electromagnetic transient tools and dynamic analyses, which distribution engineers may not be familiar with. Figure 4 shows the results of a dynamic study conducted on a distribution feeder.

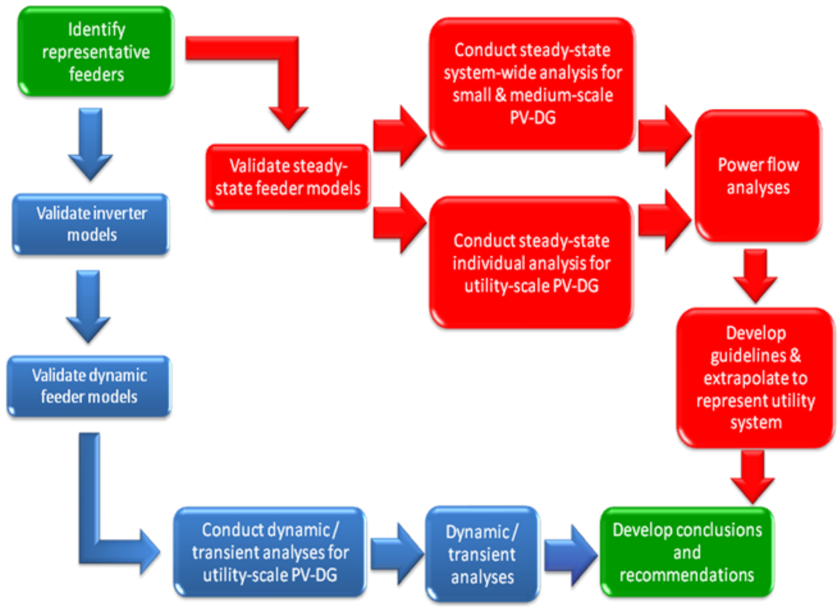

Figure 3– Generalized approach for PV-DG impact studies on distribution systems

This plot shows that TOVs exceeding 2.0 PU may occur during PV-DG islanding conditions, depending on several variables, including the configuration of PV-DG interconnection transformers.

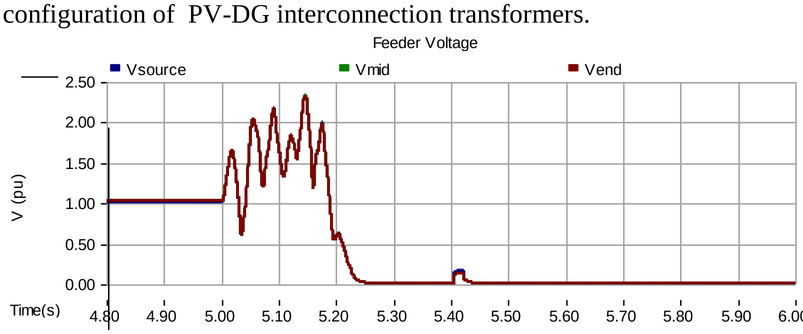

Figure 4 – Temporary Over-Voltage (TOV)

Given that the proliferation and penetration level of PV-DG on distribution systems is increasing, the need for conducting impact studies is rapidly growing as well. In order to cope with this growth, distribution utilities will have to develop new processes, standards and guidelines, acquire new analysis tools and train their workforce on conducting these studies. This requires planners and distribution engineers to become familiar with dynamic / transient and stability analyses that thus far have belonged to the realm of transmission and protection engineering.

For further information, please contact:
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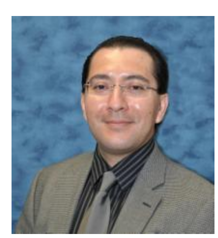


We're STILL Growing –Bigger and Better!

With great excitement and pride, Quanta Technology welcomes , not one, <u>but several renowned experts</u> to the Quanta Technology family!

