Nevada Irrigation District

Staff Report

for the Board of Director's Meeting, May 11, 2016

TO: Board of Directors

FROM: Gary D. King, Engineering Manager
Adrian Schneider, Senior Engineer

DATE: May 4, 2016

SUBJECT: **Chicago Park Powerhouse Voltage Regulator Upgrade – d'Heurle Systems Contract**

ENGINEERING

RECOMMENDATION:
Award contract to d'Huerle Systems Incorporated for the Chicago Park Powerhouse Upgrade Project in the amount of $167,430.76, and authorize the General Manager to execute the necessary documents.

BACKGROUND:
The Chicago Park Powerhouse (Powerhouse) is one of the District's seven powerhouses with a capacity of 39 megawatts and was brought on line in 1966. Portions of its older components need to be upgraded to match current technologies and therefore; eliminate reliability deficiencies, support current maintenance and troubleshooting capabilities, and improve operational ease and monitoring.

The District received a proposal for upgrading the Powerhouse's voltage regulator (excitation system) from d'Heurle Systems on April 21, 2016. The project is under a concise timeline in order to replace the equipment during the September 2016 annual outage of the Powerhouse. The District has sole-sourced this project to d'Heurle Systems based on past proven performance and experience on other District hydroelectric projects. d'Huerle Systems will be working with Basler Electric company to provide the District with the newest standardized equipment for this project.

The proposal/contract amount is for $167,430.76 and includes design, procurement, and construction support for the project. In order to meet the September outage deadline, and to ensure the completion of this project, staff recommends that the Board approve the contract amount for $167,430.76.

BUDGETARY IMPACT:
The project is currently budgeted in the Hydroelectric capital budget as Powerhouse Upgrades in the amount of $800,000.

Attachments: d'Heurle Systems Incorporated proposal dated April 21, 2016.

d'Heurle Systems
INCORPORATED
Water / Power / Control
P.O. Box 1219
Colfax, CA 95713
cell: **530-205-5089**
home: 530-346-2307
e-mail: adheurle@msn.com
Electrical Contractor C10 #895917

April 21, 2016

Nevada Irrigation District
Yuba/Bear Project
28311 Secret Town Rd.
Colfax, CA 95713

Attn: Mr. Keane Somers
Mr. Phil Nedved
Mr. Tom Kluge

Re: **Chicago Park PH, Excitation System Upgrade**
dHSI Project Quotation PQ16007A

Gentlemen:

Thank you for this opportunity to bid on the Chicago Park PH Static Excitation System Upgrade.

Justifications for the project include:

- The existing excitation system has had reliability problems.
- Service and support for the existing system is problematic:
  > the interface for troubleshooting by NID staff is not user friendly,
  > no local technical expertise available,
  > service from the OEM has been unsatisfactory in the past.
- WECC performance testing required every 5 years requires OEM technician on-site..
- Improved ease of tuning, testing, and troubleshooting with Basler.
- Local availability of technicians with Basler excitation expertise
- Standardization of switchboard excitation controls exposed to NID Operators.

The Bowman PH generator is rated 44 MVA, 39MW 11.5kV, 0.90PF, 2209 Amps AC, 60Hz, 300RPM with main field excitation rated 585ADC at 250VDC, 304ADC. The existing rotating exciter is intended for re-use and is requires 12ADC at 28VDC at rated power (determined by field testing). The existing excitation controller manufacturer is Turbine Control Service Associates.

The proposed static excitation control system improvement includes:

- Re-use of existing rotating exciter. Conversion to a static excitation system is not proposed.
- Power for excitation will continue to be derived from the station service 208/120V panel. Therefor there will be no improvement of the black-start capability of the unit.
- A complete new cabinet, sized to fit in the location of the existing control cabinet without modifications to walls or structure will be custom manufactured, factory wired and tested by Basler.
- Basler Electric DECS-250N excitation control system in redundant configuration. The two DECS-250N will be mounted internally to the excitation panel. A color touch-screen human-machine interface, Basler "IDP-801," will be door mounted facing the control room.

- The DECS-250N includes a full-wave (6-SCR) AC-DC rectifier bridge capable of negative forcing. They are rated for 20ADC output and will be minimally stressed at the 12ADC required for maximum unit MVA operation.
- The system will include redundant over-excitation protection separate and independent of the over/under excitation limiting provided by the DECS-250Ns. (Under-excitation protection is independently provided by the station 40 “loss of field” relay.) Excitation system limiting functions include Volts per Hertz (V/Hz) limiting. Excitation limiting active will be indicated to switchboard lamps and to station RTU.
- Fully automatic start-up and control under AUTO including voltage matching to line for improved speed and reliability of unit synchronization.
- Manual operation under “Field Current Regulation” (FCR) is available for emergency operation in the event of AVR system or potential transformer (PT) trouble.
- DECS-250N monitoring of the main field voltage and current is proposed with the addition of a Basler analog input module AEM-2020.
- A Basler “crowbar and de-excitation system” is included for enhanced generator protection. The existing system is currently hardwired between the commutator of the rotating exciter and the slip-rings of the main field. The proposed device will be cabinet mounted and will require cabling of the main field current from inside the air housing to the crowbar system cabinet. This feature is optional and easily eliminated from the proposal if desired. It could be retrofitted at a later date.
- Power system stabilizer (PSS) is included in this proposal, and is recommended to assure compliance with PG&E, WECC, NERC, and FERC. PSS hardware features is included in the hardware price, and PSS engineering support subcontracted to Kestrel Engineering by Basler is listed separately. A new station alarm point for PSS not active when required will be integrated with RTU and SCADA.
- Integration of Modbus serial digital communications between facility RTU and DECS-250Ns is not included, but could be provided by extra or future work.

d’Heurle Systems Incorporated integration work includes:

