QT e-News™

Quanta Technology Online Newsletter

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Letter from the President

Dear Colleague,

We are pleased to provide you with the inaugural edition of the quarterly Quanta Technology news-letter, QT e-NEWS.

By successfully serving the energy industry, we at Quanta Technology in each of the last three years have doubled our staff and client base, all while exceeding business goals. Our staff is now more than 70 persons, many of whom are top industry experts. We have been engaged by leading energy companies and utilities for many strategic projects. As an example, please see the article on the SMART transmission study, which we are performing on behalf of AEP, MidAmerican Holdings and its partner utilities.

One of our goals has been to initiate a client newsletter that offers insightful feature articles on industry issues and initiatives, overviews of our staff experts, and highlights of our noteworthy activities – including major projects, staff announcements, publications and industry speaking engagements.

In this first edition, our feature articles take a closer look at DOE's North American Synchro Phasor Initiative (NASPI) that was spawned as the result of the 2003 blackout and is imbedded in recent DOE SGIG Grant awards, interconnection issues of photovoltaic (PV) energy sources, and potential grid impacts caused by plug-in hybrid electric vehicles (PHEV). Our planned feature articles for upcoming editions are also listed.

We recognize that you have many sources of industry information available to you. We are striving with this newsletter to provide you with penetrating perspectives on contemporary industry issues and a stronger sense of our expertise. We encourage you to advise how we can improve this newsletter for your needs and explore how we might better serve you.

Sincerely, Damir Novosel - President

Capitalize on Synchronized Measurement Technology

As the power industry moves to modernize the existing electric power delivery network for a smarter grid, one technology, the synchronized measurement (or synchrophasor) technology, has moved to the forefront as a critical Smart Grid deployment effort by DOE with over $148 million in Smart Grid Investment Grants (SGIG) announced October 23, 2009. This technology produces precise measurements of voltage magnitude and phase angle whose time resolution is in the order of 1 microsecond. These measurements can then be compared with other grid synchrophasor data to determine precise real-time power system conditions for which data was not previously available.

Photo courtesy of openPDC

Starting in the late 1980s, synchronized measurement tech-nology became an important element for creating a foundation to enable development of advanced wide-area monitoring, protection and control WAMPAC applications. These applications may be broadly used for power system planning, operation, protection, maintenance

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Electric Vehicle Impact and Strategy (EVIS) Study

Quanta Technology is helping a utility to assess the impacts of EVs and develop a coherent business and technology plan.

EVs are coming! Electric Vehicle (EV) technology, which includes Plug-In Hybrid Electric Vehicle (PHEV), is coming of age. Auto manufacturers around the world are gearing up to produce EVs in mass and all are starting to focus on the American market. High prices that created only niche markets will steadily fall once volume production begins, leading to wider adoption. State, federal, and even municipal governments are offering tax incentives for their use. And the price of gasoline, while always volatile, will rise steadily over the long run.

The estimate of overall impact on peak load considers that EVs and PHEVs will be a mixture of

Article Continues on Page 5

Impacts and Solutions of Renewable Energy – by Johan Enslin

(Editor's Note: most figures referenced in the article are available in full article posted at www.quanta-technology.com/)

As US electric utilities prepare to meet their state's renewable portfolio standard, US utilities must adapt transmission system planning and operations to maintain high levels of service and reliability. State initiatives requiring integration of high levels of intermittent wind and solar renewable energy resources, i.e., >20% of the installed capacity, most of which will likely be connected via new and long lines to the transmission grid. This presents unique challenges to the transmission owners as the level of planned intermittent renewable generation in relation to their installed system capacity reaches unprecedented and disproportionate levels as compared to other utilities in the state.

Recent Quanta Technology and other similar impact studies concluded that traditional planning and operational practices will be sufficient with 10 - 15% intermittent renewable energy penetration. However, as a utility's system increasingly is required to exceed this range, a dramatic change in planning and operational practices will be required.

