Nevada Irrigation District

Staff Report

for the Board of Director's Meeting, January 11, 2017

TO: Board of Directors

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

DATE: January 4, 2017

SUBJECT: **Dutch Flat 2 Powerhouse Excitation System Upgrade Project**
d'Heurle Systems Contract

ENGINEERING

RECOMMENDATION:
Award contract to d'Huerle Systems Incorporated for the Dutch Flat 2 Excitation System Upgrade Project in the amount of $220,037, and authorize the General Manager to execute the necessary documents.

BACKGROUND:
The Dutch Flat 2 Powerhouse (Powerhouse) is one of the District's seven powerhouses with a capacity of 23 megawatts and was brought on line in the mid 1960's. The intent of this project is to replace portions of its older components that need to be upgraded to match current technologies and therefore; improve reliability, 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 December 29, 2016. The project timeline includes the replacement of equipment during the September 2017 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; the most recent project was the Chicago Park Powerhouse upgrade. 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 $220,037 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 this contract.

BUDGETARY IMPACT:
The project is currently budgeted within the Hydroelectric capital budget as Powerhouse Upgrades in the amount of $1,000,000.

Attachments: d'Heurle Systems Incorporated proposal dated December 29, 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@dhsi.biz
Electrical Contractor C10 #895917

December 29, 2016

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

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

Re: **Dutch Flat 2 PH Excitation System Upgrade**
dHSI Project Quotation PQ16022

Gentlemen:

Thank you for this opportunity to bid on the **Dutch Flat 2 PH (DF2) Excitation System Upgrade**.

1. Justifications for the project include:
   - 1.1. The existing excitation system has had reliability problems.
   - 1.2. 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..
   - 1.3. Improved ease of tuning, testing, and troubleshooting with Basler.
   - 1.4. Local availability of technicians with Basler excitation expertise.
   - 1.5. Standardization of switchboard excitation controls exposed to NID Operators.
   - 1.6. The Dutch Flat 2 PH generator is rated 26 MVA, 23.4 MW, and is NID's second largest hydro unit. Other ratings include generator 6.9 kV, 0.9 PF, 2175 Amps, 60 Hz, 450 RPM. Generator main field excitation rated 405ADC at 250VDC. The existing rotating exciter is intended for re-use and is requires 12.2ADC at 16.3VDC at unit rated power, determined by field testing.

2. Features of the proposed static excitation control system improvement include:
   - 2.1. Re-use of existing rotating exciter. Conversion to a static excitation system is not proposed.
   - 2.2. Power for excitation will continue to be derived from the station service 208/120V panel. Therefore, there will be no improvement of the black-start capability of the unit.
   - 2.3. A complete new cabinet, sized to fit in the location of the existing control cabinet without modifications to walls or structure shall be custom manufactured, factory wired and tested by Basler.
   - 2.4. Basler Electric DECS-250N excitation control system in redundant configuration. The two DECS-250Ns shall be mounted internally to the excitation panel. A color touch-screen human-machine interface (HMI), Basler "IDP-801," shall be door mounted facing the control room. (Application of two IDP-801 HMIs, one for each DECS, was reviewed but is not available.)
   - 2.5. The DECS-250N includes a full-wave (6-SCR) AC-DC rectifier bridge capable of negative forcing. They are rated for 20ADC output and shall be minimally stressed at the 12ADC required for maximum unit MVA operation.
   - 2.6. The system shall include redundant over-excitation protection separate and independent of the over/under excitation limiting provided by the DECS-250Ns. (Under-excitation protection trip 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 shall be indicated to switchboard lamps and to station RTU.
   - 2.7. Fully automatic start-up and control under "Automatic Voltage Regulation" (AVR), the normally active excitation control mode.