- Reuse of existing excitation rotating exciter, generator field slip rings and brush assemblies, field power conductors, and existing generator and line instrument transformers (PTs and CTs).
- The excitation system cabinet shall be replaced by a new Basler-manufactured and tested cabinet, sized to fit in the existing cabinet location..
- Engineering design shall be provided for complete integration of the new Basler excitation system with the powerhouse main control switchboard. Design and integration shall include start, normal and emergency stop, field flashing, raise/lower, local manual, local automatic, and remote control. Design shall include CAD re-drafting of all affected powerhouse electrical elementary, wiring diagrams, electrical plan, cable and conduit schedules. Redesign and refurbishment of control switchboard circuits for proper operation with the new excitation system is included. Submittal of drawings for review and approval prior to construction is included. Record drawings shall be submitted after commissioning.
- Proposed new features for switchboard upgrade include:
  Modifications to existing control switches for Excitation Control Mode, Excitation on/off, and Excitation raise/lower. Switchboard meters for main field volts and amps shall be reused. The existing excitation null balance meter “voltage regulator output balance” will be demolished and replaced with a blank plate.
- Bill of material (BoM) for miscellaneous materials for procurement by NID or separate resale by dHSI. Anticipated required hardware includes control switches and meters for

switchboard, miscellaneous wire and wiring supplies, cable and conduit for connection of the main field DC to the crowbar/de-excitation panel.
- Demolition and refurbishment to be performed during a pre-scheduled outage. Field construction work shall be by NID Electricians and Electrical Technicians working under dHSI engineering supervision.
- A commissioning test plan will be provided. Commissioning shall be performed by dHSI in coordination with NID staff. Commissioning shall include tuning and calibration excitation system gains, limiters, and protection functions. Operational tests shall include synchronizing, offline and online disturbance step responses, and load rejection.
- dHSI will provide field technician expertise and coordination with Kestrel Engineering (offsite) for satisfactory modelling and commissioning of the PSS feature..
- Two sets of Operations and Maintenance Manuals shall include a system summary and control narrative, Manufacturers' O&M data, record versions of all engineering drawings, commissioning test reports, configuration data, and project design validation checklist.
- Proposal includes one day for Operator and Technician training.

d'Heurle Systems Incorporated work excludes
- Craft electrical and rigging labor for onsite installation, to be provided by NID staff.
- Procurement of miscellaneous electrical and control hardware to be determined under design.
- Programming of NID or PG&E SCADA.
- Assumption of engineering responsibility for changes to dHSI's design by others. dHSI requests that NID staff respect dHSI's direction of and assumption of engineering responsibility for the work.

A proposed project schedule is attached. dHSI and Basler are confident that if NID can authorize notice to proceed by May 11, 2016, the project can be installed and commissioned during NID's scheduled outage Sept. 11-23, 2016.

Payment schedule:
1. 20% Basler materials total upon notice to proceed (net 30 days).
2. 30% Basler materials total upon approval of drawings (net 30 days).
3. 50% Basler materials total upon receipt of materials (net 30 days).
4. dHSI and PSS engineering costs billed monthly T&M (net 30 days).

Contract terms shall be in accordance with the existing NID-dHSI Consulting Master Services Agreement. Warranty terms on materials resold by dHSI shall be in accordance with the manufacturers' standard warranty terms, typically 1 year from date of delivery. dHSI mark-up on Basler materials is 15%, consistent with the 15% system integrator's discount provided by Basler to dHSI. dHSI mark-up on services is 10% in accordance with the NID-dHSI CMSA.

No extra work shall be provided by dHSI except with prior written approval by NID. Costs for any extra work shall be according to the existing NID-dHSI Consulting Master Services Agreement cost schedule.

The proposed T&M-NTE cost including sales tax and freight is $ 231,530.32 .

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Quotation is valid for 60 days and is offered on a time and materials, not-to-exceed (T&M NTE) basis. Attached cost breakdowns are provided for information only.

Please do not hesitate to call if you have any comments or questions.

Best regards,

Al d'Heurle, PE
Mechanical & Control Systems Engineer

Attachments:

- Proposed project schedule.
- Price breakdown for reference.
- Basler quotation 852448 (materials)
- Basler materials terms & conditions
- Basler 2016 PSS Engineering Services (Kestrel Engineering)
- Basler 2016 Commissioning Assistance Estimate

	2016 week of:	4/18	4/25	5/2	5/9	5/16	5/23	5/30	6/6	6/13	6/20	6/27	7/4	7/11	7/18	7/25	8/1	8/8	8/15	8/22	8/29	9/5	9/12	9/19	9/26	10/3	10/10
					1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20			
PQ16007A NID CP Excitation																											
	Basler Quote	x																									
	dHSI Quote	x																									
	NID PO & downpayment to Basler		x	x	x																						
	Basler engineering & submittal					x	x	x	x																		
	NID/dHSI approval & 30% payment to Basler								x	x																	
	Basler manufacturing									x	x	x	x	x	x	x	x	x	x	x	x						
	Basler shipping																					x					
	dHSI 50% engineering							x	x	x	x	x															
	dHSI 90% engineering												x	x	x												
	dHSI 100% engineering & test plan															x	x										
	Procure misc hardware (NID)														x	x	x	x	x	x	x						
	CP PH outage & installation																						x	x			
	record documentation & training																								x	x	x
	DF2 Outage																						x	x	x		

d'Heurle Systems Incorporated
PO Box 1219
Colfax, CA 95713

530-205-5089 adheurle@msn.com

Quote

Date	dHSI Project Quotation
4/22/2016	PQ16007A

To:

Nevada Irrigation District
Accounts Payable
1036 West Main Street
Grass Valley, CA 95945-5424

Project
PQ16007 NID CP Excitation

California Electrical Contractor
C-10 License No. 895917

Line No.	Item	Description	Qty	Cost	Total
1	Materials for Resale	Basler Dual DECS Exciter Field Excitation System for Chicago Park Power House Ref Basler Quote SQ 852448 line 1	1	86,480.00	86,480.00T
2	BAS AEM-2020	Basler AEM-2020 Analog Expansion Module Ref Basler Quote SQ 852448 line 3	1	3,690.35	3,690.35T
~~3~~	~~Materials for Resale~~	~~Basler Main Field Crowbar and De-Excitation System~~ Ref Basler Quote SQ 852448 line 4	~~1~~	~~59,627.50~~	~~59,627.50T~~
4	Freight Out	Drop ship Basler to NID, including insurance	1	3,000.00	3,000.00
5	Engineer Sr.	Sr. Engineer / Technician, Al d'Heurle: design, correspondence, meeting attendance, test plan, on-site construction and commissioning supervision, record documents, staff training.	130	200.00	26,000.00
6	CAD Draftsman	AutoCAD draftsman / Technician, Josh Chambers	100	80.00	8,000.00
7	Travel time	Al d'Heurle 18 trips to PH 1 hour/trip	18	100.00	1,800.00
8	Travel time	Josh Chambers 14 trips to PH 1 hour/trip	14	60.00	840.00
9	Mileage	no charge	0	0.54	0.00
10	Subcontract - Engine...	Basler 2016 Power System Stability Engineering Services (Kestrel engineering)	1	15,787.63	15,787.63
11	Subcontract - Engine...	Basler 2016 Commissioning Assistance Estimate dHSI & Subcontract-Engineering billed monthly on a time & materials basis. Basler Materials billed : 20% net 30 invoiced immediately upon NID PO. 30% net 30 invoiced upon Basler design approval. 50% net 30 days upon delivery.	1	15,070.00	15,070.00

