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NEW YORK STATE ELECTIC AND GAS

SENECA COMPRESSED AIR ENERGY STORAGE PROJECT

CYCLE 1 POWER GENERATION EQUIPMENT

SCOPE OF WORK

Document: CAES-1-SW-RPG7

Revision: A

Date: June 2011

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SYNOPSIS

This document details the scope of work for a budgetary quotation of Cycle 1 Generation Cycle.

Disclaimer

REV	DESCRIPTION	ORIG	REVIEW	WORLEY-PARSONS APPROVAL	DATE
A	Issued For Bid	Paul Phiambolis Digitally signed by: Paul Phiambolis DN: CN = Paul Phiambolis C = US O = WorleyParsons OU = Mechanical Department Date: 2011.06.30 13:32:19 -05'00'	Harry G. Eisenbise Digitally signed by: Harry G. Eisenbise DN: CN = Harry G. Eisenbise C = US O = WorleyParsons OU = Eastern Operations Date: 2011.06.30 13:31:07 -05'00'	Harry G. Eisenbise Digitally signed by: Harry G. Eisenbise DN: CN = Harry G. Eisenbise C = US O = WorleyParsons OU = Eastern Operations Date: 2011.06.30 13:31:30 -05'00'	June 2011
		P. Phiambolis	Harry Eisenbise	Harry Eisenbise	

1.0 General Information

The Seller shall supply all the equipment within this Scope of Work document for a First Generation Compressed Air Energy Storage plant.

The equipment / system specified herein combined with the other equipment contained in the package shall be installed and operated in a First Generation Compressed Air Energy Storage plant located in Reading, NY. Site Specific Data which includes climate, structural, and utility supply data are displayed in Attachment A. English units shall be the system of units.

It is expected that the Seller shall read overall Attachment C – Seneca CAES Project Value Drivers and apply these items within the design of the cycle and equipment.

2.0 Scope of Supply

The equipment, material and services to be provided by the Seller shall include but not be limited to the following:

1. All thermodynamic and engineering cycle work within the requirements of this Scope document.

2. One (1) Gas Fired Air Turbine Generator package and auxiliaries as described per CAES-1-SP-RPG7, “Budgetary Quotation for Air Turbine Generator” and in Exhibit 1 – Air Turbine Generator Scope of Supply.

3. One (1) Recuperator package and auxiliaries as shown per CAES-1-SP-MQ01, “Budgetary Quotation for Recuperator” and in Exhibit 1 – Recuperator Scope of Supply.

4. Cavern air flow control valve to regulate air flow to the power generation equipment.

5. Gas Exit Stack for Recuperator

6. Interconnecting piping and ductwork design and material between all Seller provided equipment.

7. All necessary controls, instrumentation, and valves necessary for proper and safe operation of the complete cycle and plant.

8. Spare parts for erection, start-up and commissioning.

9. Two (2) years spare parts.

10. Special tools for erection, commissioning, operation, and maintenance.

3.0 Utility Supply Conditions

3.1 Site Conditions

See Attachment A.

3.2 Mechanical

See Attachment A for instrument air data, Attachment B for Water Quality, and Attachment D for Fuel Gas Analysis. Fuel gas supply pressure is in the range of 700-800 psig.

3.3 Electrical

See Attachment A for motor voltages.

4.0 Seller Technical Requirements

4.1 It is expected that the Seller shall engineer, design, supply, and guarantee the complete power generation process for a First Generation Compressed Air Energy Storage plant. The power generated during the generation cycle shall be maximized given the constraints of the process and the drivers shown in Attachment C – Seneca CAES Project Value Drivers.

4.2 Cavern and Electrical Constraints

Max Cavern Pressure, psig	1340
Min Cavern Pressure, psig	480
Cavern Air Temperature, ^{o}F	95
Cavern Size, ft^3	5,000,000
Line Capacity, MVA	200

4.3 The Seller shall design all equipment to meet the requirements listed within the attached Request for Budgetary Quotation documents.

4.4 All equipment and work not included within this Scope document and the attached Equipment Quotation Requests are assumed to be provided by Owner.

4.5 The Seller shall provide any cost saving solutions or options for improved performance not listed within this package.

5.0 Information and Data Requirements

5.1 Price summary and breakdown price schedule with Seller's Scope.

5.2 Exceptions and deviations against the Scope of Work and Equipment Requirements.

5.3 Seller's bid data for all equipment including:

a. Thermal Performance predictions including power output, exhaust pressures losses, exit temperatures, and equipment efficiencies.

b. Process flow diagrams detailing flow, temperature, and pressure values of gas, air, and water streams.

c. Emissions Data (NOx, CO, VOC, CO2).

d. Technical data sheets including all auxiliary equipment.

e. General Arrangement Drawings (plan, elevation, section).

f. Utility Consumption List (cooling water, instrument air, electricity, fuel gas requirements).

g. Equipment Weights.

h. Auxiliary load list including all auxiliary equipment.

5.4 P&I diagrams showing the terminal points for scope of supply.

5.5 Priced list for Maintenance spares and consumables.

5.6 Noise Data.

5.7 Control System overview with control philosophy.

5.8 Any additional requirements listed on the Budgetary Quotation documents.

6.0 Additional Documents

6.1 CAES-1-SP-MQ01, “Budgetary Quotation for Recuperator”

6.2 CAES-1-SP-RPG7, “Budgetary Quotation for Air Turbine Generator”

6.3 Attachment A – Site Specific Data

6.4 Attachment B – Water Analysis

6.5 Attachment C – Seneca CAES Project Value Drivers

6.6 Attachment D – Fuel Gas Composition

ATTACHMENT A

SITE SPECIFIC DATA

General:

Location:	Reading Center, New York
Elevation (feet above mean sea level)	1,000
Outdoor Ambient Temperature Range:	(-)2 to 87 °F
Outdoor Ambient Design Temperature for HVAC (ASHRAE 2009)	
Summer (1.0% cooling):	87°F DB, 71°F WB
Winter (99.6% heating):	(-) 2°F DB
Design Indoor Temperature Range (Control Room, DCS Room, Office Areas, Electrical Rooms):	70 to 75°F
Design Indoor RH Range (Control Room, DCS Room, Office Areas, Electrical Rooms):	40 to 60% RH
Design Indoor Temperature Range for Ventilated Areas	45 to 90° F

Structural Data:

Building Design Codes:	IBC 2006 ASCE 7-05
Wind Load	
Exposure Category (IBC 2006, Section 1609.4)	C
Basic Wind Speed, V (IBC 2006), mph	90
Occupancy Category of Buildings and Structures (IBC 2006, Table 1604.5)	III
Importance Factor, I (ASCE 7-05, Table 6-1)	1.15
Snow Load	
Ground Snow Load, p_g (IBC 2006, Figure 1608.2)	35 psf
Exposure Category (IBC 2006, Section 1609.4)	C
Exposure Factor C_e (ASCE 7-05, Table 7-2)	1.0
Occupancy Category of Buildings and Structures (IBC 2006, Table 1604.5)	III
Importance Factor, I (ASCE 7-05, Table 7-4)	1.1
Rainfall	
Annual Average, inches	36
10 yr, 24 hr, inches	3.9
25 yr, 24 hr inches	4.5
Earthquake Loads	
Site Class (IBC 2006 Table 1613.5.2)	C
Mapped Spectral Response Acceleration, short period, Ss (IBC 2006 Figure 1613.5(1))	0.162 g
Mapped Spectral Response Acceleration, 1 second period, S_1 (IBC 2006 Figure 1613.5(2))	0.054g
Seismic Design Category (IBC 2006 Table 1613.5.6(1) & Table 1613.5.6(2))	A
Occupancy Category of Buildings and Structures (IBC 2006, Table 1604.5)	III
Importance Factor, I (ASCE 7-05, Table 11.5-1)	1.25

Electrical Data:

AC Power			
Medium Voltage	13.8 kV	3P, 3W	60 Hz
Low Voltage Power	480 V	3P, 3W	60 Hz
	208/120V	3P, 4W	60 Hz
Motors			
<= 1/3 hp motor (Except MOVs)	115 V	1P, 2W	60 Hz
> 1/3 hp but < 250 hp motor and MOVs	460 V	3P, 3W	60 Hz
>= 250 hp motor	13.2 kV	3P, 3W	60 Hz
Welding Receptacles	480 V	3P, 3W	60 Hz
Lighting	480 V	3P, 4W	60 Hz
DC Power			
Control Circuits	125 VDC	NA	NA
Instrument Power	120 VAC	1P, 2W	60 Hz

Mechanical Data:

Maximum Cooling Water Temperature, deg F	80
Site Air	
Instrument Air Maximum Pressure, psig	125
Instrument Air Dewpoint, ºF	-40
Service Air Maximum Pressure, psig	125
Instrument / Service Air Maximum Temperature, ºF	100
Noise Requirements	
Near Field (3 feet horizontally, 5 feet vertically from machine baseline	90 dBA
Far Field (Plant equiment measured 400' from plant site)	45 dBA

Notes:

None

ATTACHMENT B

Water Analysis

Circulating Cooling Water

Cations	Concentration (mg/L)
Calcium (as $CaCO_3$)	336.0
Magnesium (as $CaCO_3$)	88.00
Sodium (as Na)	1072
Potassium (as K)	21.60
Total Hardness	424
Anions	
Chloride (as Cl)	1112
Sulfate (as SO_4)	1052
Silica (as SiO_2)	14.40
Phosphate (as PO_4)	85.60
Nitrate	4.00
Total Alkalinity	46
Parameters	
pH	7.00
Max Supply Temperature	80 ºF
Suspended Solids	12.00 mg/L

Raw Water

Cations	Concentration (mg/L)
Calcium (as $CaCO_3$)	42.00
Magnesium (as $CaCO_3$)	11.00
Sodium (as Na)	133.96
Potassium (as K)	2.70
Anions	
Chloride (as Cl)	139.0
Sulfate (as SO_4)	38.00
Silica (as SiO_2)	1.80
Phosphate (as PO_4)	10.70
Nitrate	0.500
Total Alkalinity	106
Parameters	
Temperature	60 ºF
Suspended Solids	1.50 mg/L

Data based on preliminary calculations.

ATTACHMENT C

SENECA CAES PROJECT VALUE DRIVERS

Purpose:

This document presents an overview on the different operating modes in which the Seneca CAES is anticipated to operate and the key parameters that will make such operation, and thus the project, successful.

Bidders should optimize these key parameters - moderated against the goals of producing a facility that is characterized by its safety, simplicity of operation, and reliability; and moderated by the incremental cost of further optimizing any particular key parameter.

Key Parameters:

Compression (Cavern Charging):

Minimum time required to charge 5 million cubic foot cavern from its minimum charge of 480 psig to 1,340 psig as measured at well head, limited by maximum available line capacity of 200 MVA with 0.85 power factor. Grade is approximately 1,000 feet above MSL and the top of the cavern is approximately 1,200 feet below MSL.

Turn down to allow compression at reduced available power down to 40 MVA.

Confirm whether compressor-motors can be de-coupled to operate in synchronous condenser mode. If feasible, provide “D” curves (leading and lagging), how much energy is required to spin them, and what is the maximum capacity.

Generation:

Minimum output value (meeting emissions limits).

Maximum output value (limited to same available line capacity as above.)

Heat rate and energy ratio – provide values for each 10% increase in output levels, starting at zero output.

Minimum start-up time – provide time to achieve each 10% increase in total output up to full load.

Confirm a minimum ramp rate of 8 MW/min, up and down, when operating above minimum load.

Minimum time to go from compression to generation. Minimum time to go from generation to compression. Target for both is 5 minutes or less.