2.8. Manual operation under “Field Current Regulation” (FCR) is available for emergency operation in the event of AVR system or potential transformer (PT) trouble.
2.9. Monitoring of the main field voltage and current is proposed with the addition of a DC voltage and current transducers and connection of the signals to SCADA for display and logging.
2.10. A Basler “crowbar and de-excitation system” (CB-DX) for enhanced generator protection will not be included in this scope. The existing system is currently hardwired between the commutator of the rotating exciter and the slip-rings of the main field. The proposed future CB-DX device will be cabinet mounted and will require cabling of the main field current from inside the air housing to the crowbar system cabinet. The Basler excitation control cabinet shall be provided with the features required to facilitate future integration of the “crowbar and de-excitation system” at a later date.
2.11. Power system stabilizer (PSS) is not included in this proposal, as it is not required by PG&E, WECC, or NERC for units smaller than 30MVA.
2.12. Potential transformer (PT) and current transformer (CT) secondary circuits connected to the excitation cabinet shall be provided with one PT/CT test switch per DECS, to facilitate troubleshooting if required.
2.13. Two 12-point annunciators (Ametek #SMU-100) shall be provided and connected for optimal indication of distinct local alarms to facilitate troubleshooting. Non-critical alarms shall be grouped and relayed for switchboard annunciation and SCADA.
2.14. Critical faults shall be provided with individual trip cut-out switches and a common critical fault relay for trip initiation to switchboard 86E, as well as indication to switchboard annunciation and SCADA.
2.15. Integration of Modbus digital communications between facility RTU and DECS-250Ns is not included, but could be provided by extra or future work.

3. d’Heurle Systems Incorporated integration work includes:
3.1. Reuse of existing excitation rotating exciter, generator field slip rings and brush assemblies, field power conductors, and existing generator instrument transformers (PTs and CTs).
3.2. The excitation system cabinet shall be replaced by a new Basler-manufactured and tested cabinet, sized to fit in the existing cabinet location..
3.3. 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.
3.4. 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” shall be demolished and replaced with a blank plate.
3.5. 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, and miscellaneous wire and wiring supplies.
3.6. Demolition and refurbishment to be performed during a pre-scheduled outage. Field construction work shall be by dHSI electrician craft labor and supported by an NID subcontract electrician and/or by NID Electricians and Electrical Technicians working under dHSI engineering supervision.
3.7. A commissioning test plan shall 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 limiting functions. Load rejections with and without shutdown/lockout shall be included in the tests.
3.8. dHSI shall subcontract to Sage Engineers for NERC PRC-019-2 electrical engineering review and report to assure proper coordination of excitation limiting and unit protective relaying. The PRC-019-2 report shall be submitted with the final record documentation and O&M submittal.
3.9. 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, and as-left configuration data.
3.10. Proposal includes one half day for NERC MOD-025-2 excitation system performance validation. NERC MOD-025 testing can be provided immediately upon completion of commissioning or afterwards, at NID’s convenience. The MOD-025-2 report shall be submitted with the final record documentation and O&M submittal.

3.11. Project engineering submittals shall be according to schedule and shall include:
- Basler engineering submittal and review meeting.
- dHSI integration 50% engineering submittal and review meeting.
- dHSI integration 90% engineering submittal and review meeting.
- dHSI integration "For Construction" engineering.
- dHSI/Basler O&M and Record engineering documentation.

3.12. dHSI project management shall include monthly submittal to NID of a project status report with schedule and budget progress review.

4. d'Heurle Systems Incorporated work excludes:
   4.1. Craft rigging labor for onsite installation, to be provided by NID staff.
   4.2. Craft electrician labor for onsite installation in addition to the dHSI onsite personnel craft labor shall be provided by a qualified NID subcontractor or by NID qualified staff.
   4.3. Procurement of miscellaneous electrical and control hardware to be determined under design.
   4.4. Programming of NID or PG&E SCADA.
   4.5. 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.

5. A proposed project schedule is attached and conforms with NID Hydro's scheduled outage for DF2, September 13-26, 2017 with commissioning October 4-6, 2017.

6. Payment schedule:
   6.1. 20% Basler materials total upon notice to proceed (net 30 days).
   6.2. 30% Basler materials total upon approval of drawings (net 30 days).
   6.3. 50% Basler materials total upon receipt of materials (net 30 days).
   6.4. dHSI engineering and labor costs billed monthly T&M (net 30 days).

7. 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 rates stated in attached price breakdown. Extra-work materials shall be charged at dHSI cost plus fifteen percent.

The proposed time and materials, not-to-exceed (T&M-NTE) cost including sales tax and freight is $220,036.85.

