



## Pre-qualification Information Package

Substation Design



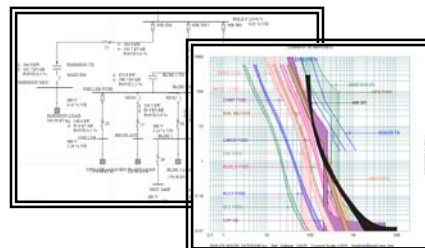
Relay & Control



SCADA & Automation



Engineering Studies



*Providing services to meet industry's needs...*



43 Freemansville Rd  
Reading, PA 19607  
610-796-7900  
215-243-8041 (fax)

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RE: Information on Orion Technical Services, LLC

Orion Technical Services, LLC is a power system engineering company specializing in power system design, power system studies, and electrical equipment testing located near Reading, PA. Our company's goal is to provide high quality power system technical services and design at competitive prices. Enclosed is a copy of our company's brochure which provides information on the services that we offer. In addition, a list of recently completed projects, a list of major projects our engineers have completed, and the resumes for the principal engineers are also enclosed. Additional information is available on our website which is located at [www.orientechserv.com](http://www.orientechserv.com).

Our areas of expertise include power system engineering at system voltages from 480V to 500 kV, in the areas of protection and control scheme design, substation design, transmission line design, generation interconnection design, SCADA and automation, as well as, engineering studies such as planning studies, protection studies, arc flash studies and protective relay settings. We also offer testing, commissioning, and training services for new installations.

Having previously worked in a utility environment, we have acquired significant experience in all of these areas on transmission, distribution, and generation installations, both from engineering and operations perspectives. This experience enables the company to provide engineering solutions that not only meet engineering requirements but are also capable of being operated and maintained in a safe and reliable manner.

We look forward to working with you in the near future. Please feel free to call us if you have any questions or need any services.

Sincerely,

A handwritten signature in black ink that reads "Steven D. King". The signature is written in a cursive style with a large, prominent "S" and "K".

Steven D. King, PE  
Principal Engineer

A handwritten signature in black ink that reads "Thomas H. Groscup". The signature is written in a cursive style with a large, prominent "T" and "G".

Thomas H. Groscup, PE  
Principal Engineer



### Substation Design

From minor substation upgrades to complete new substations, Orion Technical Services has the expertise and experience to provide a quality design package that will meet or exceed your expectations. Services provided are:

- Design of distribution and transmission substations
- Substation modifications
- Equipment specification
- Construction specification
- Project Management for design and construction
- 3D Modeling and rendition
- Complete testing and commissioning services

### Protection and Control Scheme Studies and Design

Orion Technical Services has extensive experience in control scheme development and design, fault study analysis, protective device coordination, and relay settings ranging from distribution applications to bulk transmission applications. Services provided are:

- System modeling and short circuit analysis
- System stability analysis
- System protection adequacy review
- Protective device coordination studies
- Relay settings
- Arc Flash Studies
- Control scheme specification and design
- Relay and control panels
- Digital fault recorder (DFR) application
- Complete turnkey fabrication and installation of relay and control panels and control houses through approved contractors
- Complete testing and commissioning services
- Training Services

### Planning Studies

Orion Technical Services can provide detailed computer modeling of power systems for efficient planning of power systems upgrades and enhancements. The following related services are available:

- System modeling and load flow studies
- System expansion studies



### Planning Studies (cont'd)

- Motor starting, voltage flicker analysis
- Power factor correction
- Emergency restoration procedures
- Reliability assessment

### Automation and SCADA

From traditional RTU's to complete substation and distribution automation, Orion Technical Services has the experience to specify, design, construct, and fully commission complete automation and SCADA systems. The following services can be provided:

- Automation specifications and scheme development
- Programmable Logic Controller (PLC) installation and programming
- Supervisory Control and Data Acquisition (SCADA) applications
- Communications system selection and application design
- Installation and commissioning services
- Supply systems completely mounted and wired in enclosures or cabinets
- HMI Display Development
- Training Services

### Emergency and Non-Utility Generation Design

Orion Technical Services' personnel have designed non-utility generation interconnection installations from 100kW generators interconnected on utility distribution systems to 750MW power plants interconnected to bulk transmission facilities. We offer the following services for both utilities and generation developers:

- Coordination with local utility on interconnection requirements
- Utility interconnection application and design
- Switchyard design
- Generator and interconnection protection coordination and relay settings
- Start-up and test



### Overhead and Underground Line Design

Orion Technical Services provides transmission and distribution overhead and underground line design for all applications. We have the experience to design multiple configurations to meet the requirements of the project and customers budget. Services include:

- Overhead wood pole design
- Overhead steel pole design
- Tower Analysis
- Foundation design
- Underground residential developments
- Underground design, both direct bury and in conduit or duct bank
- Telecommunication line or telecommunication attachment to existing facility design
- 3D modeling and rendition

### Operation Review and Analysis

Orion Technical Services can provide complete electrical system operation analysis from operations of protective equipment to forensic analysis of major electrical equipment failures. We provide the following services:

- Root-cause operation analysis
- Protective relay operation review
- Digital Fault Recorder (DFR) operation analysis
- Forensic analysis of electrical equipment failures

### Revenue Metering Design

Orion Technical Services can provide complete revenue metering design and systems that will meet all utility requirements for both generation and load metering. Services include:

- Specification and design for revenue metering systems
- Testing and commissioning for revenue metering systems
- Complete turnkey metering system fabrication and installation through approved contractors



## Services

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### Maintenance Program Development

Our personnel have extensive experience in protective relay and electrical equipment maintenance and testing. We can provide a complete electrical equipment maintenance program customized to your specific needs. Services include:

- Development of maintenance programs for electrical equipment
- Audit of existing maintenance programs
- Audit of existing electrical facilities
- Preparation of single lines and equipment databases
- Training on maintenance programs

### Testing Services

Orion Technical Services offers a complete design, testing, and commissioning solution for protective relays, electrical equipment and complete substations. In addition, we offer training programs on maintenance and testing. Services provided are:

- Protective relay testing
- Control scheme maintenance and functional testing
- Testing on newly installed and older systems
- Testing services for electrical equipment (circuit breakers, transformers, etc)
- Training programs for maintenance and testing

### Load Management

Our engineering, automation and revenue metering background provide us with the skills necessary to analyze the merits of load management for your facility and provide you with a reliable management system which can yield significant savings on your electric utility bills. Services provided are:

- Customized cost/benefit analysis to determine viability of load management
- Design of manual and automated load management systems for demand control
- Training for operations personnel on the issue of load management and the impact of equipment scheduling on utility costs



## Services

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### Industrial Facility Services

In addition to the services listed above, Orion Technical Services can provide a complete suite of services to meet the needs of industrial customers in the management of their electrical infrastructure. Services include:

- Load flow and coordination studies
- Single line preparation
- Electrical classification studies for hazardous locations
- Power quality analysis
- Motor control center (MCC) design
- Emergency generation additions
- SCADA and automation
- Equipment failure forensic analysis
- Maintenance program review or development
- Equipment evaluation
- Reliability assessment



## Recent Projects

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- **Substation Upgrade Project – *Central Maine Power Augusta, Maine***

Provided engineering and design for the replacement of the 115kV and 34.5kV circuit breakers, potential transformers, capacitor coupled voltage transformers, and disconnect switches. Designed new relay panels to replace all existing station relay protection and SCADA.

- **New Substation – *New York State Electric and Gas Binghamton, New York***

Performed engineering and design for a new 115kV – 12kV 25MVA substation including specifications, bid review, design of all physical and electrical installation, and coordination with equipment vendors to complete the project.

- **Substation Upgrade Project - *New York State Electric and Gas Binghamton, New York***

Provided engineering and design for the replacement of 3 single phase 115kV – 12kV transformers with a new 25MVA 3 phase transformer. In addition, provided the engineering and design to add two additional 12kV feeders and add a mobile substation tap.

- **Generation Interconnection – *Evergreen Community Power Reading, Pennsylvania***

Provided interconnection consulting services, interfaced with the interconnection utility, and completed engineering and design of the complete 69kV utility interconnecting substation and the generation facility substation. Completed equipment and relay testing and commissioning services for the 69kV interconnection substation and the generation facility substation.

- **Relay Replacement Projects – *First Energy Reading, Pennsylvania***

Provided installation, testing, and commissioning services for a 500kV substation relay replacement project. Project included removal of the old relay and communication equipment and replacing the relay and communication equipment in the existing cabinets and duplex switchboards.





## Recent Projects

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Provided installation, testing, and commissioning services for a 230kV substation relay replacement project. Project included the addition of a new 230kV line relay panel and associated equipment.

Provided installation, testing, and commissioning services for two 69kV substation relay replacement projects. Projects included the addition of new 69kV line relay panels and associated equipment.

- **New Substation Project – *ES3, LLC York, Pennsylvania***

Worked with a local electrical contractor to engineer, design, and construct a new 115kV – 13.2kV substation for ES3, LLC. After construction was complete, performed all the testing and commissioning of the substation.

- **Transient Recovery Voltage Study – *SEPTA Philadelphia, Pennsylvania***

Collected data and built a transient recovery voltage study model in EMTP. Performed a transient recovery voltage study for the addition of new substation equipment and produced a detailed report of the findings with all simulated transient response plots. Developed a vacuum circuit breaker model in EMTP that had the ability to simulate low level current chopping

- **Electrical System Monitoring and Revitalization Project – *Lehigh University Bethlehem, Pennsylvania***

Completed an electrical system evaluation including all systems from their 69kV substation down to the building distribution substations. Worked with the university to develop projects, budget, and schedule to address the issues identified in the evaluation. Completed the specifications, engineering, and design for the replacement of one of the 69kV – 12kV 14MVA transformers. Completed the engineering, design, testing, and commissioning for the upgrade of all the 69kV and 12kV relays and added a new integrated SCADA system to monitor their main 69kV substation and two 12kV distribution substations. Completed the specifications, engineering, design, testing, and commissioning for the replacement of five 69kV oil circuit breakers with new SF6 puffer circuit breakers.