Recalculated Sales Tax - ($86,480 x 3,690.35) x 0.075 = $6,762.78

CA Sales Tax: (7.5%)	~~$11,234.84~~
Please do not hesitate to call if you have comments or questions !	**Total** ~~**$231,530.32**~~

Recalculated Total Minus Item 3 - **$167,430.76**

12570 STATE ROUTE 143
HIGHLAND IL 62249-1074 USA
http://www.basler.com, info@basler.com
PHONE 618/654-2341 Operator-assisted Fax 618/654-2341, ext 248 **FAX 618/654-2351**

Power System Control and Protection for the Electric Power Industry

QUOTATION

TO: **d'Heurle Systems Inc.**
PO Box 1219
Colfax, CA 95713

QUOTATION (SQ) No.: **852448**

DATE of QUOTE: **April 19, 2016**

ATTN: Al d'Heurle

REF: NID Dutch Flat 2 and Chicago Park Power Houses

Item	Qty	Description	Price Each

Dual DECS-250N Exciter Field Excitation System for Chicago Park Power House

1 1 **Basler Dual DECS-250N Voltage Regulator System** **US$75,200.00**
with remote control and automatic fault transfer to redundant DECS-250N, consisting of the two DECS-250N, with the other devices itemized below, mounted and wired and tested in a ventilated NEMA 1 type enclosure - to be used on a brush type generator, with exciter's field rating of 12.1 Amperes at up to 27.2 Volts, suitable for operation at temperatures to 40°C at altitudes to 1000 meters.

The quoted system includes:

NEMA 1 type ventilated enclosure, measuring approximately 29" Wide x 90" High x 36" Deep (or not exceeding 52"deep), door hinge on left side, see d'Heurle Systems layout drawing with preferred terminal location and cable entry with:

Dual (2) DECS-250N CP1CN1N <u>installed behind the door</u>,

digital excitation controllers, each with the following features:

Low Input Power Freq. (60Hz)
Power Bridge-20 Ampere Capacity
Voltage Regulation 0.25%, true RMS sensing
Dual Setting Groups
Power System Stabilizer
Generator voltage softstart
Generator to bus voltage matching
Underfrequency limiting
Under excitation limiting
Over excitation limiting
On-Line and off-line modes
Five (5) point plotted limiter curve
Takeover Style
Stator Current Limiter
Field Current Regulator (includes soft-start also)
Field Voltage Regulator
Var and Power Factor Regulator

Item	Qty	Description	Price Each

DECS-250N Features, Continued:

Var Limiter
Stator Voltage Limiter
Metering, real time at local LCD or at personal computer
Preposition setpoints (maintain or release)
Setpoint position indication
IRIG-B Time Synchronization
Communication
- RS-485 port (ModBus™) USB Port
- Modbus™ RTU
- CANBUS
- Ethernet (ModBus™ TCP 100 base T)

Protection
- Generator over/under voltage (27/59)
- Generator Reverse Power (32R)
- Generator Reverse Vars (40Q)
- Generator over/under frequency (81 O/U)
- Field over current (51F)
- Field over voltage (59F)
- Rotating Diode Fault Detector (ripple detector)
- Failure to build voltage
- Loss of voltage sensing
- Configurable Protection Elements (eight) via BESTCOMS*Plus software*

Control
- Front panel keypad switches
- Provisions for external hardwired contacts and switches

BESTCOMS*Plus* Software – compatible with MS Windows™ with features including:
- Oscillography (COMTRADE compatible)
- Sequence of Events Recording
- Real-Time Metering Analysis
- Trending (up to six parameters)
- Integrated Programmable Logic Screens
- Self-Tuning for AVR Gain Parameters

Transfer Logic for Redundant DECS-250N Units (Modicon PLC) for selecting Main / Standby Regulator

IDP-801 HMI installed in door,
Ethernet Switch

Sequencing Relays
On/Off Control Interface
Auto/Manual Transfer Control Interface

Contacts wired for remote annunciation:
On/Off
"Exciter Transferred to backup DECS on Failure of primary DECS"
DECS-A Failure
DECS-B Failure
DECS A/DECS B selected active
Extended Over-Excitation Indication

Item	Qty	Description	Price Each

DECS-250N Pan-Chassis Description, continued

AC/DC power modules (208 Vac station power, 125 Vdc batteries)
Overexcitation Protection
Independent ES-74S 7MB0G4N0 (definite time characteristic) Forcing Alarm
Independent ES-74S 7MC0G4N0 (inverse time characteristic) relay for 86 lockout
Provisions for Remote Metering:
Shunt, 20 Ampere / 50 mV
Provisions for Remote Operation:
Start/Stop
Auto/Manual, reset to AVR mode
Setpoint Adjustment, raise/lower
DECS-A/DECS-B Select
Reset to Normal
Local Door Mounted Switches,
DECS Lead-backup selector switch (Electroswitch series 24)
Reset Pushbutton (Basler Standard)
Local Door Mounted Lamps
DECS A Active (GE#ET16 LED amber)
DECS B Active (GE#ET16 LED amber)
DECS-250N Crowbar Fired
Dry contacts, 125 Vdc rated, for interface with station switchboard:

- Trip to 86E (instantaneous trip) two contacts
- Trip to 86N unit shutdown with trip at no-load) two contacts
- Excitation non critical alarm, one contact

