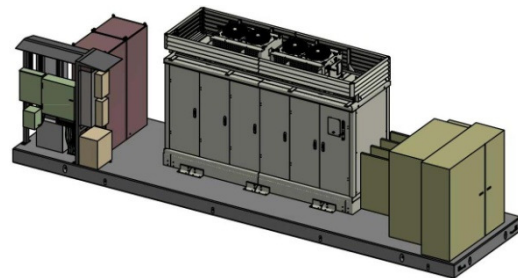
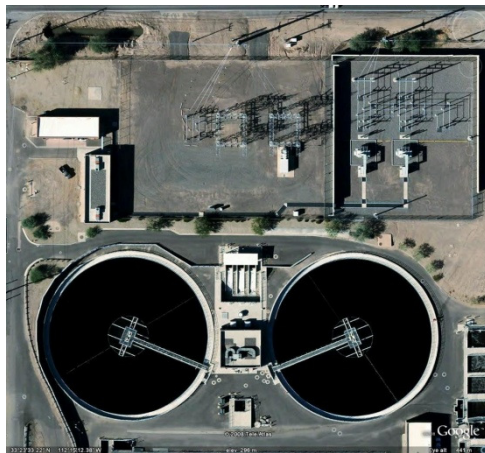


# HARDWICK ENGINEERING

## ELECTRICAL ENGINEERING SERVICES



## STATEMENT OF QUALIFICATIONS

SUBMITTED BY: ERIC HARDWICK, P.E.  
3/28/2014



## Table of Content

Table of Content .....	2
Firm Overview .....	3
Electrical Systems.....	3
Governmental/Federal/Nuclear.....	4
Industrial .....	4
Photovoltaic Systems .....	4
Commercial Systems .....	4
Projects Highlights, and References .....	5
Partial Project List .....	9
Company Resources .....	10
Services Offered .....	12
Design Services for Commercial Projects.....	12
Design Services for Industrial / Manufacturing Facilities .....	12
Design Services for Nuclear Industry .....	12
Design Services for Water / Waste Water.....	12
Consulting Services.....	12
Construction / Integration Services.....	12



## **Firm Overview**

Hardwick Engineering is a self-certified small business established in April of 2007 in Phoenix, Arizona, providing electrical engineering professional services in Arizona, California, Idaho, Ohio, Washington, and other States, focusing on commercial, industrial, and governmental industries.

Hardwick Engineering can provide excellent service for all electrical consulting and design service needs including complete design or design support for new or modified electrical systems for commercial and industrial buildings, industrial facilities including mining, water/wastewater power, and renewable energy projects, and government facilities including DOE nuclear facilities.

Hardwick Engineering has the resources to provide electrical solutions for complex or specialty/unique applications including power and arc flash analysis.

## **Electrical Systems**

Hardwick Engineering has the experience and expertise in low and medium voltage power distribution systems, protective device coordination studies, arc flash analysis, instrumentation and controls, SCADA systems, renewable energy systems, and building system designs to support any project type.

Hardwick Engineering's team members are experts with the National Electrical Safety Code (NESC), National Electrical Code (NEC), Electrical Safety in the Work Place (NFPA 70E and OSHA 1910 Subpart S), Lockout/Tagout, and Job Safety Hazard Analysis to design and implement projects in a safe and thorough manner.

Experience in power system and arc flash software include ETAP, SKM, and Arc Pro have been utilized for a number of Clients over the past several years including small private companies, large corporations, and federal projects where the requirements of NFPA 70E-2009 and 2012 Editions has been recently adopted and/or enforced.

Building system designs include new and existing buildings including offices, controls rooms, trailers, equipment rooms, churches, and institutional covering electrical and special systems such as fire alarm.

Hardwick Engineering has the experience and expertise to provide photovoltaic system designs for grid tied energy production or off grid electrical systems for any size photovoltaic or wind system.



## **Governmental/Federal/Nuclear**

Hardwick Engineering has supported directly and indirectly major national engineering firms including AECOM, Ch2MHill (CHPRC), Fluor-B&W Portsmouth, Malcolm Pirnie, Stantec, and Washington Group (WRPS).

Hardwick Engineering is currently supporting AECOM at the DOE Portsmouth Gaseous Diffusion Plant (GDP) for Decontamination & Decommissioning project activities.

Hardwick Engineering has provided proposal support and is teaming with AECOM for the electrical portion of the DOE Paducah GDP decommissioning project in Kentucky.