## Recent Projects

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- **92kV Capacitor Bank Additions – *Imperial Irrigation District Imperial, California***

Completed specifications, engineering, and design for the addition of three new 75MVAR 92kV capacitor bank installations at existing 92kV substations. Worked with the Imperial Irrigation District on the installation and commissioning of the new capacitor banks.

- **New Substation Project – *Imperial Irrigation District Indio, California***

Completed specifications, engineering, and design for the addition of a new distribution substation with three 25MVA 92kV – 13kV transformers and three lineups of 13kV metal-clad switchgear. Installed a new integrated SCADA system which was the first of its kind for the Imperial Irrigation District. Provided a training program on the new SCADA system which was used at two additional substations.

- **New Substation Projects – *Imperial Irrigation District El Centro, California***

Completed specifications, engineering, and design for the addition of two new distribution substations with one 25MVA 92kV – 13kV transformers and 13kV metal-clad switchgear. Installed a new integrated SCADA system.

- **Generation Interconnection Studies – *Imperial Irrigation District Imperial, California***

Awarded a long term contract for the completion of Feasibility, Impact, and Facility studies for the interconnection of generation to the Imperial Irrigation District electrical system. Completed over 20 interconnection studies for the Imperial Irrigation District over the last 5 years.

- **Asset and Resource Strategy Development – *Imperial Irrigation District Imperial, California***

Assisted Imperial Irrigation District with the development of an asset and resource strategy that would use the capability of their SAP enterprise system to assist them in planning, prioritizing, budgeting, and scheduling their major electrical projects and electrical maintenance. Developed a project estimating and planning utility that assists the engineer in estimating projects and greatly minimizes the effort required to plan the projects in SAP.



## Recent Projects

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- **New Substation Project – *Albright College Reading, PA***

Completed specifications, engineering, and design for a new line of 13kV and 4.8kV switchgear for a new single 13kV primary service connection. Completed a system coordination study and set all new switchgear relays. Completed an Arc Flash study for the new switchgear and provided arc flash labels for the new switchgear.

- **New Substation Projects – *University of Pennsylvania Philadelphia, Pennsylvania***

Completed specifications, engineering, and design for new 13kV switchgear units for a double feed with automatic switching at two buildings on campus. Completed a system coordination study and set all new switchgear relays. Completed an Arc Flash study for the new switchgear and provided arc flash labels for the new switchgear. Completed functional testing on the automatic switching scheme at the switchgear factory prior to the shipment of the equipment.

- **Generation Interconnection Design – *Ingersoll Rand***

Completed over 25 projects for the installation of micro turbine installations to interconnect with utility distribution systems. Services for the installations include utility interconnection design, facility electrical design, relay panel design, relay panel construction, coordination studies, relay settings, and relay testing.

- **Relay and Control System Design – *Harlo Corporation, Grandville, Michigan***

Relay and control scheme design for a 69kV East Kentucky Power Cooperative substation. Project scope included designing AC and DC schematics and developing panel wiring diagrams for five (5) relay panels.

- **Relay and Control System Design – *Harlo Corporation, Grandville, Michigan***

Relay and control scheme design for a 138-12.47kV substation for Kenworth Truck Company. Project scope included complete protective scheme specification, relay and metering diagrams, AC and DC schematics and panel wiring diagrams for two (2) relay panels. A remote paging scheme was also implemented to notify plant personnel of any equipment alarms.



## Recent Projects

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- **Generator Out-of-Step Protection – *Power System Engineering, Madison, WI***

Project scope included specifying protective relays for out-of-step protection of four (4) hydroelectric turbine-generators for Kaukauna Electric Utility and calculating settings based on system data and the stability studies.

- **Relay and Control System Design – *Harlo Corporation, Grandville, Michigan***

Developed panel wiring diagrams for two (2) relay panels for an AEP 138-13.8kV substation.

- **35kV Line Design – *Industrial Power Generating Company, Richmond, Virginia***

Provided the design and equipment specifications for a 35kV line from the interconnecting utility metering structure to the generating plant at their Chesterfield facility. This project included three dimensional (3D) modeling of line structures.

- **Power Plant Grounding and Testing – *Ocean Peaking Power Facility, Lakewood, NJ***

Project scope involved field and drawing review of generating plant grounding, testing of ground lead connections, and measurements of ground currents during plant operation to determine causes of high levels of current flowing in equipment grounds.

- **Ocean Peaking Power Project – *Ocean Peaking Power Facility, Lakewood, NJ***

Project scope included providing a proposal to replace the existing conventional RTU system with a PLC based SCADA system, complete secondary current and voltage testing to confirm meter display values, and complete a grounding review of the facility.

- **Relay and Control System Design – *Harlo Corporation, Grandville, Michigan***

Relay and control scheme design for two 161kV – 69kV East Kentucky Power Cooperative substations. Project scope included designing AC and DC schematics and developing panel wiring diagrams for 7 relay panels.