The European experience with high penetration levels of wind and PV taught us that there are consequences of integrating these levels of wind resources on network stability that have to be addressed as wind resources reach substantial levels of penetration. A list of the major issue categories follows:

- New and in-depth focus on system planning. Steady-state and dynamic considerations are crucial.
- Accurate resource and load forecasting becomes highly valuable and important.
- Voltage support: Managing reactive power compensation is critical to grid stability. This also includes dynamic reactive power requirements of intermittent resources.
- Evolving operating and power balancing requirements. Sensitivity to existing generator ramp-rates to balance large scale wind and solar generation, providing regulation and minimizing start-stop operations for load following generators.
- Increased requirements on ancillary services. Faster ramp rates and a larger percentage of regulation services will be required which can be supplied by responsive storage facilities.
- Equipment selection: Variable Speed Generation (VSG) turbines and advanced solar inverters have the added advantage of independent regulation of active and reactive power. This technology is essential for large-scale renewable generation.
- Strong interconnections and energy storage: Several large energy pump-storage plants are available in Switzerland that are used for balancing power. Large regional control areas make this possible.

Technical renewable integration issues should not delay efforts to reach renewable integration goals. However, focus has increased on planning and research to understand the needs of the system, such as research on energy storage options.

Although energy production using renewable resources is pollution free, wind and solar plants need to be balanced with fast ramping regulation services such as peaker generator or hydro generation plants. Existing regulation generation is too slow and is polluting much more during ramping regulation service. The increased requirements in regulation services counteract the emissions savings from these renewable resources. For example, the frequency regulation requirement at the CAISO is currently around 1% of peak load dispatch, or about 350 MW. This is mainly supplied by peaker generating plants and results in higher emission levels. It has been calculated that around 2% regulation would be required for integrating 20% wind and solar resources by 2010, and 4% to integrate 33% renewables by 2020.

With the integration of wind and solar generation, fossil fuel-plant output must be adjusted frequently, to cope with renewable generation fluctuations. As a consequence, some power stations will be operated below their maximum output, which requires increasing the system balancing reserves. Efficiency may be reduced as a result with an adverse effect on the emissions. At high penetrations (above 20%) wind and solar energy may need to be 'spilled' or curtailed because the grid cannot always utilize the excess energy.

To integrate still higher penetration levels (e.g. 33%) intermittent renewable resources by 2020 in California, additional planning and operational solutions that include three major levels:

- Generation mix to utilize different complementary resources.
- Advanced transmission facilities, including fast responsive energy storage, FACTS, HVDC, WAMPAC, etc.
- Demand response, including distributed resources on the distribution feeders, distributed energy storage, SmartGrid, Plug-in Hybrid Vehicles (PHEV), Demand Side Management (DSM), etc.

For CAISO, concentrated thermal solar production in the Mojave Desert region can be forecasted with relative good accuracy without large daily fluctuations. In Photovoltaic (PV) flat-plate collector systems, a 100 MW PV power plant production can fluctuate within a few seconds. With partial PV array clouding, large power fluctuations can also result at the output of the PV solar farm with large power quality impacts on distribution networks.

Some practical measurement data of the power output from utility scale PV solar farms are presented in figures 1 and 2 in the full paper available on the Quanta Technology website. It is clear that these types of power variations on large scale penetration levels can produce several power quality and power balancing problems.

The purpose of increased transmission planning is to identify complete and preferred transmission plans and facilities to integrate 15 - 18 GW, renewables of mainly wind and solar generation. The clear goal would be develop a staged transmission expansion plan, facilities and storage options to integrate this potential level renewable penetration levels.

Most of the models for these advanced wind and solar facilities have not been fully developed yet and need to be validated. Model upgrades and refinements are required in stages from 2010 to 2020. Upgrades to the existing PSLF, CAPE and PSACD models are essential. The generator models for wind and solar technologies need to be upgraded and validated to include short circuit models, dynamic variance models like clouding and short-term wind fluctuations.