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 contact us if you have any comments or questions.

Best regards,

Al d'Heurle, PE
Mechanical & Control Systems Engineer

Attachments:
- Price breakdown for reference.
- Proposed project schedule.
- dHSI request for quotation RFQ-16022-BAS
- Basler quotation 868876 (materials)
- Basler materials terms & conditions

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

530-205-5089 adheurle@dhsi.biz

Quote

Date	dHSI Project Quotation
12/29/2016	PQ16022

To:

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

California Electrical Contractor
C-10 License No. 895917

Line No.	Item	Description	Qty	Cost	Total
1	Materials for Resale	Basler Electric Co. "Dual DECS-250N Excitation System for Dutch Flat 2 power House". Per Basler quotation SQ No. 868842 Basler price x 1.15 dHSI mark-up	1	113,309.50	113,309.50T
2	Freight Out	Freight by "Exclusive use" dedicated container truck	1	6,000.00	6,000.00
3	Subcontract - Engineering	Sage Engineers, NERC PRC-019-2 excitation/protection coordination study, Sr. EE rate $285 x 1.1 dHSI mark-up	25	313.50	7,837.50
4	Engineer Sr.	Sr. Engineer / Technician, Al d'Heurle: project management, design, correspondence, meeting attendance, test plan, onsite construction and commissioning supervision, record documents.	200	220.00	44,000.00
5	CAD Draftsman	AutoCAD Draftsman, Designer, Engineering Associate, Josh Chambers	160	80.00	12,800.00
6	Electrician - Journeyman	Onsite electrician "inside wireman" craft labor, Josh Chambers, Al d'Heurle Straight time, prevailing wage.	60	130.00	7,800.00
7	Electrician - Journeyman	Onsite electrician "inside wireman" craft labor, Josh Chambers, Al d'Heurle 1.5x overtime, prevailing wage.	40	195.00	7,800.00
8	Electrician - Journeyman	Onsite electrician "inside wireman" craft labor, Josh Chambers, Al d'Heurle 2x overtime, prevailing wage.	30	260.00	7,800.00
9	Travel time	Al d'Heurle 20x round trips 1 hour	20	110.00	2,200.00
10	Travel time	Josh Chambers 20x round trips 1 hour	20	80.00	1,600.00
11	Mileage	no charge	0	0.00	0.00
12	Copy & Printing	O&M binder and record drawing printing	1	250.00	250.00
				CA Sales Tax: (7.625%)	$8,639.85

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

Total **$220,036.85**

	2017 week of:	1/2	1/9	1/16	1/23	1/30	2/6	2/13	2/20	2/27	3/6	3/13	3/20	3/27	4/3	4/10	4/17	4/24	5/1	5/8	5/15	5/22	5/29	6/5	6/12	6/19
								1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
PQ16022 NID DF2 Excitation																										
	Basler Quote	x																								
	dHSI Quote	x																								
	NID PO & downpayment to Basler		x	x	x	x	x	x																		
	Basler engineering submittal, review, approval								x	x	x	x														
	NID/dHSI approval & 30% payment to Basler												x	x	x											
	Basler manufacturing															x	x	x	x	x	x	x	x	x	x	x
	Basler shipping																									
	dHSI 50% engineering												x	x	x	x	x	x	x							
	dHSI 90% engineering																			x	x	x	x	x	x	
	dHSI 100% engineering & test plan																									x
	Procure misc hardware (NID/dHSI)																							x	x	x
	DF2 PH exc. installation 9/13 - 9/26																									
	DF2 PH exc. commissioning 10/4-10/6																									
	DF2 PH NERC MOD-025 test 10/6																									
	record documentation																									
		x	activity in progress																							
		x	deadline or deliverable																							
		x	scheduled outage or testing																							