ATTACHMENT C

SENECA CAES PROJECT VALUE DRIVERS

Minimum time to achieve synchronization.

Confirm whether expanders-generators can be de-coupled to operate in synchronous condenser mode. If feasible, provide "D" curves (leading and lagging), how much energy is required to spin them, and what is the maximum capacity.

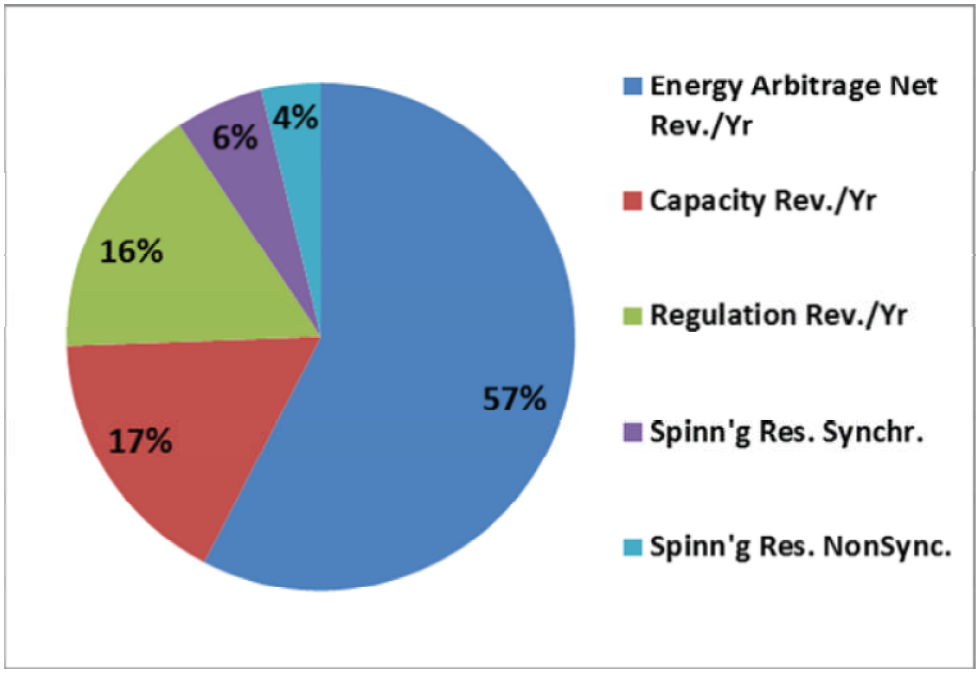
Combined:

What is the breakpoint for energy ratio or heat input with respect to going from 480 psig to 1,340 psig?

Other:

Confirm that black start capability can be provided and provide option price for this feature.

Expected Revenue Opportunity Breakdown:



ATTACHMENT D

Fuel Gas Composition

Component	Typical Analysis (mole %)	Range (mole %)
Methane	94.9	87.0 - 96.0
Ethane	2.5	1.8 - 5.1
Propane	0.2	0.1 - 1.5
iso - Butane	0.03	0.01 - 0.3
n - Butane	0.03	0.01 - 0.3
iso - Pentane	0.01	Trace - 0.14
n - Pentane	0.01	Trace - 0.04
Hexanes+	0.01	Trace - 0.06
Nitrogen	1.6	1.3 - 5.6
Carbon Dioxide	0.7	0.1 - 1.0
Oxygen	0.02	0.01 - 0.1
Hydrogen	trace	Trace - 0.02
Specific Gravity	0.585	0.57 – 0.62
Lower Heating Value (Btu/scf), dry basis	960	914 - 1021

Data based on Russell Station Project.

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NEW YORK STATE ELECTIC AND GAS

SENECA COMPRESSED AIR ENERGY STORAGE PROJECT

CYCLE 2 POWER GENERATION EQUIPMENT

SCOPE OF WORK

Document: CAES-1-SW-RPG0

Revision: A

Date: September 2011

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SYNOPSIS

This document details the scope of work for a budgetary quotation of CAES 2 Generation Cycle.

Disclaimer

REV	DESCRIPTION	ORIG	REVIEW	WORLEY-PARSONS APPROVAL	DATE
A	Issued For Bid	Paul Phiambolis P. Phiambolis	Harry G. Eisenbise Harry Eisenbise	Harry G. Eisenbise Harry Eisenbise	September 2011

1.0 General Information

The Seller shall supply all the equipment within this Scope of Work document for a Second Generation Compressed Air Energy Storage plant.

The equipment / system specified herein combined with the other equipment contained in the package shall be installed and operated in a Second Generation Compressed Air Energy Storage plant located in Reading, NY. Site Specific Data which includes climate, structural, and utility supply data are displayed in Attachment A. English units shall be the system of units.

2.0 Scope of Supply

The equipment, material and services to be provided by the Seller shall include but not be limited to the following:

1. All thermodynamic and engineering cycle work within the requirements of this Scope document.

2. Combustion Turbine Generator package and auxiliary options shown in CAES-1-SP-RPG0, “Budgetary Quotation for Combustion Turbine Generator”.

3. One (1) Air Turbine Generator package and auxiliaries as described per CAES-1-SP-RPG8, “Budgetary Quotation for Air Turbine Generator” and in Exhibit 1 – Air Turbine Generator Scope of Supply.

4. One (1) Recuperator package and auxiliaries as shown per CAES-1-SP-MQ00, “Budgetary Quotation for Recuperator”.

5. Stacks for Recuperator and Expander including a common stack option if deemed technically superior.

6. Interconnecting piping and ductwork design and material between all Seller provided equipment.

7. All necessary controls, instrumentation, and valves necessary for proper and safe operation of the complete cycle and plant.

8. Spare parts for erection, start-up and commissioning.

9. Two (2) years spare parts.

10. Special tools for erection, commissioning, operation, and maintenance.

3.0 Utility Supply Conditions

3.1 Site Conditions

See Attachment A.