Article continues on page 3

Impacts and Solutions of Renewable Energy Article *continued from Page 2*

Typical analyses to be performed include:

- Thermal studies
- Contingency studies
- Short-Circuit analysis
- Voltage and angular stability
- Power Quality, including harmonics and flicker
- Voltage ride-through analysis
- Energy storage controllers

Solutions and alternatives need to be investigated including:

- Transmission alternatives for proposed ROWs
- FACTS devices with integrated control and PMUs (WAMPAC)
- HVDC transmission lines and Back-to-Back DC interconnections.
- Regional and inter-company interconnections
- Large power balancing and control areas.
- Centralized and decentralized energy storage
- Dynamic balancing of off-peak wind power, fast ramping hydro and FACTS devices
- Protective relay setting optimization in presence of high levels of Renewables
- Wide-Area-Monitoring-Protection and Control (WAMPAC) algorithms
- Testing loop controller hardware for FACTS devices, wind and solar interface controller, and protection technologies.

The opportunities, challenges and solutions to integrate high levels of intermittent renewable resource in the US are presented in US grid design and load density. The integration of renewable energy at this scale will have significant impact, especially if the addition of energy storage devices (central or distributed) and FACTS devices are utilized to counterbalance the influence of the intermittent generation sources. Utilities should conduct study projects to accurately and reliably forecast the impacts on future system integrated resource plan. Due to the long lead time for some of the proposed technology solutions, it is recommended that utilities deal with these challenges sooner versus later. To determine if technical obstacles must be overcome, utilities should study all issues that may severely affect transmission system integrity and stability. Otherwise, utilities may experience unintended consequences from high penetrations of new renewable energy sources. ■

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Generation Mix

- Hybrid Energy Mix
- Complementary Gen.
- Advanced Power Electronics
- Turbines with independent P & Q regulation.
- Larger control areas
- Fast ramping
- Regulation capability

Advanced Transmission

- WAPAC and FACTS
- Local FACTS Integration
- HVDC Transmission
- Energy Storage
- Capacity Credits
- Renewable Dispatch
- Congestion Management
- Voltage Support & LVRT
- Ancillary Services
  - Frequency Regulation
  - Control Error
  - Spinning reserves
- Strong interconnections

Demand Response

- Wind forecasting
- Off-peak loading
- Gen. - load match
- Price sensitive load
- Frequency Response
- Responsive to Wind
- SmartGrid / AMI
- Distributed Storage
  - PHEV
  - DES

DOE PMU Research Grants Awarded

WASHINGTON, DC – The Department of Energy's Office of Electricity and Energy Reliability on August 21, 2009 announced that it will provide $4.3 million for four projects that will use innovative synchrophasor research to improve the reliability and efficiency of our Nation's electricity grid. These awards are part of the Department's efforts to modernize the electric grid and enhance the security and reliability of the energy infrastructure.

Synchrophasors are high-speed, real-time synchronized measurement devices used to diagnose the health of the electricity grid. With synchrophasor data, electric utilities can use existing power more efficiently and push more power through the grid while reducing the likelihood of power disruptions like blackouts. Like an up-to-the-minute weather map for the nation's electricity grid, synchrophasor information enhances the ability to predict possible disruptions in time to remedy them.

The research projects will demonstrate new technologies that rely on exchange of synchrophasor data among electric utility companies and other electricity entities to improve the reliability and market efficiency of the Nation's electricity delivery. DOE and selected teams will share the cost of the projects, with DOE providing 50 to 80 percent of the project cost depending on the nature of the project.

Two of the four R&D projects involve Quanta Technology, which are:

The Regents of the University of California - DOE cost share: $1.1 million
The University of California (Berkeley, CA) will develop and demonstrate tools using synchrophasor measurements to reduce the likelihood of false and inappropriate triggers of transmission system circuit breakers which protectively shut down electrical flow and can contribute to cascading blackouts.
The project team includes Pacific Gas and Electric Co. (Oakland, CA), Southern California Edison (Rosemead, CA), San Diego Gas and Electric Co. (San Diego, CA), Mississippi State University (Mississippi State, MS), Virginia Polytechnic Institute and State University (Blacksburg, VA), the California Energy Commission (Sacramento, CA) and Quanta Technology (Raleigh, NC).