## Recent Projects

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- **Relay Panel Wiring Diagrams – Harlo Corporation, Grandville, Michigan**

Developed relay panel wiring diagrams for a Jacksonville Electric Authority 138kV – 27kV substation. Scope included development of wiring diagrams for 8 - 138kV and 3 - 27kV relay panels on a compressed time schedule. The drawings were designed, drafted, and issued in less than 4 weeks.

- **Power System Study – Siegfried USA, Inc., Pennsville, New Jersey**

Prepared power system single line drawings for the 12kV and 480V systems. Performed load flow studies and protective device coordination studies for the 12kV and 480V systems. Provided a report and presentation to plant personnel on the findings of the study.

- **69kV – 13.8kV Substation Modifications – United Corrstack, LLC, Reading, Pennsylvania**

Specified all equipment and prepared construction drawings for the replacement of a 14MVA 69-13.8kV transformer. This project also included replacement of existing relays, the addition of transformer protective relaying, and the addition of substation alarm monitoring equipment. Developed relay settings and test plans for the relays being added. Construction management and relay testing supervision were also provided since the outage timeline to replace this equipment was 16 hours. An insulation coordination and lightning protection study was also performed for the substation.

- **Generation Interconnection Studies – Industrial Power Generating Company, Richmond, Virginia**

Prepared cost estimates and a report outlining interconnection requirements for Industrial Power Generating Company to interconnect their proposed 20MW generation installation with Allegheny Power 35kV sub transmission system.

Prepared cost estimates and an interconnection requirements report for Industrial Power Generating Company to interconnect their proposed 10MW generation installation with First Energy (Met-Ed) 13kV distribution system and 69kV sub transmission system.



## Recent Projects

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- **Circuit Upgrades – *Reliant Energy, Titus Station, Birdsboro, Pennsylvania***

Replaced current transformers and relays in GE AK switchgear for the addition of the new coal blending system and new stack addition. Performed protective device coordination studies and provided settings for the 4kV and 480V protective devices for the additions. Provided relay testing services for the relays being added as part of the project.

- **SCADA System Addition – *Fairchild Semiconductor, Mountain Top, Pennsylvania***

Prepared all engineering, settings, and field commissioned the addition of a SCADA system for the Fairchild Semiconductor 69kV – 12kV substation. The SCADA system was interfaced with all substation metering and relaying and a programmable logic controller was utilized for hard-wired I/O. This project used spread spectrum radios to communicate with the plant DCS master.

- **SCADA and Automation System Programming and Commissioning – *First Energy, Reading Pennsylvania***

Programmed and commissioned the SCADA systems and Programmable Logic Controllers (PLC) for First Energy at four (4) substations. Developed custom breaker control blocks to perform breaker control via protective relays networked through a communications processor. Provided training and commissioning support to the field technicians on the operation of the PLC RTU.

- **SCADA and Automation System Programming and Commissioning – *ABB, Raleigh, North Carolina***

Programmed and commissioned the SCADA system and Programmable Logic Controllers at First Energy (JCP&L) Lakewood Substation. Developed telemetry points list required from the plant to meet First Energy's requirements and interfaced the PLC RTU to remote plant meters to provide the required data.

- **Failed Substation Transformer Evaluation – *United Corrstack, LLC, Reading, Pennsylvania***

Worked with United Corrstack, LLC, First Energy (Met-Ed), and Factory Mutual Insurance Company on the cause of the substation transformer failure and the recommendations to minimize the chance of future transformer failures.



## Recent Projects

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- **Relay Operations Performance – PECO Energy, Berwyn, Pennsylvania**

Worked with PECO Energy to develop a plan to minimize the number of incorrect relay operations they were experiencing on their transmission and sub-transmission systems. This involved outlining the process steps associated with the design and maintenance of protective relay schemes and identifying key causes of misoperations in each of the steps. An action plan was developed to address these causes and minimize the number of misoperations.

- **35kV Sub-transmission Line Design – Industrial Power Generating Company, Richmond, Virginia**

Provided the design and equipment specifications for a 35kV line from the interconnection substation to the generating plant at their Mountain View facility.

- **SCADA to Distributed Control System Data Link – First Energy, Reading, Pennsylvania**

Designed a communications link between First Energy's SCADA system and a Distributed Control System (DCS) located at a generating facility interconnected with the First Energy system. Developed a telemetry points list meeting the data needs of both parties and provided all programmable logic controller (PLC) programming required for the project. Also acted as the liaison between First Energy and the generation owner to coordinate installation and commissioning activities for the project. Provided field engineering support for the commissioning of the system.

- **Electrical Classification Study – Siegfried (USA), Inc – Pennsville, New Jersey**

Performed an electrical classification study of the plant facilities to properly classify each of the facilities per National Electric Code (NEC) requirements for electrical equipment installed in hazardous locations. This study required a thorough site review and an analysis of the manufacturing processes in use to classify locations throughout the site properly.

- **Relay Addition Project – Reliant Energy, Portland Station, Portland, Pennsylvania**

Added a relay to a transformer protection scheme to eliminate an unprotected zone surrounding a neutral grounding resistor. Project was initiated after a misoperation analysis was performed and the unprotected zone was identified.