	2017 week of:	6/26	7/3	7/10	7/17	7/24	7/31	8/7	8/14	8/21	8/28	9/4	9/11	9/18	9/25	10/2	10/9	10/16	10/23
		20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
PQ16022 NID DF2 Excitation																			
	Basler Quote																		
	dHSI Quote																		
	NID PO & downpayment to Basler																		
	Basler engineering submittal, review, approval																		
	NID/dHSI approval & 30% payment to Basler																		
	Basler manufacturing	x																	
	Basler shipping		x	x															
	dHSI 50% engineering																		
	dHSI 90% engineering																		
	dHSI 100% engineering & test plan	x	x																
	Procure misc hardware (NID/dHSI)	x	x	x	x														
	DF2 PH exc. installation 9/13 - 9/26												x	x					
	DF2 PH exc. commissioning 10/4-10/6															x			
	DF2 PH NERC MOD-025 test 10/6															x			
	record documentation																x	x	x

d'Heurle Systems
INCORPORATED
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Electrical Contractor C10 #895917

November 27, 2016

Basler Electric Company
12570 State Route 143
Highland, IL 62249-1074

Attn: Mr. Rich Schaefer
Mr. Tom Richardson
Mr. Lance Bazzell

Re: **dHSI RFQ-16022-Basler**
Excitation System Upgrade for NID Dutch Flat 2 Powerhouse

Dear Rich, Tom, Lance :

dHSI is pleased to submit to you this RFQ for excitation upgrade at Nevada Irrigation District (NID) Dutch Flat 2 (DF2). Relevant data sheets are attached.

dHSI will resell the Basler product and will provide turnkey engineering, integration, installation supervision, commissioning, as-built drawings, commissioning records, and customer training. Installation work will be by dHSI staff and the customer's qualified electricians and electrical technicians. The project will generally follow the dHSI-Basler excitation projects for NID including:

- Rollins PH static excitation, 2010, with redundant DECS-400 (Basler #9458500),
- Bowman PH static excitation, 2016, DECS-400 SSE retrofit (Basler #9563500).
- Chicago Park PH (CPPH) excitation, 2016, redundant DECS-250N (Basler #9567200).

Basler's proposal for DF2 should be similar and based upon the CPPH excitation system, Basler #9567200. Requested variations from the CPPH system are noted below. Similar to CPPH, at DF2, the existing rotating exciter will be retained and reused so DECS-250N will be applied to drive the stationary field of the rotating exciter.

1. RFQ requirements:

1.1. Panel shall be Basler factory-built, assembled, wired, and tested.

1.2. Panel shall replicate the height (90"), width (29"), and depth (35") of the CPPH panel. Front panel door facing control room shall be hinged on the left.

1.3. System shall comprise redundant DECS-250Ns, internally mounted, and will include switchable lead-backup supervised by a PLC. A door-mounted selector switch (Electroswitch series 24) will allow the Operator to select the lead DECS. Typically, the customer will alternate lead on a monthly basis. Two front panel mounted lamps (GE #ET16-LED amber) shall indicate which DECS is active. PLC shall be identical to CPPH PLC.

The PLC should be mounted so that it can be observed directly (straight-on) by an Operator or Technician. (The PLC at CPPH is too high and direct viewing is blocked by a DECS. Attempting to view the PLC with a mirror to observe its status and IO lamps is very awkward and confusing.)

1.4. Cabinet shall be convection cooled with vents to intake and exhaust through the front panel door facing the control room. Cabinet will be provided with a 4.5" axial fan, 120VAC, (Grainger #3RP12 or Hoffman #A4AXFM) mounted with a fan bracket (Hoffman #ABRKT4 or similar) to enhance air flow over the DECS-250Ns and connected to run whenever excitation is active (relay K12 is energized).

Cabinet shall include a thermostat and 120VAC space heater(s) for condensation control in the event of a prolonged outage.

Fan and space heater may share the same 120VAC fuse.

1.5. A local operator interface, Basler IDP-801-C, shall be door mounted and shall provide supervision and monitoring of both lead and backup DECS-250Ns via Modbus comm over RS-485 serial. The IDP-801-C can provide data forwarding to SCADA via Modbus over Ethernet.

1.6. Excitation and control power.

Excitation bridge input power will be from station service 208V 3-phase, 3-wire. Basler shall provide a suitably rated power potential transformer "T1" for excitation bridge input power, sufficient for normal operations and suitable for positive and negative field forcing on transient events. No field flash circuitry is required.

Cabinet control power will be provided by 125VDC.

Basler shall include a control power transformer: "T2," 208V-120V/90V 1000VA, 1-phase, aT2 will include a secondary winding at 90VAC for input to the Basler power module #9482900103 .