Virginia Polytechnic Institute and State University- DOE cost share: $1.5 million
Virginia Tech (Blacksburg, VA) will develop analytic tools and calibration techniques for measurement devices to implement an innovative synchrophasor-based tracking system to monitor the state of the electric grid. The techniques will better diagnose the sources of network unbalances and identify actions needed to remedy them.

The project team includes Dominion Virginia Power (Richmond, VA) and Quanta Technology (Raleigh, NC). ■

Capitalize on Synchronized Measurement Technology

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and energy trading. Advanced WAMPAC applications will provide critical solutions for reliable and efficient operation of the North American power grid, which continues to become increasingly complex and dynamic.

This technology can take a snapshot of power systems across a wide area, whether they are contiguous or not, at precise moments for accurately assessing the overall "health states" of the grid. Synchronized Phasor Measurement Units (PMUs) provide the foundation for WAMPAC applications, which can take as many as 10 to 120 measurements (snapshots) per second.

Such capability allows system operators and WAMPAC applications to "see" events on a wide-area scale, via their control center systems, enabling them to make more accurate decisions and take more appropriate actions. This capability helps to either prevent a potential wide-area disturbance or remediate a local disturbance from becoming a cascading system collapse, such as the North American blackout of August 14, 2003.

The industry has widely accepted the technology in the last few years, helped by the publication of the IEEE C37.118-2005 standard, *IEEE Standard for Synchrophasors for Power Systems*, and the industry collaboration through organizations such as North American Synchro-Phasor Initiative (NASPI). The IEEE standard specifies the performance requirements and the data exchange protocol for synchrophasors, which are critical for ensuring a global performance and the interoperability of a deployed WAMPAC system.

PMU technology has quickly moved from the R&D stage to large-scale full deployment in the last few years:

- Synchrophasor technology was identified by US Department of Energy (DOE) as one of the targeted American Recovery and Reinvestment Act (ARRA) funding areas for the Smart Grid Investment Grant (SGIG) program.
- As a result, the DOE recently announced grants of over $148 million for ten SGIG implementation projects and an additional $4.3 million for four advanced R&D projects to develop and demonstrate advanced synchrophasor applications, all which will be completed in the next three years.
- One large US utility has successfully obtained approval from their state regulatory organization in its general rate case to deploy a wide-area situation awareness system by 2011 based on the PMU technology. This approved project is to install PMUs in all of its 500 kV and 230 kV substations (about 70) and gradually install PMUs to cover all of its substations 66 kV and higher (several hundred substations).
- China has installed PMUs at several hundred high voltage substations and key generation stations within the last two years. China will continue to install PMUs to achieve nation-wide coverage of its 500 kV and 230 kV grid.
- ONS, the ISO of Brazil, has a large scale PMU system deployment project. ONS has completed the PMU system requirements, design, specification and certification test processes. ONS will shortly procure and install the PMU and data concentrators for its control centers to complete this project.

The ARRA stimulus funding is expected to accelerate the pace of deploying WAMPAC systems at many US utilities and ISOs/RTOs. Many organizations are planning to move ahead even without ARRA funding. As a result, the industry should see many DOE funded large scale synchrophasor-based WAMPAC-deployment projects in full swing at the beginning of 2010 for completion in the next three to five years.

This technology can take a snapshot of power systems across a wide area, whether they are contiguous or not, at precise moments for accurately assessing the overall "health states" of the grid.

…the DOE recently announced grants of over $148 million for ten SGIG implementation projects and an additional $4.3 million for four advanced R&D projects to develop and demonstrate advanced synchrophasor applications.

To ensure longevity of WAMPAC systems, rigorous planning is needed that includes a thorough near-term and long-term business and operation needs assessment, system and application requirements determination, a comprehensive system design and specification process, PMU certification testing and system test plan. In addition, strong oversight of installation and commissioning is needed.

Quanta Technology has a team of experts who have assisted clients with planning and deployment of synchrophasor technology and WAMPAC systems. Our team members include contributors to the technology, Chair and members of the IEEE standard working group, Chair and members of the NASPI task team, PMU certification testers, and developers of the DOE NASPInet (synchrophasor data communications infrastructure) specification.

