

Staff Report

for the Regular Meeting of the Board of Directors, February 10, 2016

TO: Board of Directors

FROM: Gary King, Engineering Manager *GJK*
Tonia M. Tabucchi Herrera, Associate Engineer *TTH*

DATE: February 2, 2016

SUBJECT: Bowman Powerhouse Upgrade Project – Excitation System Upgrade

ENGINEERING

RECOMMENDATION:

Award a consulting service agreement to d’Heurle Systems Incorporated (d’HSI) for the design, installation, programming, commissioning and procurement for parts and spare parts for Excitation System Upgrade at the Bowman Powerhouse in the amount of \$134,150.19; and authorize the General Manager to execute the necessary documents.

BACKGROUND:

As part of the Bowman Powerhouse Upgrade Project, the Excitation System Upgrade is to improve reliability of the Bowman Powerhouse. The existing system does not function in manual mode. Under normal start up, the system would be placed in manual mode and the operator would adjust the voltage then place the system into automatic. As it operates now, only half of the functionality is available. The system is started in automatic and the voltage is adjusted. If the automatic mode was to fail, there is no ability to start up. Additionally, the exciter is an older analog type with many replacement parts unavailable. The availability of expertise to diagnose and tune is limited. The existing system is deteriorated and unreliable and has reached the end of its 30-year life.

The upgraded system would be similar to Rollins Powerhouse excitation. Spare parts would be available and interchangeable between powerhouses. Controls and startup would be the same, providing consistency in operation from powerhouse to powerhouse and reduce costly shutdowns of the facility. Upgrading the excitation system would provide ease for tuning, testing and troubleshooting.

d'HSI is recommended as a sole source provider. d'HSI was contacted directly due to their expertise in this narrow field, past history with the District (d'HSI successfully completed the exciter upgrade at Rollins) and intimate knowledge with the Bowman Powerhouse. This aptly made d'HSI the most qualified choice for the project. Additionally, due to d'HSI's knowledge of Bowman Powerhouse and experience in upgrading the exciter at Rollins, the learning curve element is eliminated which translates to a cost savings for the District.

Upon review of the Project proposal with Hydroelectric Manager and Hydro Maintenance Supervisor, staff recommends awarding contract to d'HSI in the amount of \$134,150.19.

BUDGETARY IMPACT:

The Project is currently budgeted in 2016 under the Bowman Powerhouse Upgrade (201404).

attachment (1): d'HSI Proposal dated January 25, 2016

January 25, 2016

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

P.O. Box 1219
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e-mail: adheurle@msn.com
Electrical Contractor C10 #895917

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

Re: **Bowman PH, Excitation System Upgrade**
dHSI Project Quotation PQ15024

Gentlemen:

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

Justifications for the project include:

- Manual mode and various auxiliaries of the existing system are dysfunctional.
- The existing Basler static exciter is analog design, 1980 vintage.
- Low availability of expertise in diagnosing and tuning analog electronics.
- Low reliability and end-of-life of ~30 year old electronics.
- Improved ease of tuning, testing, and troubleshooting.
- Standardization of excitation controls.

The Bowman PH generator is rated 4000 kVA, 4160V, 0.90PF, 550 AmpsAC, 60Hz, 450RPM with excitation rated 125VDC, 304ADC. The existing excitation system is Basler SSE125-250 P/N 9181300100.

The proposed static excitation control system improvement includes:

- Basler Electric DECS-400 static excitation control system in non-redundant configuration. The DECS-400 will be mounted to the excitation panel door and includes a digital operator-interface panel.
- Existing excitation power potential transformer (PPT), AC/DC rectifier bridge, and excitation system cabinets will be re-used.
- A new Basler SSE analog firing control board will modulate the command signal from the DECS-400 to the reused existing bridge. A relay and isolation transducer pan chassis will be pre-fabricated by Basler for installation within the excitation cabinet.
- Existing negative field forcing feature will be abandoned and demolished. Due to the configuration of the reused-existing rectifier bridge, the proposed system will not include negative field forcing. Basler and dHSI concur satisfactory performance will be achieved through the improved performance of the DECS-400 digital controls. Negative field forcing is not usually applied on smaller generators such as Bowman.
- Due to the proximity of the excitation cabinet to the switchboard at Bowman, redundant meters and control switches on the excitation cabinet will be demolished.
- Refurbished excitation system protection functions include rectifier blown fuse (rectifier failure) and over-excitation trip.
- Excitation controls and start-up will be consistent with the Rollins PH excitation system for improved system operability.
- 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.

- Complete excitation system limiting and protection functions including over- and under- excitation limiting, and Volts per Hertz (V/Hz) limiting. Excitation limiting indication to switchboard lamps and to station RTU (SEL-RTAC).
- The existing excitation contactor 52E (existing Basler device K3) shall be replaced with a molded case switch. The switch would remain normally closed, but would open automatically upon 86E trip. This arrangement will be similar to the Basler excitation system at Rollins PH. Starting and stopping of the excitation will be by contact command to the DECS-400 instead of by open/close of 52E. Option A will provide enhanced reliability and reduced maintenance by elimination of the frequent switching of 52E.
- Integration of Modbus serial digital communications between facility RTU (SEL-RTAC) and DECS-400 is not included, but could be provided by extra or future work.

d'Heurle Systems Incorporated integration work includes:

- Reuse of existing excitation power potential transformer (PPT), main excitation rectifier, PPT power conductors, generator field slip rings and brush assemblies, field power conductors, and generator and line instrument transformers (PTs and CTs).
- The excitation system cabinet shall be re-used but shall be completely refurbished, including control and power wiring, fans and filters, overtemperature alarm and trip. Control wiring shall be SIS-type. Terminal blocks, lugs, wire labels, and other wiring shall be according to utility best practice.
- Engineering design shall be provided for complete integration of the new Basler static 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 and wiring diagrams. Redesign and refurbishment of control switchboard circuits for proper operation with the new static 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 Weschler digital meters for field volts and amps shall be reused.
- 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.
- 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 two days for Operator and Technician training.