## **Industrial**

Hardwick Engineering has provided numerous designs for industrial projects providing power, I&C, and RTU designs in addition to power system studies and arc flash analysis for manufacturing facilities and water/wastewater plants.

## **Photovoltaic Systems**

Hardwick Engineering has designed numerous small photovoltaic systems below 200KW range for municipalities, schools, and private entities.

Hardwick Engineering has also provided specialty design of packed inverter skid designs for major inverter manufacturers including Power One and Bonfiglioli. Projects include inverter skid designs being used on the largest permitted photovoltaic system (549MW) in the US at the Antelope Valley Solar Project in California. Hardwick Engineering has worked with Power One to develop their 1MW-2MW inverter skid system.

Hardwick Engineering has also worked directly with First Solar on their 54MW Macho Springs project in New Mexico coordinating and incorporating project requirements into inverter skid system design.

## **Commercial Systems**

Hardwick Engineering has numerous architectural Clients providing Tenant Improvement (TI) and ground-up designs for projects including restaurants, churches, office buildings, and custom homes.

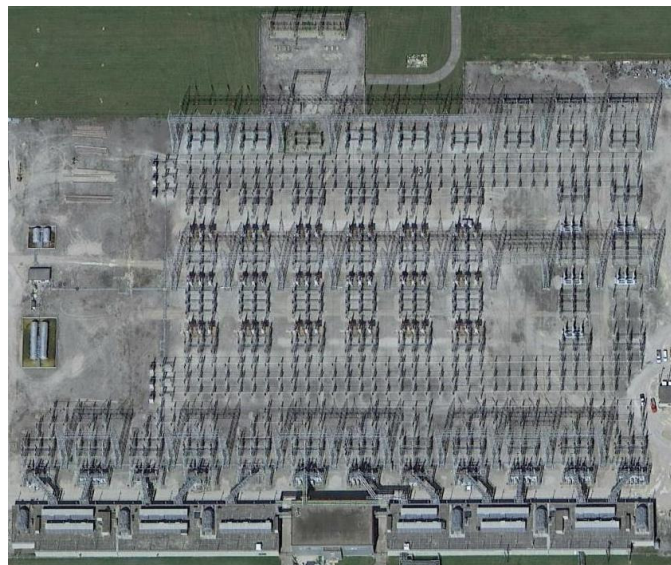
## Projects Highlights, and References



Client: AECOM, Government Services, Richard Tringale, (865) 604-4059  
Project Owner: DOE Portsmouth Gaseous Diffusion Plant  
Project Prime Contractor: Fluor B&W Portsmouth

### Project Scope & Actives:

Hardwick Engineering was awarded a 6 month contract to provide Arc Flash Subject Matter Expert support to assist in development of a new arc flash program as well as provide arc flash analysis. Hardwick Engineering performed the technical review of the 345KV, 2100MVA switchyard/ substation and 13.8KV distribution system utilizing NFPA 70E and NESC criteria as well as performing DC system arc flash analyses for the extensive 250V & 125V DC control systems. Other major projects Hardwick Engineering has provided technical support for includes a) technical reviews and construction support for a new 13.8KV overhead distribution system, b) new X-550 100MVA substation design, and c) troubleshooting existing switchyard/substation failures.



Hardwick Engineering has been awarded an additional 2 contracts totaling 15 months for NERC compliance and design implementation support and other various project support including respirator and laundry relocations, lighting improvements, trailer installations, building heating system installations and equipment installations for support of decontamination and decommissioning efforts for the next 20-30 years.

Client: E2 Consulting Engineers, Charles Tyler, Manager, (208) 206-9951

Project Owner: DOE Hanford Site

Project Prime Contractor: Washington River Protection Solutions (WRPS)



Project Scope & Actives:  
Hardwick Engineering was awarded a 9 month contract to provide consulting and design support for the Hanford Tank Farm Facilities.



Major projects included:

A) Leak detection system replacement project where Hardwick Engineering provided the design and testing requirements for replacement of an obsolete leak detection system used throughout the tank farms.

B) Sluice retrieval project providing electrical and I&C designs for the waste retrieval from various C Farm tanks.

C) Consulting for safety significant thermocouple monitor system for underground waste storage tanks. Hardwick Engineering provided the E&IC requirements, conceptual design, bill of materials, and E&IC cost estimate as the basis for conversion of a non-safety thermocouple to a DOE requested safety significant thermocouple.

D) Hardwick Engineering provided the electrical design for temporary power to the AY/AZ tank farms to allow for installation of the AY/AZ tank farm switchgear upgrades.