Please visit our website at www.quanta-technology.com to review the paper, *Dawn of the Grid Synchronization*, Damir Novosel et al, for a more in-depth reference. ■

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Electric Vehicle Impact and Strategy (EVIS) Study

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As a general rule of thumb, two electric vehicles could increase uncontrolled peak demand by roughly the same amount as one new residential customer.

different sizes (from small "Smart-car" size urban runabouts to spacious vehicles functionally indistinguishable from today's biggest SUVs). These will be driven different distances in a variety of different usage patterns, and some will be pure EVs while others will be PHEVs. This perspective is based on more than a dozen detailed studies of EVs.

Luckily, any scenario of widespread EV usage will not happen overnight, so utilities will have time to prepare. The most comprehensive studies to date suggest that, after taking all factors into account, EVs could contribute an additional one to two percent annual growth rate to uncontrolled peak demand in most urban and metro systems, with a similar growth in energy usage and revenues, starting as early as 2013 and continuing steadily for perhaps the next 30 years. Furthermore, EV peak load impacts are relatively easy to contain and control with appropriate technology, system planning guideline changes, and marketing and pricing coordination performed far enough in advance to be effective. This can lead to improved system load factors, equipment utilization and better business cases, if all is well planned and coordinated.

EVs could contribute an additional 1% to 2% annual growth rate of uncontrolled peak demand to most utility systems, beginning ≈ 2013.

What surprises utility executives and managers who first look into EVs is how pervasive the impacts will be, affecting a surprising wide range of issues besides peak demand, and often requiring early revisions of equipment specifications, system design guidelines, operations protocols, and maintenance standards throughout the system - all in places long before EV usage is widespread.

An EVIS Study: What It Is? What It Does

Quanta Technology is assisting a major utility, whose operating area is likely to have many early adopters of EVs, by developing a coherent business system technology plan. This EVIS (electric vehicle impact and strategy) study will include:

- A comprehensive analysis of the initial impacts that EV early adopters would have on the utility's power delivery system.
- A longer term analysis of impact from an increasing penetration of EVs in its service territory.
- Considerations as to how best to gather load data via "smart meter" technology deployed by the utility and integrate the results into a realtime spatial load model and forecast (this methodology is discussed below).
- An analysis of different realtime options the utility could initially use to respond to or control EV loads as well as longer term distribution system design approaches.
- Finally, the study will assess asset management business and technology strategies, which could be implemented to deal with and optimize the long term costs to support EV integration by the delivery system.

Quanta Technology's Spatial Load Analysis Methodology

Quanta Technology EVIS studies build upon spatial load analysis and system planning methods pioneered by Quanta Technology's Lee Willis. The proven methodology employs two unique "shortcuts" that dramatically reduce the work without diminishing accuracy or dependability of results.

First, Quanta Technology applies a representative model approach, which is a T&D impact planning method proven over 25 years in various types of impact studies. In this approach, an analysis to identify the statistical pattern of the utility's T&D system and its customer base provides a set of representative circuits along with a set of generalization rules and formula. Detailed impact analyses are performed on these circuits and associated equipment. Impact results are then extrapolated to the system overall. The number of representative circuits will be determined from the diversity of the utility's customer base, details of its T&D system design, and the degree of confidence needed for the results.

Second, Quanta Technology applies a packaged "sweep" analysis of various EV market penetrations that will consider voltage and current, losses, loading, heating, equipment lifetimes, and harmonics impacts for all potential amounts of EVs. The sweep analysis provides a very detailed scenario of the potential amounts of EV impacts on the utility's system quickly and affordably.

A detailed "dynamic" analysis of various control, customer or demand response programs is built upon this foundation. Strategies for both electrical and business impacts can then be assessed and compared. The goals are to assess the utility's options in dealing with EVs efficiently and economically and to help identify the best strategy for meeting the utility's business goals.