**Orion Technical Services, LLC**  
**Engineering Personnel**  
**Major Project Experience**  
**(610) 796-7900**

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***Substation Projects***

**Foxhill 230-34.5 kV Substation, Stroudsburg, PA** - This project entailed the construction of a new 230-34.5 kV distribution substation. The various protective schemes included in the project were:

- 1) Redundant Fiber optic Current Differential protection scheme for bus tie protection
- 2) Redundant Directional Comparison Blocking protection on the 230 kV line feeding the station
- 3) Transformer and distribution line protection

In addition to performing the short circuit analysis and specification and coordination of protective devices, completed the control circuit design used in the substation.

**Lorane #1 Bk Replacement Project, Reading, PA** - This project included the replacement of an existing 14 MVA 69-13.2 kV transformer with a new 28 MVA 69-13.2 kV unit. Protection schemes upgraded as part of this project included new transformer differential protection, as well as, microprocessor based transformer overload and distribution feeder protection.

**Glendon 115 kV Rebuild Project, Easton, PA** - This project included the replacement of 115 kV line protection at six (6) terminals and transformer protection for two (2) 115-34.5 kV transformers. Determined the protective relay schemes to be installed, as well as, the settings for all of the relays. Completed the control scheme design and assisted the technicians in commissioning and testing the new schemes.

**Warren 230 kV Substation Project, Warren, PA** - This project entailed the installation of a new 230 kV breaker terminal, 230-115 kV auto-transformer, and relay replacements at two (2) remote 230 kV terminals. Responsibilities included substation expansion, specifying equipment, protection and control design, determining all of the relay settings and supervising the commissioning and in-service testing of the equipment installed. Developed test plans and provided training for the technicians on the testing of all relays.

**Tower Hill 115-34.5 kV Substation Project, Mansfield, PA** - This project included the installation of a new 115 kV terminal at an existing substation and the construction of a new 115-34.5 kV Substation. Completed the substation design and protection scheme design, including panel layout and wiring design. Determined all of the relay settings necessary. The substation protection was performed almost exclusively with microprocessor-based relays. Provided training and supervision for the commissioning and in-service testing of all of the equipment installed.





**Pleasureville 983 Line Terminal Project, York, PA** – This project entailed the engineering required for the addition of a 115 kV line terminal at the Pleasureville Substation. Project design included the design of a new 115 kV terminal including box structure addition, new circuit breaker, new line protection panel utilizing a directional comparison blocking scheme using power line carrier equipment. Developed all of the relay settings required for the project.

**East Sayre Relay Replacement Project, Sayre, PA** – Completed the design of a new 115 kV line protection panel to replace an existing electromechanical relay panel. Also, developed all relay settings required for the project. Project management activities included coordination with an interconnecting utility and their customer on meeting the project schedule and requirements.

**Westgate Substation, York, PA** – Project engineer for the \$1.2 million addition of a new 115 kV – 13.2 kV substation with 2 - 115 kV breakers, a 28 MVA transformer, and 13.2 kV switchgear.

**Hunterstown Substation, Gettysburg, PA** – Project was to add a new 500kV shunt capacitor bank recommended by the power pool to increase power transfers from west to east. This included a 500kV capacitor bank and an associated 500kV circuit breaker. This also included a programmable logic controller to automatically switch the capacitor breaker for system conditions that require the capacitor to be tied to the system. Responsibility for this project was substation design, protection, and control design, and relay settings.

**Northwood Substation, Forks Twsp, PA** – This project was to determine the failure mode of two 230kV – 34.5kV, 125 MVA transformers, specify and manage the purchase and design of a new replacement transformer, and to specify and manage the repair of the second failed transformer. Responsibility for this project was to analyze all operation and failure data to determine what caused the failures and specify the design requirements for a new transformer. Responsibility also included following the transformer through design, performing the transformer core and coil inspections, overseeing the final testing, and providing field direction for the installation. The requirements of the project also included overseeing the disassembly of the second failed unit and working with the manufacturer that was redesigning the unit to assure all our requirements were met.

**Yorkana Substation, York, PA** – Project scope was to add a second 230kV – 115kV 200MVA autotransformer to the existing substation. Project responsibility included, specifying and managing the purchase and design of the new transformer, complete all substation upgrades, determine the relay schemes required, complete all control design, perform fault analysis, and complete all relay settings.

**Erie South 230kV Shunt Capacitor Bank Installation, Erie, PA** – Responsible for installation, testing, and commissioning for the addition of two (2) 65MVAR substation shunt capacitor banks. This included major modifications to the 230kV bus and the relay protection. Scheduled 230kV bus outages, coordinated construction and testing crews, planned the work in stages to allow for only



short outages of the 230kV bus to tie in major systems. Also responsible for preparing as-built drawings for the project.

**East Windsor 500kV substation expansion, Windsor, NJ** – Project Manager for the design, installation, and testing of a second 500kV – 230kV, three phase, 870MVA transformer and 230kV ring bus at Jersey Central Power & Light’s East Windsor substation. This project also included 500kV line re-routing including a new double circuit 500kV tubular steel pole design, and 230kV line re-routing.