Solveig Ward has joined Quanta Technology's Protection and Automation group as a Principle Advisor. She has a MSEE from the Royal Institute of Technology, Sweden, and 33 years of experience in protective relaying and power system protection. Prior to joining Quanta Technology she was Director for Product Management at RFL Electronics, and a Product Manager at ABB's Power System Protection and Control Division.

At Quanta Technology, Solveig will provide leadership in the area of communications systems for power system protection and control including both cyber-security and technology integration issues. More generally, Solveig is also an accomplished protection engineer and will provide senior-level experience in large system protection and automation projects.

Solveig is a Senior Member of the IEEE and incoming chairman of its System Protection Subcommittee. She is the author of numerous technical papers, tutorials, and articles on protective relaying, power system protection communications, and cyber security, and editor of one book on power system relaying.

Dr. Aty Edris has joined Quanta Technology as an Executive Advisor and Senior Director, Renewable Integration. Dr. Edris has Bachelor's, Master's, and Ph.D. degrees in Electrical Engineering, and over 35 years of experience in the power industry, much of it as an acknowledged leader in the field of power electronics.

Aty is a Senior member of the IEEE and received the IEEE Outstanding Engineer of the Year Award in 2008. Prior to joining Quanta Technologies, Dr. Edris was with Siemens Energy where he helped develop low-voltage ride through problems for renewable energy sources and development of Smart Grid power electronics-based controllers. He has also worked at EPRI and ABB and as a research program director in renewable energy at Chalmers University.

In addition to his recognition as a worldwide expert of FACTS and HVDC technology, Aty received the IEEE Award for Industry Leadership in 2006 and has been recognized by R&D Magazine as a top 100 innovator. Dr. Edris is the author of over one hundred major technical papers and holds several patents.

Dr. Bozidar (Boza) Avramovic has joined Quanta Technology as an Executive Advisor in the Transmission group. Boza brings a wealth of experience system operations, energy markets, control center design, energy management system architecture, and power system planning.

Boza will be based in McLean, Virginia.

Scott Lockwood We are pleased welcome Scott Lockwood. Scott is joining us after 35 years in the utility industry; most His primary area of expertise is Transmission Operations and Planning. Additional Areas of Expertise include: Realtime System Operations; Steady State Power Flow Analyses; and NERC Reliability Standards related to Transmission Operations and Planning.

Scott will be working out of his home in Johnstown, Ohio.

And yes! There is more!!!

Dr. Muhidin ("Dino") Lelic has joined Quanta Technology as Director of Program Management and Principle Advisor in the Transmission group. Dino has Bachelor's, Master's, and Ph.D degrees in electrical engineering and an Executive Masters in Management from Rensselaer. He has 30 years of experience as professor and in industry. Prior to joining Quanta Technology he was Program Manager for New Products at United Technologies.

Dr. Lelic will have a dual role at Quanta Technology. As Director of Program Management he will help design and implement new processes and procedures to streamline our program, project, and resource management to assure they are efficient and effective for both customers and our organization as we grow in both number of team members and offices around the world. As a Principle Advisor, Dino will work on transmission and PMU projects and where his expertise in evaluation of emerging technologies will help provide value.

Dino is a Senior Member of the IEEE and participates in its Power, Control, Signal Processing, Communications and Reliability Societies. He is the author/co-author of four books and over 100 technical papers, and has 34 patents or patents pending

We just keep growing and growing…..

Danny Faulk – In Mr. Faulk's first 14 years of experience in the electric power industry he progressed from a Junior Engineer to Senior Engineer at Dallas Power & Light Co.

Between 1978-1984, he then worked overseas for 6 years for Aramco in Dhahran, Saudi Arabia. In the next 14 years, he progressed from Principal Engineer to Manager at TXU Electric (Oncor), and has worked primarily as a Consultant to the power industry over the past 11 years, with two years at QuantaTechnology.

Bas Kruimer has joined Quanta Technology as Managing Director Europe. Bas has a Master's degree in Electrical Engineering from Delft Technical University and more than 22 years of experience.