Results

The deliverable products will be a comprehensive report on the method, data, results, and recommendations. The deliverables will also include a database of study results, which can be used for future analyses. In addition, Quanta Technology will provide workshops to the utility's staff. Typically a workshop to present the study results and provides an information base from which the utility can understand how EVs will affect its equipment, system, operations and bottom line. The second workshop will focus on the options the utility has and the strategies for best meeting its goals. ■

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Strategic Midwest Area Renewable Transmission (SMART) Study

Electric Transmission America (ETA), a joint venture between subsidiaries of American Electric Power and MidAmerican Energy Holdings Company, joined with American Transmission Company, Exelon Corporation, NorthWestern Energy, MidAmerican Energy Company and Xcel Energy to sponsor a comprehensive study, the Strategic Midwest Area Renewable Transmission (SMART) Study, to determine the transmission capabilities needed in the Upper Midwest to support renewable energy development and transport that energy to markets throughout MISO and the study area. Starting August 18, 2009, Quanta Technology was retained to evaluate extra high voltage (EHV) transmission alternatives and provide recommendations for the study area.

The SMART study builds on previous studies that have been performed by a variety of organizations, including the Midwest Independent System Operator (MISO), DOE National Renewable Energy Laboratory, the Organization of MISO States and PJM. The SMART study provides an assessment of the wind levels on a state-by-state basis that incorporates and refines the wind generation assumptions used in the previous studies. The outcome of the SMART study in combination with other studies currently being performed by MISO, PJM, and others will be used as input to the regional transmission planning processes and result in transmission projects being identified. Ultimately Regional Transmission Organizations and state regulatory bodies will make the final decision as to the scope and timing of transmission projects.

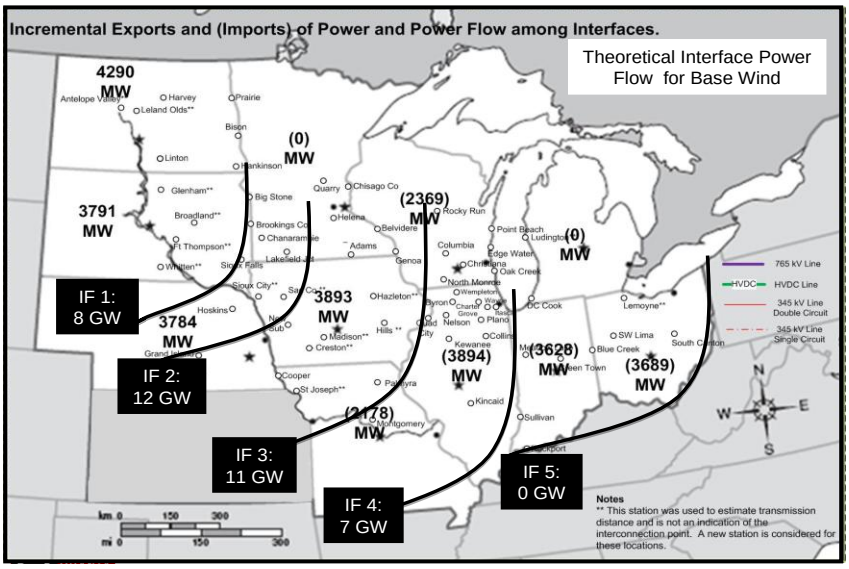
The SMART study is focusing on a 20-year period and transcends the traditional utility and regional boundaries. Its primary geographical focus is on the states of North Dakota, South Dakota, Iowa, Nebraska, Indiana, Ohio, Illinois, Minnesota, Wisconsin and Michigan.

The study process directed by the sponsors includes presentations to and discussions with national and state regulatory and planning authorities, regional and independent transmission operators, electric delivery utilities, energy generators and suppliers, and other industry stakeholders to broadly ensure their issues and concerns are considered in the analysis. The study encourages broad stakeholder participation and includes a succession of stakeholder meetings.

The following graphic of the study area was discussed at the most recent stakeholder meeting held on December 18th, during which wind generation and conceptual alternatives were reviewed.

This graphic depicts:

- An assessment of the net wind energy exports or imports from RPS requirements. Values with Brackets "( )" represent imports in MW.
- An Assessment of approximate flow direction and magnitude of wind energy to balance export and import needs within the Upper Midwest region. Theoretical interfaces (cut sets) are used to better understand the approximate power flow within the study area to help in the development of candidate alternatives for 2009.