Note: customer to specify which indication for each

Thermostat, 120 V Heater, Light and Convenience Outlet
Control Power Transformer, 208:120V 1 phase, for space heater, light and convenience outlet, etc.
Redundant 24 Vdc Power for auxiliary devices (for IDP-801, ES relays, PLC, etc.)
Phoenix #RT5 terminal blocks, (p/n 42899)
Internal wiring non insulated ring tongue lugs where practical
Power Potential Transformer, (Excitation Power) designed for mounting in the bottom of the excitation enclosure.
4000 VA, Three Phase, 60 Hz
Primary: wye 208 Vac with fuses
Secondary: delta 120V

Standard Factory Tests

One Set DECS-250N BESTCOMS Software – compatible with Windows™
Final Documentation:
Three (3) Printed Sets Instruction Books with “As-Built” Drawings
One (1) CD of all Documentation/Drawings

Item	Qty	Description	Price Each

Dual DECS-250N Exciter Field Excitation System for Dutch Flat 2 Power House

2 1 **Basler Dual DECS-250N Voltage Regulator System** **US$68,500.00**

with remote control and automatic fault transfer to redundant DECS-250N, consisting of the two DECS-250N, with the other devices itemized below, mounted and wired and tested in a ventilated NEMA 1 type enclosure - to be used on a brush type generator, with exciter's field rating of 12.2 Amperes at up to 16.3 Volts, suitable for operation at temperatures to 40°C at altitudes to 1000 meters.

The quoted system includes:

NEMA 1 type ventilated enclosure, measuring approximately 29" Wide x 90" High x 36" Deep (or not exceeding 52"deep), door hinge on left side, see d'Heurle Systems layout drawing with preferred terminal location and cable entry with:

Dual (2) DECS-250N CN1CN1N <u>installed behind the door</u>,

digital excitation controllers, each with the following features:

- Low Input Power Freq. (60Hz)
- Power Bridge-20 Ampere Capacity
- Voltage Regulation 0.25%, true RMS sensing
- Dual Setting Groups
- Generator voltage softstart
- Generator to bus voltage matching
- Underfrequency limiting
- Under excitation limiting
- Over excitation limiting
  - On-Line and off-line modes
- Five (5) point plotted limiter curve
  - Takeover Style
- Stator Current Limiter
- Field Current Regulator (includes soft-start also)
- Field Voltage Regulator
- Var and Power Factor Regulator
- Var Limiter
- Stator Voltage Limiter
- Metering, real time at local LCD or at personal computer
- Preposition setpoints (maintain or release)
- Setpoint position indication
- IRIG-B Time Synchronization
- Communication
  - RS-485 port (ModBus™) USB Port
  - Modbus™ RTU
  - CANBUS
  - Ethernet (ModBus™ TCP 100 base T)
- Protection
  - Generator over/under voltage (27/59)
  - Generator Reverse Power (32R)
  - Generator Reverse Vars (40Q)
  - Generator over/under frequency (81 O/U)
  - Field over current (51F)
  - Field over voltage (59F)

Item	Qty	Description	Price Each

Rotating Diode Fault Detector (ripple detector)
DECS-250N Features, Continued:
Protection
Failure to build voltage
Loss of voltage sensing
Configurable Protection Elements (eight) via BESTCOMS*Plus software*
Control
Front panel keypad switches
Provisions for external hardwired contacts and switches
BESTCOMS*Plus* Software – compatible with MS Windows™ with features including:
Oscillography (COMTRADE compatible)
Sequence of Events Recording
Real-Time Metering Analysis
Trending (up to six parameters)
Integrated Programmable Logic Screens
Self-Tuning for AVR Gain Parameters
Transfer Logic for Redundant DECS-250N Units (Modicon PLC) for selecting Main / Standby Regulator
IDP-801 HMI installed in door,
Ethernet Switch
Sequencing Relays
On/Off Control Interface
Auto/Manual Transfer Control Interface
Contacts wired for remote annunciation:
On/Off
"Exciter Transferred to backup DECS on Failure of primary DECS"
DECS-A Failure
DECS-B Failure
DECS A/DECS B selected active
Extended Over-Excitation Indication
AC/DC power modules (208 Vac station power, 125 Vdc batteries)
Overexcitation Protection
Independent ES-74S 7MB0G4N0 (definite time characteristic) Forcing Alarm
Independent ES-74S 7MC0G4N0 (inverse time characteristic) relay for 86 lockout
Provisions for Remote Metering:
Shunt, 20 Ampere / 50 mV
Provisions for Remote Operation:
Start/Stop
Auto/Manual, reset to AVR mode
Setpoint Adjustment, raise/lower
DECS-A/DECS-B Select
Reset to Normal
Local Door Mounted Switches,
DECS Lead-backup selector switch (Electroswitch series 24)
Reset Pushbutton (Basler Standard)

Item	Qty	Description	Price Each

DECS-250N Pan-Chassis Description, continued

Local Door Mounted Lamps
DECS A Active (GE#ET16 LED amber)
DECS B Active (GE#ET16 LED amber)
DECS-250N Crowbar Fired

Dry contacts, 125 Vdc rated, for interface with station switchboard:

- Trip to 86E (instantaneous trip) two contacts
- Trip to 86N unit shutdown with trip at no-load) two contacts
- Excitation non critical alarm, one contact

Note: customer to specify which indication for each

Thermostat, 120 V Heater, Light and Convenience Outlet

Control Power Transformer, 208:120V 1 phase, for space heater, light and convenience outlet, etc.

Redundant 24 Vdc Power for auxiliary devices (for IDP-801, ES relays, PLC, etc.)