**United Coorstack, Reading, PA** – This project included replacing a failed 69kV – 13.8kV, 14MVA transformer, upgrading transformer protection, performing a lightning and insulation coordination study, performing a relay coordination study, relay settings, and adding power quality metering to the substation. Construction specification and coordination was also provided.

**Fairchild Semiconductor, Mountain Top, PA** – Designed and commissioned the installation of a SCADA system to gather transformer and feeder load and status information from the substation and send it to their plant control system.

**North Temple Substation, Temple, PA** - Replaced both 230-kV 112 MVA transformers and associated equipment with 224 MVA transformers. Expanded existing 230-kV substation and reconfigured straight 230-kV bus to a (5) breaker ring bus for (5) 230-kV lines and (2) 224-MVA transformers. Construction was completed in its entirety while keeping at least one transformer and most of the 230-kV lines in service at all times.

**Harley Davidson Substation, York, PA** – Addition of a new 115 to 13.2-kV substation owned and operated by Harley Davidson. Consisted of (2) 25-MVA transformers, (9) 13.2-kV switchgear breakers and (6) distribution feeder circuits.

**Lewistown 230kV Shunt Capacitor Addition** – Designed the installation of a shunt capacitor bank at Lewistown 230kV substation. Responsibility included substation expansion, specifying capacitor bank, and coordinating installation.

**Casey County and Windsor Substations, Kentucky** – Completed relay and control scheme design for 2- 161kV to 69kV East Kentucky Power Cooperative substations. Responsibility included design of AC and DC schematics and development of panel wiring diagrams for 7 – 161kV and 69kV relay and control panels. Engineering was completed for Harlo Corporation who was the relay panel construction contractor.

**Beeghly Heights Substation, Jacksonville, FL** – Completed the design and drafting for wiring diagrams for 8 – 138kV and 3 – 27kV relay and control panels for Harlo Corporation on an expedited schedule. All drawings were issued 1 week ahead of schedule.



## ***Generation Projects***

**Portland Unit #5 Combustion Turbine Project, Portland, PA** - Reviewed/specified and determined settings for all of the protective relaying equipment used to protect the 150 MVA generator and associated equipment. Also, was assigned the responsibility for commissioning this equipment during the period between July and November of 1994. Developed a test program and scheduled and supervised the contractors hired to do the testing. In addition, worked closely with the manufacturer's commissioning engineers during the "Primary Test" phase of the startup and test program.

**York Haven Generating Facility, York Haven, PA** – This project scope was the upgrade of the 1926 hydroelectric generating facility. Project included new electrical equipment and addition of automatic control. Scope included replacement of generator switchgear, main switchgear, 4 kV – 115 kV step-up transformers, station service switchgear, station service transformer, and updating the 115 kV utility interconnection.

**Solar Turbines, York, PA** – Project was for the installation of 8 small combustion turbines at Caterpillar Tractor substation. Responsibility was utility project engineer working directly with Solar Turbines and their engineering firm to specify protection requirements, review their protection and control drawings, and make recommendations to allow them to meet the utility requirements and to help them control the costs for interconnection. Responsibility also included protective relay settings for the interconnection, review generator and associated auxiliary protective relays, and review of the final as built protection and control drawings.

**Combustion Turbine Upgrade Project, Metropolitan Edison Co., PA** – This project included the upgrading of the turbine and generator protection and control schemes of eleven 20MW dual fuel fired combustion turbines. Responsibility was protection and control engineer for the replacement of the electro-mechanical generator and turbine control schemes with a PLC based scheme. This included upgrading automatic synchronizing schemes, frequency protection, voltage restrained overcurrent protection, high and low voltage protection, loss of excitation protection, and generator differential protection.

**Reliant Energy – Titus Station, Birdsboro, PA** – Completed the design, installation, and testing to upgrade the plant coal handling switchgear to handle a new coal blending system. Performed short circuit and relay coordination studies for switchgear relaying and the substation feeds to the switchgear.

**Reliant Energy – Titus Station, Birdsboro, PA** – Completed the design, installation, and testing of the new feed to the stack electrical system and upgraded Unit #3 station service switchgear to source the new feed. Purchased and installed cable, termination enclosures, current transformers and new protective relays, performed short circuit and relay coordination studies for switchgear



relaying and the substation feeds to the switchgear, and completed relay testing and in-service testing of the new feed.

**Ontelaunee Energy Center, Temple, PA** - Installation of new 230-kV switching station for a 540 MW natural gas fired generating facility owned by Calpine.

**AES Ironwood Substation and Switchyard, Lebanon, PA** – Project and Engineering Manager for the design, installation, and testing of a new 230kV utility substation and the owners 230kV switchyard. The project also included splitting an existing 230kV transmission line and relay upgrades at the remote terminals, including the addition of dual high speed relaying schemes on the two lines formed from the split.

**AES Red Oak Substation, Sayreville, NJ** - Installation of new 230-kV switching station for a 765 MW gas fired generating facility owned by AES.