Subsequent study work will assess the alternative transmission requirements to meet 2029 energy transfer needs.

Stakeholder presentations are available at www.smartstudy.biz.

New Regional Office in Oakland, CA

In May, 2009, Quanta Technology proudly opened its new West Coast office in Oakland, CA. The office is located in downtown Oakland on the 9th floor of 428 Thirteenth St. and has excellent public transportation access to both the Oakland and San Francisco airports.

"We are very proud of this new office. It is an example of Quanta Technology's commitment to providing better service to our West Coast clients" said Luther Dow, Sr. Director, Distribution and West Coast Operations. "If you are in the San Francisco Bay Area, you are invited to stop by, say hello and visit these new facilities."

Currently there are six consultants headquartered in Oakland, which has space for thirteen. It is expected that each Quanta Technology Business Area will have at least one consultant working out of this office within a year.

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Dr. Gerald B. Sheblé

Quanta Technology is pleased to announce the appointment of Dr. Gerald B. Sheblé to the role of Executive Advisor and Sr. Director of Research & Development Market Area. He has over fifteen years of industrial experience and twenty years of academic research experience and his paper production is in excess of 70 journal papers and 110 conference papers. Dr. Sheblé designed the optimization scheduling package used by over 50 electric utilities to schedule electrical production. Dr. Sheblé has assisted with the siting of wind generation in China and the evaluation of wind energy in Europe. Dr. Sheblé has continued consulting with companies in North America and Europe on electric industry deregulation as well as serving as Expert Witness Testimony on the National Electric Code, Software Engineering, Electric Power System Deregulation, and Intellectual Property Rights. Dr. Sheblé has developed and implemented one of the first electric market simulators for EPRI, with use of genetic algorithms to simulate the competing players. He received his B.S. and M.S. degrees from Purdue University and his Ph.D. in Electrical Engineering from Virginia Tech. Dr. Sheblé is a Fellow of the IEEE and an IEEE PES Distinguished Lecturer. We are delighted to have such a talented industry professional and believe that Dr. Sheblé will be an enormous asset to Quanta Technology.

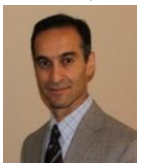
Get to Know Our Staff

Hahn Tram has 30 years of experience planning, designing and implementing integrated engineering, automation, information technology and business solutions for energy utilities worldwide.

Hahn has helped several US utilities successfully develop strategic initiatives for Advanced Metering Infrastructure, Smart Grid and Demand Response to build the foundation for utility and smart grids of the future – from strategic implementation roadmap to business case and regulatory application, and from enterprise solution architecture and technology selection to process re-engineering and system integration.

Quanta Technology Staff Announcements

Dr. Farnoosh Rahmatian,



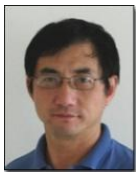
who recently joined Quanta Technology, has been appointed Sr. Director to serve within Quanta Technology's Operations and Design business Area. In addition, Dr. Rahmatian will provide leadership in Canada for developing business and supporting operations. He has over 18 years of business-focused technology development experience in the electric power industry, including development of several patented optical sensors for accurate measurement of HV lines parameters, optical sensors for capacitor banks protection and testing, and a portable voltage sensor for calibration and testing of EHV capacitive voltage transformers. Farnoosh has received a number of awards, including an R&D 100 Award for the NXVCT Optical Voltage and Current Sensor, judged to be among the 100 most technologically significant new products of the year in 2002. We proudly welcome Dr. Rahmatian to the Quanta Technology team.

Dr. Juergen Holbach

Quanta Technology announces the recent addition of Dr. Juergen Holbach as the new Director of the Protection and Automation business area. Dr. Holbach was formerly the Product Lifecycle Manager as well as the Manger for the Engineering and Operation Group at Siemens. He attended the Technical University of Berlin, Germany where he received his PhD degree in 1996. Juergen is well known in our industry as a business and technical leader in Protection and Automation. He was one of the lead engineers on the first IEC61850 Protection and Control, Multi-Vendor Project in the United States.