Phoenix #RT5 terminal blocks, (p/n 42899)

Power Potential Transformer, (Excitation Power) Similar to BE34399-001 except designed for mounting in the bottom of the excitation enclosure.
4000 VA, Three Phase, 60 Hz
Primary: wye 208 Vac with fuses
Secondary: delta 120V

Standard Factory Tests

One Set DECS-250N BESTCOMS Software – compatible with Windows™

Final Documentation:

Three (3) Printed Sets Instruction Books with "As-Built" Drawings

One (1) CD of all Documentation/Drawings

Optional Analog Expansion Module for Monitoring Generator Field Voltage and Current

3	ea	**AEM-2020 Analog Expansion Module,** mounted and wired in the enclosure of Item 1 or 2, to monitor the generator field voltage and current using existing dc shunt in the generator field.	**US$3,209.00**

Preliminary Spare Parts for Item 1 and 2 DECS 250N Systems

Qty	Description	Price Each
1	**DECS-250N CP1CN1N Digital Excitation Controller (w/PSS)**	**US$19,215.00**
or		
1	**DECS-250N CN1CN1N Digital Excitation Controller (no PSS)**	**US$11,715.00**
1	**ES-74S** 7MB0G4N0**, Extended Field Over Current Relay**	**US$188.00**
1	**ES-74S** 7MC0G4N0**, Extended Field Over Current Relay**	**US$384.00**

Item	Qty	Description	Price Each

Dutch Flat 2 and Chicago Park Power House Crowbar and De-Excitation System, Similar in function to 9467600102

4 2 **Main Field Crowbar and De-excitation System** **US$51,850.00**

A main field de-excitation module for use when de-energizing the generator field rated up to **250 volts** and **500 amps**.
NEMA1 enclosure measuring approximately 30"W x 90"H x 30"D, with hinges on left side. Estimated weight of 1300 lbs. containing:
De-Excitation module
Crowbar Module
Single pole DC contactor (rated 750 Vdc, 1800 amp)
Field discharge resistor
Main Field Shunt (100mv 500A)
Test Fault (Press to test light)
Reset (Pushbutton switch)
Relays/designations:
41-EX2
41-EY2
41-EC2
41-ET2
K47
DX/CB Inactive
DX/CB Active
DX/CB Fired
Field Breaker Position
Cabinet-mounted "Push to Test" Indicating Lights (GE #ET16 LED) Labeled :
Breaker Closed - Red LED
Breaker Open – Green LED
Fault - Blue LED
Thermostat, 120 Vac space heater and convenience outlet
208:120 single phase control power transformer for heater

Optional Generator Protection Relay

5 each **BE1-11g Generator Protection Relay** **USD$3,105.00**

Style Selection of BE1-11g **6D1M0J1P0E000**
Shipped Loose,
With: Dual 5A CT inputs, 48/125 V control power input, Modbus RS 485 Communications, ***Current Differential Protection (87),*** and Normally open output contacts
One Set BESTCOMS*Plus* Software – compatible with Windows™

Style Selection Note: *Other optional features are available for this relay. For full feature descriptions, BE-11g bulletin URJ can be found at* *www.basler.com/downloads*

Item Qty Description Price Each

Dutch Flat 2 Machine Data from APPENDIX SPECIFICATION DATA SHEET:

Hydro Generator: 26 MVA, 24 MW, 6900V, 60 Hz

Exciter Field Full Load Excitation tested 3/2/16 @ 12.2 Adc, 16.3 Vdc

Generator Field Full Load Excitation: tested 3/2/16 @ 370 Adc, 150 Vdc

208 Volt, 3 Phase Station Power; 125 Vdc Station Batteries

Chicago Park Machine Data from APPENDIX SPECIFICATION DATA SHEET:

Hydro Generator: 44 MVA, 39 MW, 11500V, 60 Hz

Exciter Field Full Load Excitation tested 3/2/16 @ 12.1 Adc, 27.2 Vdc

Generator Field Full Load Excitation: tested 3/2/16 @ 440 Adc, 165 Vdc

208 Volt, 3 Phase Station Power; 125 Vdc Station Batteries

Project Milestone	Weeks	Explanation
Engineering Drawing Creation	4	Approval drawings for submittal can be created in approximately 4 weeks ARO, and will consist of system interconnection diagram, excitation cubicle outline, and transformer enclosure outline (if ordered) drawings.
Customer Drawing Review & Approval	2	The quoted lead-time anticipates customer approval notification within 2 weeks of drawing submittal. System design and/or manufacturing will remain on hold until customer approval is received. If the approval process extends beyond 2 weeks, Basler Electric reserves the right to re-evaluate quoted shipping schedule based on manufacturing backlog.
System Manufacturing Process	12	Based on current production backlogs and material procurement lead times, systems can typically be manufactured in 12 weeks after engineering designs are released to the factory.
Total Time ARO (After Receipt of Order) Estimate	**18**	**This total 18-week time covers the Drawing Creation, Customer Review/Approval, Procurement, and Manufacturing Processes. Please contact Basler if shorter lead times are required.**

Item	Qty	Description	Price Each

Delivery: Delivery will be made FOB Seller's manufacturing plant, title and risk of loss shall pass to Buyer at that point, freight collect.

Standard Shipping: This proposal includes Basler Electric's standard cubicle system packaging for shipment within North America (pallets, shrink wrapping, hex-comb cornered, full tarp covered for road shipment). Please note packaging may vary for shipped loose or chassis items, contact Basler for details. Any other special requested packaging requirements may be subject to re-quote and must be specified at time of order. Changes requested less than 2 weeks from ship date may be subject to scheduling changes and/or price adjustments.

PSS Tuning: In accordance with Section 9.3 of the Field Service Terms, Conditions, and Rates **Form No. FA100006**, if this quotation includes Power System Stabilizer (PSS) tuning, the attached PSS data collection form must be completed and submitted to Basler Electric Company 30 days prior to the requirement of such tuning.

Field Service: Field service is not included with the price of the equipment. Attached you will find a copy of Basler Electric's current *FIELD SERVICE TERMS AND CONDITIONS*, Form № FA100006, for on-site technical support pertaining to services limited to Basler Electric equipment. These terms and conditions are subject to change without notice. The attached copy of Form № FA100006 may vary from the applicable terms and conditions in force at the time your service work on-site is actually required. All Field Service requests shall be sent to Basler Electric's Sales and Customer Service Department in Highland, IL, USA.

Terms and Conditions: Basler Terms and Conditions **Form No. FA100001** apply to this quotation. All prices are quoted in United States Dollars (US$). Quoted price is based on current costs of raw material and purchased parts. Due to the present state of unprecedented instability of these costs, adjustments to the selling price may be required on production releases. The unit price for equipment included in this quotation is valid for 60 days from the date of issuance. If this quotation includes an ESTIMATE for field service work, please note that the ESTIMATED price is not fixed, and those rates are subject to change dependent upon the date the service is actually required.

Progress payments will be required. Please contact Basler Electric for details.