3.2 Mechanical

See Attachment A for instrument air data, Attachment B for Water Quality, and Attachment D for Fuel Gas Analysis.

3.3 Electrical

See Attachment A for motor voltages.

5.0 Seller Technical Requirements

5.1 It is expected that the Seller shall engineer, design, supply, and guarantee the complete power generation process for a Second Generation Compressed Air Energy Storage plant. The power generated during the generation cycle shall be maximized given the constraints of the process.

5.2 Cavern and Electrical Constraints

The Supplier shall select compression / generation equipment with the following plant design parameters:

Max Cavern Pressure/Temperature, psig/deg F	1500 / 125
Min Cavern Pressure/Temperature, psig/deg F	1150 / 85
Total Usable Air Stored in Cavern, lbs	17,800,000
Maximum Compression Power Available, kW	170,000
Maximum Desired Net Plant Output, kW	210,000

5.3 The Seller shall design all equipment to meet the requirements listed within the attached Request for Budgetary Quotation documents.

5.4 All equipment and work not included within this Scope document and the attached Equipment Quotation Requests are assumed to be provided by Owner.

5.5 The Seller shall provide any cost saving solutions or options for improved performance not listed within this package.

6.0 Information and Data Requirements

6.1 Price summary and breakdown price schedule with Seller's Scope.

6.2 Exceptions and deviations against the Scope of Work and Equipment Requirements.

6.3 Seller's bid data for all equipment including:

a. Thermal Performance predictions including power output, exhaust pressures losses, exit temperatures, and equipment efficiencies.

b. Process flow diagrams detailing flow, temperature, and pressure values of gas, air, and water streams.

c. Emissions Data (NOx, CO, VOC, CO2).

d. Technical data sheets including all auxiliary equipment.

e. General Arrangement Drawings (plan, elevation, section).

f. Utility Consumption List (cooling water, instrument air, electricity, water washing, fuel gas requirements).

g. Equipment Weights.

h. Auxiliary load list including all auxiliary equipment.

6.4 P&I diagrams showing the terminal points for scope of supply.

6.5 Priced list for Maintenance spares and consumables.

6.6 Noise Data.

6.7 Control System overview with control philosophy.

6.8 Any additional requirements listed on the Budgetary Quotation documents.

7.0 Additional Documents

7.1 CAES-1-SP-RPG0, "Budgetary Quotation for Combustion Turbine Generator"

7.2 CAES-1-SP-MQ00, "Budgetary Quotation for Recuperator"

7.3 CAES-1-SP-RPG8, “Budgetary Quotation for Air Turbine Generator”

7.4 Attachment A – Site Specific Data

7.5 Attachment B – Water Analysis

7.6 Attachment C – Not Used

7.7 Attachment D – Fuel Gas Composition

ATTACHMENT A

SITE SPECIFIC DATA

General:

Location:	Reading Center, New York
Elevation (feet above mean sea level)	1,000
Outdoor Ambient Temperature Range:	(-)2 to 87 °F
Outdoor Ambient Design Temperature for HVAC (ASHRAE 2009)	
Summer (1.0% cooling):	87°F DB, 71°F WB
Winter (99.6% heating):	(-) 2°F DB
Design Indoor Temperature Range (Control Room, DCS Room, Office Areas, Electrical Rooms):	70 to 75°F
Design Indoor RH Range (Control Room, DCS Room, Office Areas, Electrical Rooms):	40 to 60% RH
Design Indoor Temperature Range for Ventilated Areas	45 to 90° F

Structural Data:

Building Design Codes:	IBC 2006 ASCE 7-05
Wind Load	
Exposure Category (IBC 2006, Section 1609.4)	C
Basic Wind Speed, V (IBC 2006), mph	90
Occupancy Category of Buildings and Structures (IBC 2006, Table 1604.5)	III
Importance Factor, I (ASCE 7-05, Table 6-1)	1.15
Snow Load	
Ground Snow Load, p_g (IBC 2006, Figure 1608.2)	35 psf
Exposure Category (IBC 2006, Section 1609.4)	C
Exposure Factor C_e (ASCE 7-05, Table 7-2)	1.0
Occupancy Category of Buildings and Structures (IBC 2006, Table 1604.5)	III
Importance Factor, I (ASCE 7-05, Table 7-4)	1.1
Rainfall	
Annual Average, inches	36
10 yr, 24 hr, inches	3.9
25 yr, 24 hr inches	4.5
Earthquake Loads	
Site Class (IBC 2006 Table 1613.5.2)	C
Mapped Spectral Response Acceleration, short period, Ss (IBC 2006 Figure 1613.5(1))	0.162 g
Mapped Spectral Response Acceleration, 1 second period, S_1 (IBC 2006 Figure 1613.5(2))	0.054g
Seismic Design Category (IBC 2006 Table 1613.5.6(1) & Table 1613.5.6(2))	A
Occupancy Category of Buildings and Structures (IBC 2006, Table 1604.5)	III
Importance Factor, I (ASCE 7-05, Table 11.5-1)	1.25

Electrical Data:

AC Power			
Medium Voltage	13.8 kV	3P, 3W	60 Hz
Low Voltage Power	480 V	3P, 3W	60 Hz
	208/120V	3P, 4W	60 Hz
Motors			
<= 1/3 hp motor (Except MOVs)	115 V	1P, 2W	60 Hz
> 1/3 hp but < 250 hp motor and MOVs	460 V	3P, 3W	60 Hz
>= 250 hp motor	13.2 kV	3P, 3W	60 Hz
Welding Receptacles	480 V	3P, 3W	60 Hz
Lighting	480 V	3P, 4W	60 Hz
DC Power			
Control Circuits	125 VDC	NA	NA
Instrument Power	120 VAC	1P, 2W	60 Hz

Mechanical Data:

Maximum Cooling Water Temperature, deg F	80
Site Air	
Instrument Air Maximum Pressure, psig	125
Instrument Air Dewpoint, ºF	-40
Service Air Maximum Pressure, psig	125
Instrument / Service Air Maximum Temperature, ºF	100
Noise Requirements	
Near Field (3 feet horizontally, 5 feet vertically from machine baseline	90 dBA
Far Field (Plant equiment measured 400' from plant site)	45 dBA

Notes:

None

ATTACHMENT B

Water Analysis

Circulating Cooling Water

Cations	Concentration (mg/L)
Calcium (as $CaCO_3$)	336.0
Magnesium (as $CaCO_3$)	88.00
Sodium (as Na)	1072
Potassium (as K)	21.60
Total Hardness	424
Anions	
Chloride (as Cl)	1112
Sulfate (as SO_4)	1052
Silica (as SiO_2)	14.40
Phosphate (as PO_4)	85.60
Nitrate	4.00
Total Alkalinity	46
Parameters	
pH	7.00
Max Supply Temperature	80 ºF
Suspended Solids	12.00 mg/L

Raw Water

Cations	Concentration (mg/L)
Calcium (as $CaCO_3$)	42.00
Magnesium (as $CaCO_3$)	11.00
Sodium (as Na)	133.96
Potassium (as K)	2.70
Anions	
Chloride (as Cl)	139.0
Sulfate (as SO_4)	38.00
Silica (as SiO_2)	1.80
Phosphate (as PO_4)	10.70
Nitrate	0.500
Total Alkalinity	106
Parameters	
Temperature	60 ºF
Suspended Solids	1.50 mg/L

Data based on preliminary calculations.

ATTACHMENT D

Fuel Gas Composition

Component	Typical Analysis (mole %)	Range (mole %)
Methane	94.9	87.0 - 96.0
Ethane	2.5	1.8 - 5.1
Propane	0.2	0.1 - 1.5
iso - Butane	0.03	0.01 - 0.3
n - Butane	0.03	0.01 - 0.3
iso - Pentane	0.01	Trace - 0.14
n - Pentane	0.01	Trace - 0.04
Hexanes+	0.01	Trace - 0.06
Nitrogen	1.6	1.3 - 5.6
Carbon Dioxide	0.7	0.1 - 1.0
Oxygen	0.02	0.01 - 0.1
Hydrogen	trace	Trace - 0.02
Specific Gravity	0.585	0.57 – 0.62
Lower Heating Value (Btu/scf), dry basis	960	914 - 1021

Data based on Russell Station Project.

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NEW YORK STATE ELECTIC AND GAS

SENECA COMPRESSED AIR ENERGY STORAGE PROJECT

PROCESS AIR COMPRESSOR

REQUEST FOR BUDGETARY QUOTATION

Document: CAES-1-SP-MFC1

Revision: B

Date: June 2011

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SYNOPSIS

This document presents the design criteria for the preparation of a budgetary quotation for an Air Compressor System.

Disclaimer

REV	DESCRIPTION	ORIG	REVIEW	WORLEY-PARSONS APPROVAL	DATE
A	Issued For Review	Paul Phiambolis	Jay White	Harry G. Eisenbise	June 15, 2011
B	Issued For Bid	Paul Phiambolis (Digitally signed by: Paul Phiambolis DN: CN = Paul Phiambolis C = US O = WorleyParsons OU = Mechanical Department Date: 2011.06.22 13:48:36 -05'00')	Jay White (Digitally signed by: Jay White DN: CN = Jay White C = US O = WorleyParsons OU = Mechanical Date: 2011.06.23 08:38:17 -05'00')	Harry G. Eisenbise (Digitally signed by: Harry G. Eisenbise DN: CN = Harry G. Eisenbise C = US O = WorleyParsons OU = Eastern Operations Date: 2011.06.23 09:08:44 -05'00')	June 22, 2011

1.0 General Information

The Seller shall provide a budgetary quote based on the information specified herein for an Air Compressor System.

The equipment / system specified herein will be used in a Compressed Air Energy Storage plant located in Reading Center, NY. The compressor will be supplying atmospheric air to a 5 million cubic feet cavern for storage at cavern pressures ranging from 480 to 1340 psig. The desired compression time is 8-10 hours. The desired efficiency shall be greater than 80%.

Site Specific Data which includes climate, structural, and utility supply data are displayed in Attachment A. English units shall be the system of units. Attachment C provides a summary of the project purpose and expectations.

2.0 Scope of Supply

A complete, functional system is desired. The equipment, material and services to be provided by the Seller shall include but not be limited to the following:

1. Two (2) oil free air compressors (1 x 60% capacity and 1 x 40% capacity) complete with motors and drives. The type shall be determined by Seller.

2. Variable frequency drives for all air compressors supplied.

3. All necessary block and non-return valves at compressor exit.

4. Lubrication system, complete with pumps, filters, cooler, reservoir, and piping required.

5. Complete intercooling and aftercooling system including water cooled heat exchangers, moisture separators, piping, and valves.

6. Local controls and instruments as required.

7. Local control panel for each compressor, complete with all panel mounted controls, instruments, piping, and wiring shop installed.

8. Terminal blocks for common trouble alarms, system monitoring, remote stop/start inputs from Owner's Distributed Control System (DCS), and control interconnections. The remote controls will operate in parallel with Seller-supplied local controls.

9. Programmable Logic Controller (PLC) based compressor control system, including automatic capacity control.

10. Vibration monitoring equipment.

11. All integral and interconnecting piping, valving, and wiring required.

12. Relief valves as required.

13. Noise attenuation as required.

14. Spare parts and consumables for erection, start-up and commissioning.

15. Two (2) years spare parts and consumables.

16. Special tools for erection, commissioning, operation, and maintenance.

3.0 Codes and Standards

The design, manufacture and construction of the equipment and systems shall conform to the applicable sections of the following codes and standards in addition to those indicated in the attached documents.