Excitation panel DECS, relays, and control circuits will be supplied by a dedicated 125DC panel distribution breaker and will be additionally supplemented by transformer T2 and the Basler power module.

24VDC power for auxiliaries including IDP-801 shall be provided with redundant Phoenix Contact #Quint-PS (e.g. #2866747) power supplies.

SHIP LOOSE FOR FIELD INSTALLATION: Components to be shipped loose for field installation (with the object of improving technician safety when accessing the excitation panel interior) will include T1, T2, F3, F4, F5, F6, F7 (please reference device numbers on CPPH, Basler project 9457200).

1.7. PT/CT Test switches.

DF2 shall not require PSS and shall have only one B-phase CT connected for DECS sensing. Basler may provide the two test switches each with 3 CT shorting switch pairs or 1 CT shorting switch pair at Basler's preference.

To facilitate sustained operation in case removal of a DECS becomes necessary, the PT/CT inputs shall be configured with two PT/CT test switches, one for each DECS.

PT/CT test switches shall be door-mounted with clear plastic covers, and shall be similar to "TS1 at CPPH, Basler project 9457200, or ABB FT1. Potential poles shall have red handles while CT shorting poles shall have black handles.

A CT short-circuiting terminal block shall be provided for termination of the remote CT wiring.

1.8. Unit trip outputs:

Basler shall include one machine-tool relay “K90-ESD” to provide two dry contacts, 125VDC-rated, for interface with station switchboard as follows:

- Trip to 86E shutdown/lockout
- Annunciation of excitation trip.

Basler shall include a door-mounted test switch with yellow handles for trip cutout (TCO) between the initiating and receiving trip devices as follows:

- TCO blocks overexcitation K32 trip to K90-ESD
- TCO blocks overexcitation ES-74S-2 trip to K90-ESD
- TCO blocks DECSA + DECSB failure trip to K90-ESD
- TCO blocks lead DECS + PLC failure trip to K90-ESD
- TCO blocks main field DX/CB CB fired trip to K90-ESD
- TCO blocks K90-ESD trip to 86E

10-pole, yellow-handled test switch with clear cover shall be ABB FT-1 #C9683A01G01 (code#499) or equal.

Please reference dHSI CPPH drawings attached, Sh. 4, 5J, and Sh. 6, 3F.

1.9. Excitation system alarms.

Excitation system alarms shall be individually annunciated at the excitation cabinet and a common alarm contact shall be relayed for annunciation of “excitation system trouble” at the station switchboard (which is relayed in turn to SCADA). Thorough annunciation of distinct alarms is desired to facilitate future troubleshooting.

Two Ametek #SM100U 12-point annunciators shall be door mounted and shall individually annunciate the following alarm points:

1. DECS-A relay 3 common alarm
2. DECS-B relay 3 common alarm
3. DECS-A failure K18
4. DECS-B failure K19
5. PLC common alarm
6. PLC failed
7. Transfer on protection (K61)
8. Overexcitation trip ES-74S-1 via K32
9. Overexcitation trip ES-74S-2
10. DECS-A PT sense failure
11. DECS-B PT sense failure
12. DECS-A crowbar
13. DECS-B crowbar
14. CB/DX main field crowbar (wire out to main TB for future)
15. CB/DX main field DC breaker open
16. 125VDC failure (blown fuse F1 or F2 – aux relay required)
17. 24VDC P/S-1 failure (aux relay required)
18. 24VDC P/S-2 failure (aux relay required)
19. Spare wired out to TB
20. Spare wired out to TB

All Ametek annunciator point aux relay contacts shall be wired in parallel to common alarm relay K24. K24 shall have two NO terminals wired out to the main TB for indication to switchboard annunciator and SCADA.

The DC negative power to the Ametek annunciators shall pass through a N/C contact of the panel reset pushbutton, to facilitate clearing multiple alarms.

Please reference dHSI CPPH drawings attached, Sh.4, 7E, and Sh.5,

1.10. Overexcitation protection:

Base bid will include over-excitation protection on the rotating exciter field current (DECS-250N output current) and will include one DC shunt and two Basler ES-74S.