Your Basler Sales Rep is:

Mr. Tom Ribar
Associated Power Solutions
2500 Old Crow Canyon Rd Ste 520
San Ramon, CALIFORNIA 94583-1627
Phone: 925.820.8102
Email: tribar@aps-power.com

TERMS AND CONDITIONS OF SALE

1. **ACCEPTANCE:** All quotations are valid for 30 days unless otherwise stated. For the purpose of these terms and conditions "Seller" includes Basler Electric Company and its wholly owned subsidiaries (Basler Plastics, LLC; Basler Electric Company (Singapore) PTE. LTD). The nature of our business is such that we handle for our customers a large number of orders, many of which specify terms and conditions which would add to, or differ from, those set forth herein. To negotiate individually with respect to these terms and conditions, which vary from customer to customer, would seriously interfere with our service to all our customers. Consequently, notwithstanding any terms or conditions which may appear on the Buyer's order, Seller products are offered for sale only, on the conditions and terms contained herein. Acceptance of Buyers' order is made only on the expressed understanding and condition that insofar as the terms and conditions of this acceptance, quotation or acknowledgement conflict with any terms and conditions of Buyer's order, the terms and conditions of this document shall govern irrespective of whether the Buyer accepts these conditions by a written acknowledgement, by implication or acceptance and payment of goods hereunder. Seller's failure to object to provisions contained in any communications from Buyer shall not be deemed a waiver of the provisions of this document.

2. **COMPLIANCE WITH LAWS:** Seller, to the best of his knowledge and belief, is complying with all State and Federal laws, orders and regulations applicable to the manufacture of the articles ordered.

3. **PRICES:** The price of any article, is subject to increase by Seller, until the goods are ready for shipment unless otherwise agreed to by Seller in writing. All prices quoted are based upon current labor, raw material and purchased parts prices and will be reviewed and prices are subject to change at the time of shipment unless otherwise agreed to in writing by Seller.. Prices are Ex - Works Seller's manufacturing plant or shipping point, unless Seller otherwise specifies. Additional services are subject to charge at Seller's standard rates. Prices include ordinary packing only, unless otherwise specified in writing by Seller.

4. **TRANSPORTATION AND DELIVERY:** Unless Seller otherwise specifies, delivery will be made Ex Works manufacturing plant or shipping point, title and risk of loss shall pass to Buyer at the point freight collect. Seller shall have the right to change means of transportation and to route shipment when specific instructions are not included with Buyer's order. When Buyer's shipping instructions are vague, such as "ship best way" or "ship cheapest way", Seller shall not accept nor be responsible for any claims for alleged excess transportation cost. Seller shall have no liability whatsoever nor shall this order be subject to cancellation for delays in delivery due to act of God, civil or military riot or commotion, strikes, labor disturbance, vandalism, fire, war, insurrection, transportation, weather, federal, state or municipal orders and directions, default of supplier or subcontractor or due to any other cause beyond Seller's control. In such an event or events causing delay for any such cause, the specified delivery date shall be extended for a reasonable length of time but not less than the period of delay.

5. **SPECIFICATIONS:** All drawings, plans, specifications, additions and change orders must be in writing furnished by Buyer subject to acceptance and approved by Seller.

6. **TERMS OF PAYMENT:** All orders are net thirty days from date of shipment by Seller on approved credit If credit is not granted Seller may require progress payments and/or cash in advance; interest of 1-1/2% per month on billings will be charged on all past due accounts until paid. All expenses of collection shall be paid by Buyer, including costs and reasonable attorney's fees.

7. **LIMITED WARRANTY POLICY:** Seller warrants that Articles sold hereunder to be free from defects in material and workmanship. THESE EXPRESS WARRANTIES ARE THE SOLE WARRANTIES OF SELLER AND ANY OTHER WARRANTIES, EXPRESSED, IMPLIED IN LAW OR IMPLIED IN FACT ARE HEREBY SPECIFICALLY EXCLUDED. Seller's sole obligation under its warranty shall be, at its option, to either issue a credit, or repair or replace any article or part thereof, which is proved to be a warrantable item. Any adjustment of credits will be based upon original billing prices. Warranties for products are 18 months from the date of shipment by Seller unless otherwise specified in other written communications from Seller. Notice of claimed breach of warranty must be given within the applicable period. No allowances shall be made to Buyer for any transportation, duties, brokerage fees, labor costs or parts adjustments or repairs, or any other work, unless said charges are authorized in writing, in advance, by Seller. SELLER SHALL IN NO EVENT BE LIABLE FOR SPECIAL OR CONSEQUENTIAL DAMAGES OR FOR LOSS OF PROFIT. If any article is claimed to be defective in material or workmanship, Seller, upon notice promptly given will either examine the Articles at its site, or issue shipping instructions for return to Seller. The warranty shall not extend to any Articles or parts thereof which have been installed, used or serviced, other than in conformity with Seller's applicable specifications, manuals, bulletins, or instructions, or, if none, shall have been subjected to improper installation, misuse or neglect. The warranties shall not apply to any materials or parts thereof, furnished by Buyer, or acquired from others at Buyer's request and/or to Buyer's specifications or designs. THE FOREGOING LIMITATIONS ON SELLER'S LIABILITY IN THE EVENT OF BREACH OF WARRANTY, SHALL ALSO BE THE ABSOLUTE LIMIT OF SELLER'S LIABILITY IN THE EVENT OF SELLER'S NEGLIGENCE IN MANUFACTURE, INSTALLATION, SERVICE OR OTHERWISE, WITH REGARD TO THE ARTICLES COVERED HEREBY; AND UPON THE EXPIRATION OF THE STATED WARRANTY PERIOD, ALL SUCH LIABILITIES SHALL TERMINATE. Seller warrants only those Articles which are custom designed based upon Buyer's specifications, specifically for Buyer, to be fit for the particular purpose identified by Buyer, in writing, for a period set forth on the front page of this document or on our quote. In no event shall Seller be liable for special or consequential damages or loss of profit respecting said Articles and Seller's sole obligation shall be to either issue a credit or to repair or replace said article or part thereof.