1. American Society of Mechanical Engineers (ASME)
2. American National Standard Institute (ANSI)
3. American Petroleum Institue (API)
4. American Society of Civil Engineers (ASCE)
5. American Society of Testing and Materials (ASTM)
6. International Building Code (IBC)
7. Institute of Electrical and Electronics Engineers (IEEE)
8. National Electrical Manufacturer's Association (NEMA)
9. National Electrical Code (NEC)
10. National Fire Protection Association (NFPA)
11. The International Society of Automation (ISA)

Seller must confirm with Owner if the codes listed above may be substituted for other codes utilized by Seller.

4.0 Utility Supply Conditions

4.1 Site Conditions

See Attachment A.

4.2 Mechanical

See Attachment A and B for cooling water data.

4.3 Electrical

See Attachment A for motor voltages.

Power from grid limited to a range of 50 MVA to 200 MVA.

5.0 Technical Requirements

5.1 The compressors shall be of a design suitable for the service and the specified application and performance stated within this section and in Exhibit 1 – Air Compressor Performance Sheet. All performance parameters shall be guaranteed at Seller's terminal points.

5.2 The compressor trains shall be designed to charge the cavern to 1,340 psig from a starting pressure of 480 psig with the power limitations stated in Section 4.3. This power limitation will set the maximum flowrate and compression cycle time. It is expected that the Seller shall provide the most applicable compressors to meet these requirements. Seller shall guarantee power requirement of compressors.

5.3 The compressor trains shall be designed to operate so when power availability is low, the smaller compressor train shall operate and when power availability is high, both compressor trains shall operate. Each compressor shall be designed for the same pressure and temperature requirements.

5.4 Each air compressor train shall be designed to run individually and in parallel and share a common discharge header. The individual lines from the compressor exhaust to common header shall be standard piping 24" or less. These lines will be tied together by Owner to a 24" main line. The Seller shall provide all necessary valves, fittings, and instruments on the individual lines that are required for proper operation of the equipment.

5.5 The compressors shall be motor driven with a variable frequency drive for part load operation. The air compressor system shall be designed to operate at all flows between 60 – 100% capacity.

5.6 Compressors shall be axial and/or centrifugal type with as much factory installed piping, valves, and controls as possible.

5.7 Design and construction shall be such as to ensure continuous safe and reliable operation without undue temperature rise, vibration and noise. All parts shall be easily accessible for maintenance and/or adjustment.

5.8 A rotor bundle cradle shall be provided for handling the removed bundle.

5.9 Compressor equipment shall be skid mounted and piped to the maximum extent possible on a baseplate of continuous welded steel construction.

5.10 Intercoolers and aftercooler shall be shell and tube type and be water cooled. Maximum discharge air temperature can be found in Exhibit 1. Cooling water shall be provided directly from Owner supplied cooling tower and large tubes shall be used to accommodate any particles in the water. The coolers shall include all necessary valves and instrumentation. See Attachment B for a water quality details.

5.11 All materials of construction shall be those proven by service in similar designs and suitable for the specified conditions of service, including atmospheric conditions of pressure, temperature, relative humidity and airborne contaminants. The metallurgy of all major components shall be clearly stated in the proposal.

5.12 The lubrication system equipment for each compressor shall include, but not be limited to, one air cooled (1) oil cooler and relief valve(s). The lubrication system components shall be designed completely integral with the equipment.

5.13 The inlet air systems shall be provided with a snow and rain hoods, access platforms and ladders, filters, silencer, and duct system for outdoor installation. Filters shall be of the self cleaning type using compressor bleed air. An anti icing system shall also be provided if deemed necessary by Seller.

5.14 Compressor and auxiliary component noise emissions shall not exceed levels stated in Attachment A. Suitable noise attenuation enclosures shall be provided as required.

5.15 Each air compressor shall be furnished with controls to permit complete operation, including starting, stopping, and emergency control functions. The controls shall include all devices for performing remote (start/stop) operation and monitoring.

5.16 The control system shall be integral to the compressor package and designed to provide manual and automatic running. The control system shall provide circuits for loading delay and starting idling delay at shutoff. The control system shall also provide for automatic shutoff of the compressor during periods of low demand and excessive idling to conserve energy.

5.17 A common water wash skid shall be supplied for compressor washing.

5.18 The air compressors will be located indoors.

6.0 Information and Data Requirement

6.1 Price summary and breakdown price schedule for each option.

6.2 Exceptions and deviations against the specification.

6.3 Seller's bid data including:

a. Technical data sheets including all auxiliary equipment.

b. Completed Exhibit 1.

c. General Arrangement Drawings (plan, elevation, section, & anchoring details).

d. Utility Consumption List (cooling water, instrument air, electricity, water washing).

e. Cooling water details including quality requirements and particulate size, temperature range, and flowrates.

f. Estimated equipment weights including rotor weights and heaviest component.

g. Power requirements of auxiliary equipment.