Over-excitation protection shall conform to PG&E interconnection standard G2 (Feb. 23, 2015): "*Two levels of over-excitation protection. The first level should provide a forcing alarm and trip the voltage regulator after a time delay. The second level shall have an inverse time characteristic such that the time-current relationship may be coordinated with the generator short time thermal requirements (ANSI C50.13 or C50.14).*"

ES-74S-1 shall be ES-74S-7MB0G4N0, 50mV, 24VDC p/s, fixed time delay, and shall supervise PLC "transfer on protection", and unit trip via relay K32 after additional time delay.

ES-74S-2 shall be ES-74S-7NC0G4N0, 100mV, inverse time delay, and shall trip unit directly and alarm.

MilliVolt wiring between the excitation output shunt and the relays ES-74S-1 and -2 shall be with shielded-twisted pair wiring and shall land on a DIN-rail terminal block fitted with Phoenix Contact #UK5-MTK-P/P (#3004032) and shield grounding terminals to facilitate testing and calibration before terminating on the ES relays.

1.11. Main field monitoring:

Basler shall include monitoring of main field DC voltage and amperes (DC millivolt from shunt) with transducers connected to external metering and SCADA. (Basler AEM-2020 analog expansion modules will not be used.)

Signal transducers shall be Ohio Semitronics:

- main field voltage VT7-008E, input 0-400VDC, output 4-20mADC, p/s 125VDC.
- main field current VT7-016E, input 0-100mVDC, output 4-20mADC, p/s 125VDC.

Main field shunt, and transducer output signal wiring shall be with shielded twisted pair wiring. All transducer output signal wiring will land on a DIN-rail terminal block fitted with Phoenix Contact #UK5-MTK-P/P (#3004032) terminals to facilitate testing and calibration before terminating on main TB.

1.12. Main field de-excitation and crowbar:

The cabinet will include provision for future integration of Basler's de-excitation/crowbar/DC breaker/discharge resistor solution "CB/DX" for rapid de-energization of the main field. The CB/DX main field DC breaker will be automatically only upon 86E trip/lockout.

Features to be applied in the excitation control panel for future CB/DX integration include:

- Red & green lamps (GE #ET16LED) for main field breaker status indication at the exciter cabinet.
- Pushbutton for CB/DX main field breaker close.
- Annunciator point for main field breaker open (see above).
- Annunciator point for main field crowbar fired (see above).
- Tripping circuit to K90-ESD for main field crowbar fired (see above).
- Relay for multiplication of main field crowbar fired.
- Wiring out to main TB for above.

1.13. Wiring and relay notes.

Main terminal block will be with Phoenix Contact #RT5 for external wiring termination with non-insulated ring lugs.

Internal wiring shall be terminated with non-insulated ring lugs or ferrules. Wire labelling shall be Basler standard circuit-branch designation.

Wiring at DECS shall avoid daisy-chain connections (two wires landed on a single DECS terminal point).

Basler panel and wiring shall include relays 90ANX and 90BNX to indicate “excitation high limit” and “excitation low limit” similar to dHSI CPPH dwg sh.3 J6. Main TB shall include wiring for 90ANX and 90BNX contacts for switchboard lamps and for SCADA. DECS output relays #5 and #9 shall be programmed similar to CPPH for low limit and high limit indication.

Relay K52X (auxiliary to unit paralleling breaker) shall be connected to DECS input #5 “preposition” and shall also indicate to the DECS “online operation” with switch from offline limiter settings to online limiter settings, similar to CPPH.

Relay K12 shall be a machine-tool type relay and shall have 1x NO and 1x NC terminals separately wired out to main TB for use in switchboard start and breaker close control circuits.

CT wiring shall be with #10 SIS.
Miscellaneous control wiring shall be #14 SIS.
Analog signal wiring including shunt mV wiring shall be with shielded twisted pair cable, 600V insulation (e.g. Belden #8719).

1.14. Main terminal block arrangement.

Main terminal block for field wiring will be located on the upper, rear section of the right-hand interior panel.

The arrangement shall be similar to CPPH, except the main rear terminal block shall be mounted more forward, to allow additional space for field cable entry, to allow improved access for installation and troubleshooting, and to avoid screwdriver interference with the DECS-250Ns.