**Handsome Lake Energy Center, Kennerdell, PA** - Installation of new 345-kV switching station comprised of a (3) breaker ring bus in support of the Handsome Lake Energy Project, a 250 MW gas fueled power plant owned by Constellation Energy Group in Kennerdell, PA.

**Ocean Peaking Power, Lakewood, NJ** – Responsibility included completing a proposal to replace the existing conventional RTU with a PLC based SCADA system, completing secondary current and voltage testing to confirm metering data, and performing a grounding review of the facility.

### ***Engineering Studies***

**Siegfried (USA), Pennsville, NJ** - Performed site electrical evaluation, composed single line diagrams of their entire power distribution system, completed power system modeling, load studies, short circuit studies, protective device coordination review, and future planning studies.

**INGENCO, Richmond, VA** – Completed utility interconnection studies for two of their generation development projects. Provided a report including design requirements, single line diagrams, and protection requirements that would be necessary to attach their generation to the utility grid.



## ***Programmable Logic Controller (PLC) Applications***

**Birdsboro 69 kV Restoration Scheme, Birdsboro, PA** - This scheme was designed to automatically reclose three (3) 69 kV circuit breakers and a 13.2 kV transformer breaker upon an operation of the adjacent transformer protection scheme.

**Stroudsburg 34.5 kV Circuit Breaker Transfer and LTC Control Scheme, Stroudsburg, PA** - This scheme performed an automatic circuit breaker transfer between two (2) 34.5 kV circuit breakers feeding a distribution substation. Also incorporated into the design was an automatic LTC control for two distribution power transformers in the substation.

**Lickdale Sectionalizing Scheme & 13.2 kV Tie Switch Scheme, Lebanon, PA** - This installation included the sectionalizing scheme mentioned above and a 13.2 kV tie switch scheme used to close two (2) 13.2 kV tie switches to pick up feeders in the event of a transformer failure. Due to the loading and characteristics of the feeders involved, the scheme also performed an automatic change of relay settings on ABB DPU relays prior to performing the transfer.

**Warren 115 kV Circuit Breaker & Relay Potential Transfer Scheme, Warren, PA** – This scheme performed a bus transfer for two (2) 115 kV circuit breakers between two isolated 115 kV busses. Prior to performing the transfer, a successful transfer of relay potential needed to be performed and verified. A 115 kV reclosure scheme was also provided for one of the circuits.

**Erie South 230-115 kV Auto-transformer LTC Control Scheme, Erie, PA** - This scheme was installed to perform manual tap changes for three (3) parallel 230-115 kV auto-transformers with different numbers of LTC taps.

**PLC-based RTU Projects** – Completed PLC programming for ten (10) PLC-based SCADA RTU systems. Programming of the PLC was completed utilizing IEC 1131 programming language and included not only the development of the PLC resident software, but also configuration and programming of various protocol converters utilized to communicate with other intelligent electronic devices (relays and meters).

**Remote Terminal Unit Standard, GPU Energy, Reading, PA** – This project included redesigning the control and data acquisition system platform at GPU Energy to be able to provide the current control and analog data requirements using communications systems and to be easily expandable to provide substation automation with minimal wiring changes. This project got national attention and was published in T&D magazine and numerous presentations were given on this project.



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**Education:** B.S. Electrical Engineering - Drexel University '90

**Licenses:** Registered Professional Engineer in the Commonwealth of Pennsylvania

### **Protection & Control Scheme Studies & Design**

20 yrs experience in protection and control scheme application and design at voltages ranging from 480V to 500 kV on T&D and generation systems. Experience includes:

- ❑ System Studies including modeling and analysis
- ❑ Relay and fuse coordination studies
- ❑ Setting microprocessor and electromechanical relays
- ❑ Pilot schemes using carrier, audio tone, and fiber optic differential
- ❑ Control scheme design
- ❑ Circuit breaker interrupting studies
- ❑ Operation analysis, digital fault recorder analysis, and relay operation analysis
- ❑ Microprocessor-based relay communication networks for remote access and data retrieval
- ❑ Preparation of substation operating instructions to be used by maintenance personnel and system operators

### **Substation Engineering & Design**

Experience in substation design at system voltages ranging from 2.3 kV to 500 kV. Experience includes:

- ❑ Developed a substation project cost estimating and planning tool which greatly simplifies the planning of projects.
- ❑ Completed substation engineering and design packages for substation projects at distribution and transmission levels.
- ❑ Developed substation design alternatives to meet system planning and reliability requirements.
- ❑ Prepared material and construction services specifications and provided support to procurement departments during the competitive procurement process.

### **Planning Studies**

- ❑ Developed system planning criteria and business processes for transmission and distribution planning.
- ❑ Developed system models and performed load flow studies for transmission and distribution systems.
- ❑ Conducted switching studies to determine appropriate system switching to carry loads during contingencies.



- ❑ Developed system models to be used for power quality problem analyses conducted utilizing computer simulation tools.