8. **NUCLEAR USE:** Products produced and sold by Seller are commercial grade products and as such products produced and sold hereunder by seller are not intended for use in connection with any nuclear facility or activity, unless specifically identified in writing by Seller. . Seller disclaims all liability, if so used, for any nuclear damage, injury or contamination and buyer shall and does hereby agree to indemnify and hold seller and its representatives and employees, its successors, assigns and customers, harmless, including damages, expenses, attorneys fees and cost of defense or otherwise caused by or resulting from reason of such use.

9. **ORDER CHANGES:** Buyers shall have the right, by giving written notice to Seller, to make changes in the quantity, drawings, designs or specifications for the articles to be manufactured. Upon receipt of any such notice, Seller shall notify Buyer as promptly as possible changes in price of, or the time required for performance of, the order and an equitable adjustment shall be made in the contract price or delivery schedule, or both, prior to incorporating said changes into the manufactured article. Seller reserves the right to accept or reject any requested changes by Buyer

10. **CANCELLATION:** Orders are not subject to cancellation, complete or partial, without Seller's written consent. Any reduction in quantities ordered shall constitute a partial cancellation subject to this clause. Where Seller consents to cancellation, settlement will be made on the following basis: Buyer will pay to Seller, upon delivery, the full purchase price of all articles completed at the time Seller agrees to cancellation. Buyer will further pay to Seller a percentage of the purchase price of all other articles equivalent to the percentage of completion thereof as determined by Seller's normal cost accounting methods. Buyer will also pay the full unamortized cost of materials, dies, tools, patterns and fixtures, made or contracted specifically for Buyer's order. Invoices for all cancellation charges are payable promptly upon presentation. If within sixty (60) days from the presentation of such invoice, Buyer does not instruct Seller as to the disposition of the material, etc. arising from the cancellation, Seller may sell the same, crediting buyer for the proceeds. Buyer will also pay the reasonable cost and expenses incurred by Seller in making a settlement hereunder and in protecting property in which Buyer has an interest. Where United States Government contracts are involved, cancellation shall be in accordance with the appropriate Armed Service's procurement Regulation and contract provisions. Seller will defer manufacture or delivery of any articles only if and to the extent agreed to in writing.

11. **PARTIAL SHIPMENTS:** Seller reserves the right to make and to invoice for partial shipments of completed articles.

12. **CUSTOMER CREDITS AND DEFAULTS:** Accounts are opened only with firms or individuals on approved credit. The Seller reserves the privilege of declining to make deliveries whenever, for any reason, doubt as to the Buyer's financial responsibility develops, and shall not, in such event be liable for non-performance of contract in whole or in part. If Buyer shall fail to pay promptly, when due, any sum owing to Seller, or to perform any agreement under this order or under any other order, heretofore or hereafter placed with Seller or Buyer shall be adjudicated bankrupt or insolvent, or shall make an assignment for the benefit of creditors, or if there shall be instituted by or against Buyer any proceeding under any bankruptcy, reorganization, arrangement, readjustment of debt or insolvency law of any jurisdiction, or for the appointment of a receiver or trustee in respect of any of Buyer's property and if such proceeding shall be instituted against Buyer, and it shall not be dismissed within twenty (20) days, or if Seller shall reasonably believe that Buyer is unable to meet Buyer's debts as they mature, then, and in any such event, Seller may, in addition to exercising any or all other rights that Seller may have, require payment of Cash upon delivery, and Seller may, upon written notice to Buyer at any time, terminate all Seller's obligations under any one or more of such orders. Upon any termination pursuant to this clause, Buyer shall thereupon become obligated to pay to Seller the same sum in respect to each such order as if such order had been cancelled by Buyer with Seller's consent and consent and settlement had been made on the basis set forth in Paragraph 10 of these Terms and Conditions.

13. **TAXES:** Prices do not include any present or future Federal, State or Local sales, use, excise, manufacturing, processing or importation tax, or any other tax or charge, that is or may be imposed on the articles or services covered hereby or on subsidiary articles or material incorporated therein. Any such taxes or charges will be added to the invoices as separate items, unless appropriate exemption certificates are furnished to Seller.

14. **MANUFACTURING POLICY:** Production quantity under-runs will be held to a minimum consistent with accepted industry manufacturing practices.

15. **PATENTS:** Seller will defend any suit or proceeding against Buyer, insofar as it is based on a claim that any article or part thereof furnished by Seller hereunder constitutes an infringement of any patent of the United States, if Seller is notified promptly in writing by Buyer and Seller is given authority, information and assistance from Buyer (at Seller's expense) for the defense or settlement of the same; except if such suit or proceeding shall result from (a) any such article or part was manufactured by Seller in accordance with any design, drawing or specification that is furnished to Seller by or for Buyer, and that is not based on Seller's design, drawing or specification, or (b) alleged infringement arises out of, or is based upon, the use of Seller's article with another article or material, or in a particular manner, not furnished by Seller. If any article or part furnished by Seller does infringe upon a patent, then Seller will, at Seller's expense, and at Seller's option, either (i) procure for Buyer the right to continue using such article or part; (ii) replace it with a non-infringing article or part; (iii) modify it so that it becomes non-infringing, or (iv) refund the purchase price and transportation costs upon return to Seller of the infringing article or part. The foregoing provision sets forth Seller's entire liability for, or resulting from patent infringement or claim thereof..

16. **FORCE MAJEURE:** Seller shall have no liability whatsoever, nor shall this order be subject to cancellation for delays and delivery due to act of God, civil or military riot or commotion, strikes, labor disturbance, vandalism, fire, war, insurrection, transportation, weather, federal, state or municipal orders and directions, default of supplier or subcontractor or due to any other cause beyond Seller's control. In such an event or events causing delay for such cause, the specified delivery date shall be extended for a reasonable length of time, but not less than the period of delay.