E) Hardwick Engineering provided the electrical & IC gap analysis of existing Cold Test Facility renovations to allow for submerged pump testing.



Client: E2 Consulting Engineers, Charles Tyler, Manager, (208) 206-9951

Project Owner: DOE Hanford Site

Project Prime Contractor: CHMHILL Plateau Remediation Cleanup (CHPRC)



**Project Scope & Actives:**  
Hardwick Engineering was awarded a 9 month contract to provide consulting, design and construction support for CHPRC's Ground Retrieval Project.



Major project activities included:

A) Hardwick Engineering provided design support and construction oversight of AG-1 Portable HEPA Exhauster System. Hardwick Engineering developed the schematic diagrams, FAT for the exhauster and the CAT incorporating testing and turnover requirements for both the AG-1 Portable HEPA Exhauster and Portable Kelley Closure building per ASME AG-1 (Code on Nuclear Air and Gas Treatment) requirements.

B) Hardwick Engineering provided the electrical infrastructure design at the 3A, 4B, and 4C burial

sites for the NGR-TRU Waste Retrieval Project as well as providing construction oversight and developing testing requirements.



Client: URS EG&G Technical Services, Lynn Wickham, (208) 529-8700

Project Reference: DOE Idaho National Laboratory Site

Project Prime Contractor: CH2MILL-Washington Inc (CWI)



**Project Scope & Actives:**

Hardwick Engineering was awarded a 12 month contract to provide consulting and design support for the Idaho National Laboratory Decontamination and Decommissioning Project.

**Major projects and activities included:**

A) Design modifications to INL facility AG-1 HEPA Exhaust System Controls.

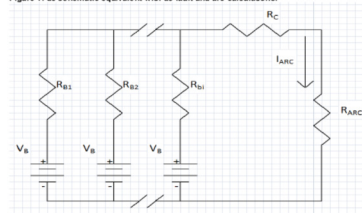
B) Designed temporary power systems for the isolation and demolition of numerous buildings.

C) Hardwick Engineering provided electrical design and construction specifications for the relocation of the INL Site telecommunications room to a new concrete building.

D) Designed a new tower mounted security camera system.

E) Hardwick Engineering developed CWI's DC arc flash analysis process.

Figure 1. dc schematic equivalent with dc fault and arc calculations.



$$I_{bf} = \frac{(V_b)}{(R_{b1} || R_{b2} \dots || R_b + R_c)} \quad (1)$$

where

$I_{bf}$  = Bolted Fault Current in amps (A)

$V_b$  = Battery Voltage in volts (V)

$R_b$  = Battery Resistance in milli-ohms (mΩ)

$R_c$  = Cable Resistance in milli-ohms (mΩ)

$$I_{arc} = \frac{(V_b)}{(R_b || R_{arc} + R_b + R_{arc})} \quad (2)$$

where

$I_{arc}$  = Arcing Fault current in amps (A)

$R_{arc}$  = Arc Resistance in milli-ohms (mΩ)

$$R_{arc} = [20 + 0.684 (Z_g)] / [(I_{arc})^{0.67}] \quad (3)$$

where  $Z_g$  = Air Gap in millimeters (mm)

Outlines regarding air gap values may be obtained from NFPA 70E - 2009 by referring to Table D.7.2, "Factors for Equipment and Voltage Classes."

Substitute equation 3 into equation 2 and iteratively solve for  $I_{arc}$  &  $R_{arc}$  until convergence.





## **Partial Project List**

### **Federal/Nuclear**

DOE Portsmouth Gaseous Diffusion Plant, Decontamination & Decommissioning, AECOM and FBP, Piketon, OH  
DOE Hanford Tank Farm Consulting and Design Support, E2 Consulting and WRPS, Hanford, WA  
DOE Hanford Ground Retrieval Waste Cleanup Project, E2 Consulting and CHPRC, Hanford, WA  
DOE Idaho National Laboratory, Decontamination & Decommissioning, EG&G and CWI, Idaho Falls, ID

### **Industrial**

JBS Packerland Chiller Project, Watkins Electric  
JBS Packerland Pump Station Project, Watkins Electric  
Client Confidential: Leach Dump Pump Station, Copper State Engineering  
Highland Pines Domestic Water Improvement District Pump Station SCADA System  
Crisantes Tubac Well and Pump Control Controls, Kimley Horn & Associates  
America West Quarter Horse Ranch Disinfection System Upgrade, Fluid Systems  
FICO Pump and Tank Site Design Services, Kimley-Horn Associates  
Sahuarita Water Booster Station Design, Kimley-Horn Associates  
La Paz County Centennial Park Pump Station Improvements, Brooks Engineering  
Diesel Storage Tank Controls Design, F5 Equipment