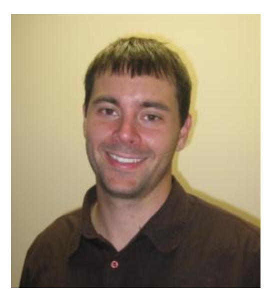
He brings to our team extensive experience in the energy and utility industry serving in capacities with Joulz Projects as Sales Manager for utility high voltage applications, KEMA in various management positions and with ABB in substation automation and system protection.

Bas will be based in Rotterdam, The Netherlands, and be responsible for the startup, staffing, management and leadership of Quanta Technology Europe

Please see the Announcement of our new office in Rotterdam on page 7.

We also welcome 2 new full time employees. They were former interns with us!

Zhuoning (Daniel) Liu, Engineer, is a recent graduate from North Carolina State University with a Master of Science degree in Electrical Engineering. . While in school, he worked as an intern in the Protection & Automation group of Quanta Technology, monitoring, protection & control.



Kyle A. Lewis Engineer - Transmission.
As a recent graduate from Montana, Kyle interned for Quanta Technology in the summer of 2010. He joined the Transmission Team soon after. Kyle plans to attend NCSU to obtain a MSEE degree in the next year.

Recent QT Publications

"Steady State Impacts and Benefits of Solar Photovoltaic Distributed Generation on Power Distribution Systems"
By **Julio Romero Agüero**

"Storm Hardening the Distribution System"
By Richard Brown

"Electric Power Distribution Reliability"
by Richard Brown

"The Impact of Plug-In Electric Hybrid Vehicles (PHEV) on Electric Utilities."
by Edmund Phillips et al.

"Managing Enterprise Information for Smart Meters and Smart Grid"
by Hahn Tram

For a complete copy of these publications, please visit us at:
www.quanta-technology.com

Please Join Us

Application of Synchro-Phasor Technology Seminar–
October 25-27, Las Vegas, NV Damir Novosel, Yi Hu, Vasudev Gharpure

Smart Grid Road Show
Nov. 2-3 Portland, OR Reza Nasri, Hahn Tram

Spatial Load Forecasting
Nov 8-9 St. Louis, MO Lee Willis

Business Essentials for Engineers Seminar
January 19-20 San Antonio, TX Richard Brown

DistribuTech 2011 Technical Program - Utility University
January, 30-31 San Diego, CA

DistribuTech 2011 Exhibition and Conference
February 1-3 San Diego, CA

Aging Infrastructure
Mar 21-22 Baltimore, MD Lee Willis

Details to be posted at **www.quanta-technology.com**

Upcoming QT e-News Feature Articles

The feature articles for upcoming QT e-News issues will be developed by the Quanta Technology staff on the following topics. We reserve the right to make changes as the result of client feedback and industry interests.

Winter 2011

- Topic for the issue – Regulation and Compliance.

DistribuTECH Special Edition

- Topic for the issue – Aging Infrastructure, Resurgence of Concerns

About Quanta Technology

Quanta Technology, LLC, headquartered in Raleigh, NC, is the expertise-based, independent consulting arm of Quanta Services. We provide business and technical expertise to energy utilities and industry for deploying holistic and practical solutions that result in improved performance. We have grown to a client base of nearly 100 companies and to an exceptional staff – now over 70 persons – many of whom are foremost industry experts for serving client needs. **Quanta Services, Inc.**, headquartered in Houston, TX (NYSE:PWR), member of the S&P 500, with 2009 revenue of $3.3 Billion, is the largest specialty engineering constructor in North America serving energy companies and communication utilities, according to McGraw Hill's ECN. More information is available at www.quantaservices.com.

QUANTA TECHNOLOGY

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The QT e-News newsletter is published 4 times per year, in both electronic and printed form, and in special editions for important industry events. If you would like to receive your copy, please contact:
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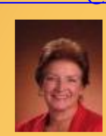

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