Proposed project schedule is

Preliminary Drawing Submittal for review:	5 weeks after receipt of order
Drawing review and approval:	2 weeks after submittal
Manufacturing time:	8 weeks after approval of drawings
Installation time during outage:	7-12 workdays
Testing and tuning upon unit availability:	3 days
Operator & Technician training:	1 days
Record drawings and O&M:	2 weeks after commissioning.

Payment schedule:

1. 20% project total upon notice to proceed (net 30 days).
2. 20% project total upon approval of drawings (net 30 days).
3. 30% project total upon delivery of materials (net 30 days).
4. 30% project total upon project completion (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.

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 cost of the Base Bid is \$ 89,485.87 .

Option A for provision of spare parts \$ 44,664.32 .

Quotation is valid for 60 days and is offered on a time and materials, not-to-exceed 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

Attachment: Price breakdown for reference only.

	Description	Part No.	Mfg	qty	dHSI Cost per unit	Price per unit	Price line total	
Base bid labor								
1.1	Sr. Engineer / Technician, Al d'Heurle: design, panel and electrical construction supervision, correspondence, meeting attendance, programming, DOSO, test plan, on-site work, record documents, staff training.			100		\$200.00	\$20,000.00	
1.2	AutoCAD draftsman / Technician, Josh Chambers			100		\$80.00	\$8,000.00	
1.3	Travel time Al d'Heurle (8x site visits)			24		\$100.00	\$2,400.00	
1.4	Travel time Josh Chambers (8x site visits)			24		\$60.00	\$1,440.00	
1.5	Mileage (16 site visits at 94miles/visit)			1504		\$0.540	\$812.16	
Subtotal labor							\$32,652.16	
Base bid materials								
2.1	DECS-400 SSE Retrofit Kit -DECS-400 2C5U digital controller -SSE analog firing control board -Relay & Isolation Transducer Pan Chassis approx 12"W x 28"H x 8 3/4", weight 18 lbs.		Basler	1	\$39,577.00	\$45,513.55	\$45,513.55	
2.2	Failed Rectifier Detector Relay, Lo	ES-47 3SA1N0N0,	Basler	1	\$167.00	\$192.05	\$192.05	
2.3	Molded Case Switch with accessories: shunt trip and aux. switches, Functional replacement for K3,	41401 41404 42150	Basler	1	\$2,470.00	\$2,840.50	\$2,840.50	
2.4	Field Flash Contactor	42382	Basler	1	\$1,338.00	\$1,538.70	\$1,538.70	
2.5	Field Overcurrent Relay	ES-74S 7MB0A4N0,	Basler	1	\$169.20	\$194.58	\$194.58	
2.6	#14 AWG SIS wire fine strand, tin plated			2000	\$0.20	\$0.23	\$460.00	
2.7	2-#16 Cu shielded-twisted cable 600V	8719	Belden	250	\$1.10	\$1.27	\$316.25	
2.8	#4/0AWG DLO flexible cable fine strand, 2000V			100	\$4.99	\$5.74	\$573.85	
2.9	LED lamps 125VDC red & green for Bkr 52E status	ET-16	GE	2	\$63.00	\$72.45	\$144.90	
2.10	misc wiring supplies: tie-wraps, lugs, wire-labels		various	1			\$350.00	
Subtotal materials							\$52,124.38	
						CA Sales tax	7.50%	\$3,909.33
						Estimated shipping		\$800.00
Base bid total							\$89,485.87	
Option A spare parts								
3.1	Digital Excitation Controller	DECS-400 2C5U	Basler	1	22,930.00	\$26,369.50	\$26,369.50	
3.2	Field Isolation Transducer & Cable		Basler	1	2,050.00	\$2,357.50	\$2,357.50	
3.3	Thyristor Gate Firing Control Module, circuit board only.		Basler	1	4,529.00	\$5,208.35	\$5,208.35	
Spare parts for existing rectifier bridge P/N 91079011110								
3.4	Field flash diode 150A	42975	Basler	1	261.00	\$300.15	\$300.15	
3.5	Power diodes 450A	11602	Basler	3	512.00	\$588.80	\$1,766.40	
3.6	Power SCRs 350A	11604	Basler	3	609.00	\$700.35	\$2,101.05	
3.7	Fuses	11601	Basler	3	175.00	\$201.25	\$603.75	
3.8	Surge suppressor	11603	Basler	1	2,210.00	\$2,541.50	\$2,541.50	
Option A spare parts total							\$41,248.20	
						Estimated shipping	\$300.00	
						CA sales tax	7.50%	\$3,116.12
Option A Spare Parts Total w/ shipping & sales tax							\$44,664.32	