6.4 P&I diagrams showing the terminal points for scope of supply.

6.5 Operating power consumption curves between 60 and 100% of nominal capacity.

6.6 Price list for maintenance spares and consumables.

6.7 Noise Data.

6.8 Control system details including control principle, layout, and manufacturer/model information.

7.0 Additional Documents

7.1 Exhibit 1 – Compressor Datasheet

7.2 Attachment A – Site Specific Data

7.3 Attachment B – Water Analysis

7.4 Attachment C – Seneca CAES Project Value Drivers

Exhibit 1 – Air Compressor Datasheet

LOCATION: Indoors		
FLUID: Air		
SIZE / REDUNDANCY:	1 x 60%	1 x 40%
TYPE OF COMPRESSOR:	Axial and/or Centrifugal	Axial and/or Centrifugal
Air Compressor Performance, each	Seller shall guarantee items with an *	Seller shall guarantee items with an *
a. Discharge capacity @ 480 psig	Design: TBD by Seller* Operating Range: 60 – 100%*	Design: TBD by Seller* Operating Range: 60 – 100%*
b. Design inlet / discharge pressures	Inlet: 14.0-14.17 psia Discharge: 495-1,355 psia*	Inlet: 14.0-14.17 psia Discharge: 495-1,355 psia*
c. Min / Max air supply temperatures	-2 ºF / 87 ºF	-2 ºF / 87 ºF
d. Max air discharge temperature	*95 ºF	*95 ºF
e. Usable Air Storage (480 to 1340 psig)	20,917,246 lbs	
Seller to Provided Data Below		
a. Manufacturer's Model Number		
b. Air flow at maximum discharge pressure	*lbs/sec	*lbs/sec
c. Air flow at minimum discharge pressure	*lbs/sec	*lbs/sec
d. Oil Flooded (Yes/No)		
e. Brake power at rated capacity (max flow)	*kW	*kW
f. Compressor motor rating	*kW	*kW
g. Compressor speed at full load	rpm	rpm
h. Volumetric efficiency	%	%
i. Maximum sound pressure level @ 3 feet	*dBA	*dBA
j. Maximum Power Consumption	*kW	*kW
k. Cooling water temperature range	*ºF	*ºF
l. Cooling water flow	*GPM	*GPM

SITE SPECIFIC DATA

General:

Location:	Reading Center, New York
Elevation (feet above mean sea level)	1,000
Outdoor Ambient Temperature Range:	(-)2 to 87 °F
Outdoor Ambient Design Temperature for HVAC (ASHRAE 2009)	
Summer (1.0% cooling):	87°F DB, 71°F WB
Winter (99.6% heating):	(-) 2°F DB
Design Indoor Temperature Range (Control Room, DCS Room, Office Areas, Electrical Rooms):	70 to 75°F
Design Indoor RH Range (Control Room, DCS Room, Office Areas, Electrical Rooms):	40 to 60% RH
Design Indoor Temperature Range for Ventilated Areas	45 to 90° F

Structural Data:

Building Design Codes:	IBC 2006 ASCE 7-05
Wind Load	
Exposure Category (IBC 2006, Section 1609.4)	C
Basic Wind Speed, V (IBC 2006), mph	90
Occupancy Category of Buildings and Structures (IBC 2006, Table 1604.5)	III
Importance Factor, I (ASCE 7-05, Table 6-1)	1.15
Snow Load	
Ground Snow Load, p_g (IBC 2006, Figure 1608.2)	35 psf
Exposure Category (IBC 2006, Section 1609.4)	C
Exposure Factor C_e (ASCE 7-05, Table 7-2)	1.0
Occupancy Category of Buildings and Structures (IBC 2006, Table 1604.5)	III
Importance Factor, I (ASCE 7-05, Table 7-4)	1.1
Rainfall	
Annual Average, inches	36
10 yr, 24 hr, inches	3.9
25 yr, 24 hr inches	4.5
Earthquake Loads	
Site Class (IBC 2006 Table 1613.5.2)	C
Mapped Spectral Response Acceleration, short period, Ss (IBC 2006 Figure 1613.5(1))	0.162 g
Mapped Spectral Response Acceleration, 1 second period, S_1 (IBC 2006 Figure 1613.5(2))	0.054g
Seismic Design Category (IBC 2006 Table 1613.5.6(1) & Table 1613.5.6(2))	A
Occupancy Category of Buildings and Structures (IBC 2006, Table 1604.5)	III
Importance Factor, I (ASCE 7-05, Table 11.5-1)	1.25

Electrical Data:

AC Power			
Medium Voltage	13.8 kV	3P, 3W	60 Hz
Low Voltage Power	480 V	3P, 3W	60 Hz
	208/120V	3P, 4W	60 Hz
Motors			
<= 1/3 hp motor (Except MOVs)	115 V	1P, 2W	60 Hz
> 1/3 hp but < 250 hp motor and MOVs	460 V	3P, 3W	60 Hz
>= 250 hp motor	13.2 kV	3P, 3W	60 Hz
Welding Receptacles	480 V	3P, 3W	60 Hz
Lighting	480 V	3P, 4W	60 Hz
DC Power			
Control Circuits	125 VDC	NA	NA
Instrument Power	120 VAC	1P, 2W	60 Hz

Mechanical Data:

Maximum Cooling Water Temperature, deg F	80
Site Air	
Instrument Air Maximum Pressure, psig	125
Instrument Air Dewpoint, ºF	-40
Service Air Maximum Pressure, psig	125
Instrument / Service Air Maximum Temperature, ºF	100
Noise Requirements	
Near Field (3 feet horizontally, 5 feet vertically from machine baseline	90 dBA
Far Field (Plant equiment measured 400' from plant site)	45 dBA

Notes:

None

Water Analysis

Circulating Cooling Water

Cations	Concentration (mg/L)
Calcium (as $CaCO_3$)	336.0
Magnesium (as $CaCO_3$)	88.00
Sodium (as Na)	1072
Potassium (as K)	21.60
Total Hardness	424
Anions	
Chloride (as Cl)	1112
Sulfate (as SO_4)	1052
Silica (as SiO_2)	14.40
Phosphate (as PO_4)	85.60
Nitrate	4.00
Total Alkalinity	46
Parameters	
pH	7.00
Max Supply Temperature	80 ºF
Suspended Solids	12.00 mg/L

Raw Water

Cations	Concentration (mg/L)
Calcium (as $CaCO_3$)	42.00
Magnesium (as $CaCO_3$)	11.00
Sodium (as Na)	133.96
Potassium (as K)	2.70
Anions	
Chloride (as Cl)	139.0
Sulfate (as SO_4)	38.00
Silica (as SiO_2)	1.80
Phosphate (as PO_4)	10.70
Nitrate	0.500
Total Alkalinity	106
Parameters	
Temperature	60 ºF
Suspended Solids	1.50 mg/L

Data based on preliminary calculations.

Attachment C

SENECA CAES PROJECT VALUE DRIVERS

Purpose:

This document presents an overview on the different operating modes in which the Seneca CAES is anticipated to operate and the key parameters that will make such operation, and thus the project, successful.