Juergen is a member of several IEEE-PSRC working groups as well as CIGRE working groups and holds several patents in the field of protection relaying. Quanta Technology welcomes Dr. Holbach, a dynamic professional who will help guide the company's continued growth.

Dr. Yi Hu has been appointed Director of Quanta Technology's Wide Area Monitoring, Protection and Control (WAMPAC) Market Area. He joined Quanta Technology in 2007 and has been focusing on WAMPAC business development and associated phasor technology applications. He has managed the DOE specification development project for the North American Synchro Phasor Initiative (NASPInet) network. Most recently he has assisted organizations to prepare DOE smart grid grant funding applications for synchrophasor technology applications. Dr. Hu has over 25 years of experience working with electric utilities and vendors. He has developed concepts and methods to improve power system operation, protection and control. He holds 13 patents.



Dr. Farid Katiraei, has been appointed Advisor of Quanta Technology's System Testing services. He joined Quanta Technology in 2008. Among his several active client projects, he is leading a large protection project for a major utility to support system-wide benchmarking of protection coordination and NERC compliance. He has more than seven years of experience with design, modeling and implementation of power electronic apparatus, dynamic system analysis, and testing of emerging technologies and architectures for mini-grid, microgrid and smart-grid approaches.

Dr. Nagy Abed has been promoted to Principle Engineer. Dr. Abed has more than 10 years of experience in various areas including power system modeling; power quality, power system planning, power system stability, fault diagnosis, FACTs devices, Electromagnetics effects, distributed control, real time simulations with Hardware in the loop and power system protection. He has been active in renewable energy impacts and device modeling, helping to push the state of the art and understanding the impacts of high concentrations of renewable energy on the WECC electric system. Nagy has authored and co-authored more than 43 technical papers in refereed Journals and Conference Proceedings.

Dr. Xiaohuan Tan has been promoted to Principle Engineer. Dr. Tan has more than 10 years of experience in power economics research and power system design/analysis. She has been focused on mathematical modeling, analysis, and game theoretical research and relevant applications including strategic bidding process in the deregulated electricity market. She is in the Transmission Group and is focusing on transmission planning analyses including generator interconnection studies, transmission service studies, and voltage stability studies. In this capacity, she provides expertise, guidance, support, and training on best practices and technologies to help electrical utility and industrial customers achieve optimal performance, better manage risks, and achieve reliability, financial, and regulatory goals with respect to various transmission asset management and operational challenges.

Recent QT Publications

"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

"Grid Impacts and Solutions of Renewables at High Penetration Levels"
by Johan Enslin

"Capacity Credit Value of Wind in a Balanced Portfolio"
by Johan Enslin, Bhavya Gudimetla, & Ramakumar, RG

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

Please Join Us

- **IEEE, *Innovative Smart Grid Technologies Conference*,** January 19-21, 2010, at NIST Conference Center, Gaithersburg, MD. Paper by Edwin Liu, Quanta Technology.
- **EUCI Seminar – *Business Essentials for Utility Engineers*,** January 25-26, 2010, San Antonio, Texas. Instructor: Richard Brown.
- **2010 Utility Telecom Forum (Regions 8-10 Meeting)** February 8-10, 1010, Reno, NV – Trevor Hall, Quanta Technology to attend
- **Distributech 2010, Conference and Exhibition**, March 21 – 25, Tampa Convention Center, Tampa, FL. Pre-conference seminars, technical papers and exhibit booth.

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

Upcoming QT e-News Feature Articles

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

Spring 2010
- Storm Hardening of Transmission and Distribution Systems
- Smart Grid Interoperability and Cyber Security
- Interconnection of Variable Energy Generation

Summer 2010
- Maintenance/Testing Strategy for Smart Grid Devices
- Benchmarking System Protection for ERO Compliance
- Optimization Strategy for Home Automation and Demand Response

Autumn 2010
- Grid Energy Storage Approaches for Renewable Generation
- Spatial Load Forecast to Support Smart Grid Investment
- Energized Transmission Maintenance and Construction with Robotics

About Quanta Technology

Quanta Technology, LLC, headquartered in Raleigh, NC, is the high-growth, 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 approaching $5 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.

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