The main TB may extend the full height of the panel. Sectioning the main TB is acceptable, but the minimum available space provided for field cables at the front TB of CPPH should be avoided.

Unnecessary utilization of main TBs is to be avoided. Jumpers required at DECS-250N Input 7 (PF/VAR disable) should be applied locally, not at the main TB. Unused DECS-250N inputs or outputs do not require wiring out to the TB.

Please do not hesitate to contact me if you have any comment, question or suggestion !

I look forward to your quotation within 3 weeks. NID has requested my proposal before the Christmas holidays.

Thank you !
Best regards,

Al d'Heurle, PE
Mechanical & Control Systems Engineer

.Attachments: dHSI CPPH excitation drawings Sh.1-Sh.6

12570 STATE ROUTE 143
HIGHLAND IL 62249-1074 USA
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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.: **868842**

DATE of QUOTE: **December 13, 2016**

ATTN: Al d'Heurle

REF: NID Dutch Flat 2

Item	Qty	Description	Price Each

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

1 1 **Basler Dual DECS-250N Voltage Regulator System** **US$98,530.00**

Similar to and based upon P/N 9567200100, 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, hinged on the left and containing:

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
DECS-250N Features, Continued:
Var Limiter

Item	Qty	Description	Price Each

DECS-250N Standard Features, Continued:
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)
- 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)
- PLC to be mounted for direct, unobstructed view of status lamps.
- Redundant Power Supplies for PLC
- Lead/Backup DECS Control

IDP-801-C 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

Dual DECS-250N System Description, Continued:

Control Power Transformer, *shipped loose*
T2, BE32451-001, 208:120/90, 1 KVA
F3, F4 CPT Primary Fuses and holders shipped loose

AC/DC power module (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 (Exciter Field):
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

Local Door Mounted 12 Point Annunciators, (Qty 2)
Ametek #SM100U; See d'Heurle document for description of annunciation points

One machine-tool relay "K90-ESD", to provide two dry contacts, 125 Vdc rated, for interface with station switchboard:

- Trip to 86E shutdown/lockout
- Annunciation of excitation trip

Thermostat, 120 V Heater, Light and Convenience Outlet

Axial Fan, 4.5" for supplemental AVR cooling, K12 controlled

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

Main Field Monitoring with Ohio Semitronics transducers:
Voltage with VT7-008E
Current with VT7-16E (shunt provided by others)

PT/CT Test Switches (one per DECS-250N)

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

#10 SIS wiring for CT circuits

#14 SIS wiring for miscellaneous control wiring

Non-insulated ring lugs or ferrules where appropriate

Power Potential Transformer, *(T1, shipped loose)*
BE34665-001
4000 VA, Three Phase, 60 Hz
Primary: wye 208 Vac with fuses and holders -
(F5, F6, F7 shipped loose)
Secondary: delta 120V

Item	Qty	Description	Price Each

Dual DECS-250N System Description, Continued:

Provisions for future integration of main field CB/DX/Breaker:

- Red & green lamps (GE #ET16LED) for main field breaker status indication at the exciter cabinet.
- Pushbutton for CB/DX main field breaker close.
- Annunciator point for main field breaker open (see above).
- Annunciator point for main field crowbar fired (see above).
- Tripping circuit to K90-ESD for main field crowbar fired (see above).
- Relay for multiplication of main field crowbar fired.
- Wiring out to main TB for above.

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 Generator Protection Relay

2 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*

Preliminary Spare Parts for DECS 250N System

Qty	Description	Price Each
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 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

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.

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 payment invoices against the equipment portion of this quotation will be issued, upon credit approval at time of order placement, at the following project milestones:

1. Drawings sent out for customer approval - 20% of equipment pricing (net thirty days).
2. Drawings returned approved and final engineering design completed and released to manufacture - 30% of equipment pricing (net thirty days).
3. Equipment shipped-remainder of equipment pricing - 50% of equipment pricing (net thirty days).

Invoices for services will be issued at the time the indicated service is completed.

Your Basler Sales Rep is:

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Associated Power Solutions
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San Ramon, CALIFORNIA 94583-1627
Phone: 925.820.8102
Email: tribar@aps-power.com