### **Power Systems**

Portsmouth Gaseous Diffusion Plant, AC and DC Arc Flash Analysis, AECOM and Fluor B&W  
PNNL Battelle Self Contained Laboratory Arc Flash Analysis, Northpoint Electric  
DOE Hanford AY & AZ Tank Farm Temporary Power System Design and Power System Analysis, WRPS  
Pureheart Christian Coordination & Arc Flash Analysis, Pureheart Christian Church  
City of Phoenix 69/4.196 KV Transformer Relay Coordination Study, MET Electrical/Malcolm Pirnie  
City of Henderson (NV) Waste Reclamation Phase 2 Expansion Coordination Study, MET Electrical  
DOE Idaho National Laboratory, AC & DC Arc Flash Analysis, EG&G/URS, CWI

### **Photovoltaic Systems**

1.5MW Inverter Skid System for Antelope Valley Solar Projects, Old Caste PreCast / Power One  
1.5MW Inverter Skid System for Macho Springs, Old Caste PreCast / Power One  
1.9MW Inverter Skid System for Centinela Solar Energy Facility, Old Caste PreCast / Bonfiglioli  
Chidester 6.6KW Grid-Tied with Battery Backup PV System, BV Plumbing  
Willows Spring 80KW Off-Grid PV System, Setter Construction  
AZ Department of Emergency Management Affairs 25KW to 120KW PV Systems, PWI Solar  
School PV Systems (various from 25KW to 50KW), PWI Solar  
Peoria Challenger Center PV System, PWI Solar  
CRUHSD #2 14.4kW PV River Valley High School Site Visit, Devault Electric  
CRUHSD #2 14.4kW PV Mohave High School, Devault Electric  
RLM Companies 5KW PV System, Control System Integration / ESSCO  
Woodward Residential PV System, BV Plumbing

### **Commercial Systems**

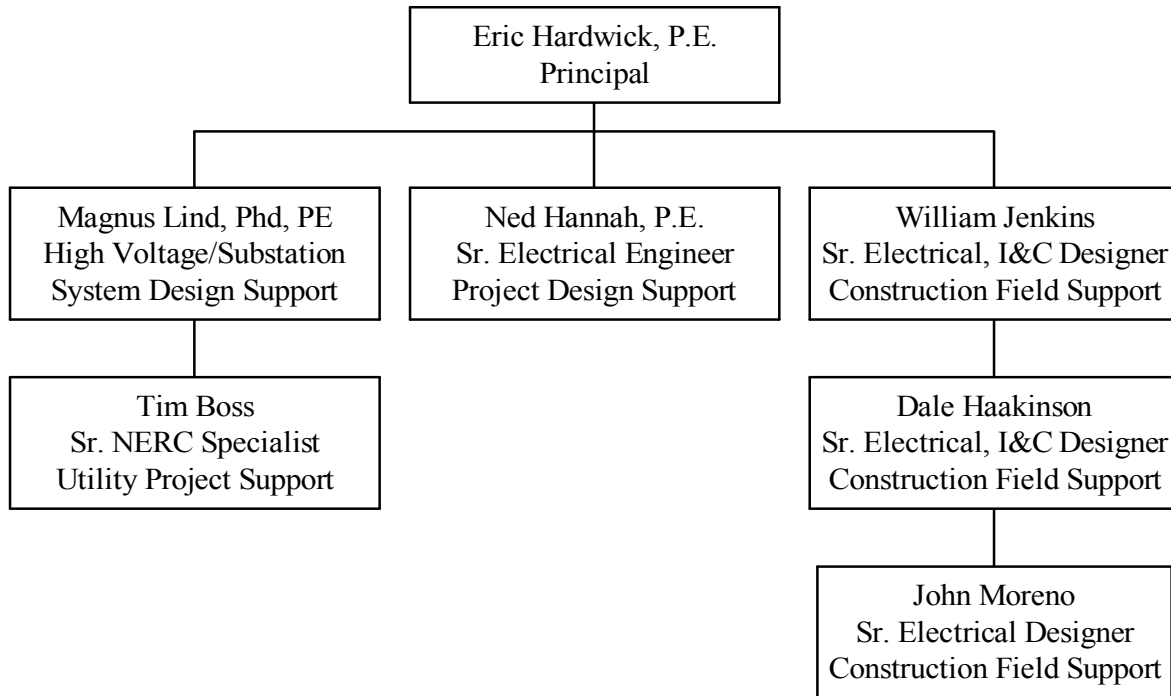
TI's and ground-up projects including restaurants, churches, and office buildings (List available upon request)



## Company Resources

Hardwick Engineering's staffing resources include a pool (10-20) of experienced engineers and designers available as needed based on company work load and backlog.