17. **Indemnification:** TO THE EXTENT ALLOWED BY LAW BUYER AGREES TO INDEMNIFY AND HOLD HARMLESS SELLER IT'S DIRECTORS, OFFICERS AND EMPLOYEES, FROM AND AGAINST ANY AND ALL LOSSES, CLAIMS, ATTORNEYS' FEES AND EXPENSES ARISING FORM THE NEGLIGENT ACT OR OMISSION OR WILFUL MISCONDUCT OF BUYER RELATED TO THIS AGREEMENT WHICH CAUSES THE DEATH OF, INJURY TO, OR DAMAGE TO THE PROPERTY OF, ANY PERSON

18. **Ownership:** The Products may be covered by one or more patents and copyrights in the United States and other countries. Through Buyer's purchase of the Products, Seller grants to Buyer, and Buyer accepts, a paid-up, royalty-free, non-exclusive, non-transferable license to use the purchased Products, under said patents and copyrights. Seller owns copyrights in any software that is embedded or loaded in the Products, and/or in software provided by Seller for use in conjunction with the Products (collectively "Accompanying Software"). Seller grants Buyer the right to perform and display copyrighted Accompanying Software in conjunction with the use or sale of the Products, but Buyer has no right to copy Accompanying Software except to make a single backup copy of each program for Buyer's exclusive use. Seller grants Buyer the right to use, but not reproduce, any drawings, prints, manuals, and specifications delivered by Seller with the Products to Buyer under a Purchase Order with the sole exception that the material can be copied for internal use for the sole purposes of using and maintaining such products. Seller may grant Buyer other licenses as to Accompanying Software for use in conjunction with Products, and Buyer's rights and duties under any such licenses shall be in addition to the terms of this license.

19. **GENERAL:** If any such clause, sentence, word or other terms of this agreement are found or declared by law or legal proceedings to be unenforceable, void or illegal, the remainder of said agreement shall remain in full force and effect and binding on the parties hereto. The terms and conditions herein contained shall, unless otherwise specifically agreed to by Seller in writing, be the sole terms and conditions governing any purchase and sales contract entered into between the Buyer and Seller. Stenographical and clerical errors are subject to correction. No modification or addition to or waiver of any of the terms and conditions hereof will be effective unless agreed to in writing by Seller. This contract is made and entered into in the State of Illinois, therefore, this agreement and all amendments, additions and modifications thereto shall be governed and construed and interpreted in accordance with and by the laws of the State of Illinois and is so accepted. Any action brought with respects to this agreement shall be brought in Madison County Illinois and Buyer accepts and agrees to the exclusive venue of Madison County Illinois.

Basler Electric

Highland, Illinois USA

Suzhou, China - Wasselonne, France - Singapore

www.basler.com

2016 POWER SYSTEM STABILITY ENGINEERING SERVICES

Ea. **Power System Stabilizer (PSS) Tuning Support -1st Unit** ~~US$17,719.00~~

Mathematical Simulation Modeling of PSS and digital excitation controller with limiter (OEL and UEL) modeling
Stabilizer Settings (Tuning)
Report of
IEEE Model of Excitation System and
Power System Stabilizer

US $14,352.39 per Basler e-mail 4/22/16

Not Included in Fee for Tuning Support: Item does NOT include the following:

- On-site technical work of measuring generator characteristics
- On-site technical verification of the performance of the stabilizer

These on-site tasks are covered elsewhere in this proposal as field engineering services. Mobilization, for tuning a PSS will require the above-described mathematical study as well as 2-3 days on site for field service engineer to perform measurement tests and testing to verify performance on each exciter.

In accordance with **Form № FA100006,** *Field Service Terms, Conditions and Rates* §9.3, a request for Power System Stabilizer tuning must be accompanied by a completed PSS data collection form, which must be submitted to Basler Electric 30 days prior to the requirement of such tuning.

Ea. **SISTER unit PSS Tuning plus OEL and UEL modeling** ~~US$7,550.00~~

-Mathematical Simulation Modeling of limiters, as well as the PSS and excitation controller
-SECOND machine identical to the initial unit
-Tuning effort conducted on the same mobilization and only one report required for the two sister machines

N/A

Ea.	**PRC-019/024 Adder (Initial Unit)**	**US$6,750.00**
Ea.	**PRC-019/024 Adder (Sister Unit)**	**US$1,500.00**
Ea.	**Exciter/Limiter Modeling (Mod-026)**	**US$11,250.00**
Ea.	**Exciter/Limiter Modeling (Mod-026 Sister Unit)**	**US$3,563.00**

Quoted pricing assumes a 30 day lead-time minimum. If a shorter lead-time is required an expediting fee will apply.

Contact:

- Laura Tebbe
  - LauraTebbe@BASLER.com
  - +1 618 654 2341 Ext. 710
  - Highland, Illinois 62249-1074 United States

Highland, Illinois USA

Suzhou, China - Singapore

www.basler.com

2016 Commissioning Assistance ESTIMATE – One Trip, Per Exciter

Basler Electric Field Service Engineering Trip **US$13,700.00**

Estimated – BASED ON THE FOLLOWING

- Single mobilization, one engineer
- Three (3) consecutive, non-holiday weekdays on site, 8 hours each, with no overtime hours
- One full weekday of travel outbound and one full weekday of travel for return
- **Estimated** Daily Living Expenses
- **Estimated** Air Fare for Travel to jobsite and back

Field Service Quote Estimate

	DAYS ON SITE (INPUT):	3	
Qty	**Description**	**Rate**	**Extended*** **
40	Normal, Standby & Travel Hours	$260.00	$10,400.00
0	Overtime, Weekday Hours	$365.00	$0.00
0	Weekend/Holiday Hours	$470.00	$0.00
5	**Estimated** Daily Living Expenses	$300.00	$1,650.00
1	**Estimated** Air Fare (variable by site)	$1,500.00	$1,650.00
0	Other:	$0.00	$0.00
	TOTAL ESTIMATE:		**$13,700.00**

Table FSE-3 1

*** Out of pocket travel costs will be invoiced at Basler Electric's actual cost plus 10%. Such expenses include, but are not limited to, freight, custom duties, charges for luggage, passports and visas, medical vaccines, parking, fuel, transportation, airline or other transportation costs; board and lodging costs, hotel, food, refreshments, telecommunications, gratuities, and laundry.

Field Service Notes: All of the estimates in the table above are based on present hourly rates and on durations of on-site time and travel time based on general experience for such services. This estimate is an example, provided as a courtesy to assist the client in budgeting future service work.

If additional information is needed on Basler Electric's current Field Service Terms and Conditions, a copy can be obtained upon request of Basler **Form No. FA100006**. International commissioning is subject to approval by country for travel limitations. These terms, conditions and rates are subject to change, and may vary from the time your service work on-site is actually required.

Quoted pricing assumes a 30 day lead-time minimum. If a shorter lead-time is required an expediting fee will apply.

Contact:

- Terry Gaines
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