### **Automation and SCADA**

- ❑ Designed and programmed automation and SCADA systems utilizing programmable logic controllers. Examples of automation schemes developed are: loop-line sectionalizing, breaker transfer, circuit breaker reclosing, and load tap changer control schemes. Developed standard function blocks to extract information and provide control functionality through relays using communication processors.
- ❑ Developed SCADA systems using microprocessor technology and leveraging information available in intelligent electronic devices (i.e. relays, meters, equipment monitors, etc).
- ❑ Designed and configured human-machine interface terminals to provide information sharing and control capabilities within substation installations.
- ❑ Automated the programming of PLC based RTUs from a points list thereby greatly simplifying the configuration of the RTU.

### **Emergency and Non-Utility Generation Design**

- ❑ Developed interconnection standards for the connection of non-utility generation to the utility system.
- ❑ Coordinated the interconnection of generation with generation developers.
- ❑ Performed system protection adequacy reviews of new generation installations.
- ❑ Developed interconnection designs meeting utility functional requirements while providing significant cost savings to generation developers.
- ❑ Prepared utility interconnection applications and electrical design packages for numerous distributed generation projects throughout the continental U.S.

### **Revenue Metering**

- ❑ Experience in interfacing revenue meters to SCADA systems
- ❑ Designed metering systems for numerous customer-owned generation installations

### **Protection and Control System Commissioning**

- ❑ Developed protective relay test plans and performed relay commissioning tests on relays applied to distribution, transmission, and generation systems.
- ❑ Developed relay and control scheme testing practices to be followed by contract testing personnel.
- ❑ Provided training on new protective relays and programmable logic controllers for maintenance personnel.
- ❑ Commissioned SCADA systems and provided training on modification of RTU programs.



### **Project Management**

- ❑ Implemented a critical path scheduling system for the management of substation design projects. This system was used to manage approximately 100 projects annually.
- ❑ Developed project management processes and methodology for managing substation and transmission projects at a major utility.
- ❑ Developed a visual substation project cost estimating tool built on the AutoCAD platform. This tool allows for quick and accurate cost estimation of substation projects and also included critical path schedule creation and upload into SAP R/3.





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**Education:** B.S. Electrical Engineering - Pennsylvania State University '85

**Licenses:** Registered Professional Engineer in the Commonwealth of Pennsylvania & State of New Jersey

**Substation Engineering & Design**

Over 20 years experience in utility and customer substation engineering and design on transmission and distribution systems.

- ❑ Conceptual substation design to meet requirements
- ❑ Develop cost, manpower, and material estimates
- ❑ Develop electrical equipment specifications
- ❑ Evaluate major electrical equipment proposals
- ❑ Perform substation grounding calculations and design
- ❑ Perform lightning studies
- ❑ Complete substation construction drawings
- ❑ Complete substation schematic and wiring drawings
- ❑ Develop construction specifications
- ❑ Design and review substation Spill Prevention Control and Countermeasure Plans
- ❑ Supervise Construction Managers, Engineers, & Designers

**Protection & Control Scheme Studies & Design**

Relay and control experience on transmission and distribution power systems with system voltages 480v through 500 kV and generation systems. Experience includes:

- ❑ System Studies including modeling and analysis
- ❑ Relay and fuse Coordination studies
- ❑ Setting microprocessor and electromechanical relays
- ❑ Pilot schemes using carrier, audio tone, and fiber optic differential
- ❑ Control scheme design
- ❑ Circuit breaker interrupting studies
- ❑ Arc Flash studies
- ❑ Operation analysis, digital fault recorder analysis, and relay operation analysis



### **Planning Studies**

System planning experience for utility load growth and customer interconnection. Modeled and analyzed power systems from 15kV to 230kV for load additions, generation connections, large motor connections, and system operations and contingencies.

- ❑ System load modeling and analysis of network and radial systems
- ❑ Switching studies for planned outages and emergency planning
- ❑ Develop options for planned expansion and growth using load analysis and financial modeling
- ❑ Power factor studies and power factor correction solutions
- ❑ Motor starting studies and recommendations
- ❑ Voltage studies and voltage correction solutions
- ❑ Transient recovery voltage studies

### **Emergency and Non-Utility Generation Design**

Extensive experience in non-utility generation interconnection with utility systems from small customer 480V interconnections to 500kV EHV transmission system interconnections.

- ❑ Developed interconnection standards for the connection of non-utility generation to the utility system.
- ❑ Coordinated the interconnection of generation with generation developers and utilities.
- ❑ Performed system protection adequacy reviews of new generation installations.
- ❑ Completed revenue metering design and coordination with utilities.

### **Electrical Equipment Maintenance**

Electrical equipment maintenance and testing experience on power circuit breakers, transformers, and relays. Experience includes:

- ❑ Relay testing and commissioning
- ❑ Control scheme verification by connectivity checks, operational testing, and high potential testing
- ❑ Circuit breaker timing and power factor testing
- ❑ Transformer power factor, exciting current, and turns ratio testing.
- ❑ Vacuum oil filling and degassing power transformers
- ❑ Develop maintenance plans and programs

### **Project Management**

Implemented a standardized critical path scheduling system for the management of substation design projects. This system was used to manage approximately 100 projects annually. Was responsible for annual substation construction budget of between \$50 - \$120 million annually.