Below is Hardwick Engineering's primary organizational chart.



A summary of qualifications for some select Hardwick Engineering team members is as follows:

Eric Hardwick, P.E. is the owner and principal of Hardwick Engineering with 20 years of experience including design work for DOE Nuclear facility projects, heavy industrial manufacturing including glass and metals production, water/wastewater systems, commercial building electrical systems, emergency system, photovoltaic systems, power system analysis, and arc flash analysis. Mr. Hardwick is currently licensed in Arizona, California, Idaho, and Washington. Mr. Hardwick is the primary point of contact for Hardwick Engineering projects.

Magnus Lind, PHD, P.E. is a professionally licensed engineer in Utah and Washington with over 30 years' experience covering power system analysis and design, computer simulations, instrumentation, PLC and microprocessor based programming, and commissioning. Mr. Lind provides support on medium and high voltage designs for new and existing substations.



Mr. Timothy Boss has a BSEE with over 40 years' extensive design, operations, and maintenance experience in the electric utility industry involving fossil fuel and nuclear power plants, switchyards, substations, and T&D. Mr. Boss provides support for design activities of power generation, transmission and distribution meeting NERC requirements.

William Hannah, P.E. is a professionally licensed electrical engineer in Arizona and New Mexico and retired license in Nevada with over 20 years' extensive experience in the electric utility industry and 20 years in providing consulting design service for industrial, mining, municipal, and architectural projects. Mr. Hannah provides support for design activities of power, instrumentation, and control systems, construction observations, field instrumentation configurations, equipment data collection, and other field support activities as need.

Dale Haakinson is a Senior I&C Designer with 20 years of Navy nuclear submarine experience, and over 10 years design experience in control systems for industrial and water/wastewater projects. Mr. Haakinson provides support for design activities of power, I&C, construction observations, field instrumentation configurations, equipment data collection, and other field support activities as need.

William Jenkins is a Senior Electrical and I&C Designer with over 20 years' experience in power and control systems for industrial and water/wastewater projects. Mr. Jenkins provides support for design activities of power, I&C, construction observations, field instrumentation configurations, equipment data collection, and other field support activities as need.

John Moreno is a Senior Electrical Designer with over 30 years' experience in building systems for commercial and industrial projects. Mr. Moreno provides support for design activities of power, construction observations, equipment data collection, and other field support activities as need.



## Services Offered

### Design Services for Commercial Projects

- Electrical Site Plans
- Electrical Single Line Diagrams
- Schematic Diagrams
- Connection/Wiring Diagrams
- Lighting Plans
- Photometric Plans
- Grounding Plans
- Communication Plans
- Fire Alarm Plans
- Security Plans
- Emergency Systems
- Photovoltaic Systems

### Design Services for Industrial / Manufacturing Facilities

- MV & HV Substations and Switchyards
- Material Handling Control Systems
- Machine Automation Systems
- Power Distribution Systems
- Standby and Emergency Systems
- Communications Systems
- Security Systems
- Instrumentation and Control Systems
- P&IDs
- Loop Diagrams
- SCADA
- Hazardous Classified Area Evaluations
- Control Panel Design

### Design Services for Nuclear Industry

- Class 1E Power and Raceway Systems
- Specifications for Safety System
- Equipment
- Commercial Grade Dedication
- DOE nuclear standards
- Safety Analysis

### Design Services for Water / Waste Water

- Valve Vaults
- Pressure Reducing Vaults
- Reservoirs
- Well Sites
- Lift Stations
- Pump Stations
- Water Treatment Facilities
- Waste Water Facilities
- Power systems
- Instrumentation and Controls
- SCADA systems

### Consulting Services

- Energy Analysis and Audits
- Power System Studies
- NERC Compliance
- AC & DC System Arc Flash Analysis
- NEC Code Analysis
- Hazard Analysis
- Design Review
- QC/QA Review
- Cost Estimates
- Bid Evaluations
- Product Reviews
- Value Engineering
- Patent Search
- Training

### Construction / Integration Services

- Construction Project Management
- Special Inspections
- Submittal Reviews
- Field Observations
- PLC Programming
- HMI Programming