Bidders should optimize these key parameters - moderated against the goals of producing a facility that is characterized by its safety, simplicity of operation, and reliability; and moderated by the incremental cost of further optimizing any particular key parameter.

Key Parameters:

Compression (Cavern Charging):

Minimum time required to charge 5 million cubic foot cavern from its minimum charge of 480 psig to 1,340 psig as measured at well head, limited by maximum available line capacity of 200 MVA with 0.85 power factor. Grade is approximately 1,000 feet above MSL and the top of the cavern is approximately 1,200 feet below MSL.

Turn down to allow compression at reduced available power down to 40 MVA.

Confirm whether compressor-motors can be de-coupled to operate in synchronous condenser mode. If feasible, provide “D” curves (leading and lagging), how much energy is required to spin them, and what is the maximum capacity.

Generation:

Minimum output value (meeting emissions limits).

Maximum output value (limited to same available line capacity as above.)

Heat rate and energy ratio – provide values for each 10% increase in output levels, starting at zero output.

Minimum start-up time – provide time to achieve each 10% increase in total output up to full load.

Confirm a minimum ramp rate of 8 MW/min, up and down, when operating above minimum load.

Minimum time to go from compression to generation. Minimum time to go from generation to compression. Target for both is 5 minutes or less.

Attachment C

SENECA CAES PROJECT VALUE DRIVERS

Minimum time to achieve synchronization.

Confirm whether expanders-generators can be de-coupled to operate in synchronous condenser mode. If feasible, provide "D" curves (leading and lagging), how much energy is required to spin them, and what is the maximum capacity.

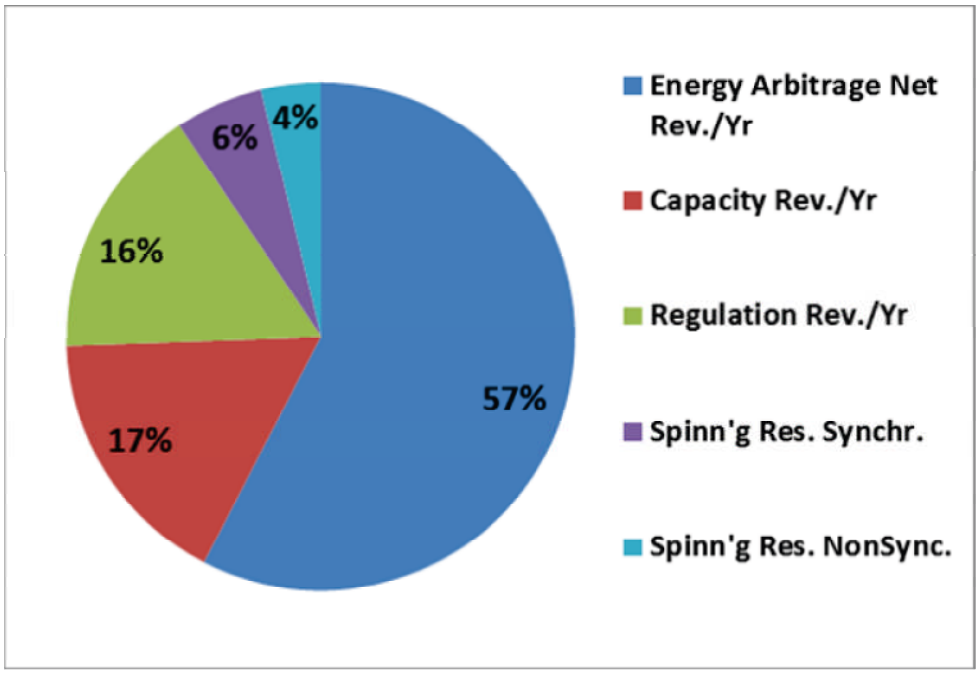
Combined:

What is the breakpoint for energy ratio or heat input with respect to going from 480 psig to 1,340 psig?

Other:

Confirm that black start capability can be provided and provide option price for this feature.

Expected Revenue Opportunity Breakdown:



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NEW YORK STATE ELECTIC AND GAS

SENECA COMPRESSED AIR ENERGY STORAGE PROJECT

AIR TURBINE GENERATOR

REQUEST FOR BUDGETARY QUOTATION

Document: CAES-1-SP-RPG7

Revision: A

Date: June 2011

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SYNOPSIS

This document presents the design criteria for the preparation of a budgetary quotation for an Air Turbine Generator used within a CAES Cycle 1 process.

Disclaimer

REV	DESCRIPTION	ORIG	REVIEW	WORLEY-PARSONS APPROVAL	DATE
A	Issued For Bid	Paul Phiambolis	Jay White	Harry G. Eisenbise	30-Jun-2011
		P. Phiambolis	Jay White	Harry Eisenbise	

NYSEG COMPRESSED AIR ENERGY STORAGE PROJECT
AIR TURBINE GENERATOR
REQUEST FOR BUDGETARY QUOTATION

1.0 General Information

The Supplier shall provide a budgetary quote based on the information specified herein for Air Turbine Generators (ATG).

2.0 Scope of Supply

The equipment, material and services to be provided by the Supplier shall include but not be limited to the following:

1. One (1) x 100% Air Turbine Generator package and auxiliaries as shown per Exhibit 1 – Scope of Supply Matrix.
2. All necessary combustors to increase the air temperature to provide efficient turbine performance.
3. All necessary controls, instrumentation, and valves necessary for proper and safe operation of the equipment.
4. Spare parts for erection, start-up and commissioning.
5. Two (2) years spare parts.
6. Special tools for erection, commissioning, operation, and maintenance.

3.0 Codes and Standards

The design, manufacture and construction of the equipment and systems shall conform to the applicable sections of the following codes and standards in addition to those indicated in the attached documents.

1. American Society of Civil Engineers (ASCE)
2. American Society of Mechanical Engineers (ASME)
3. American National Standard Institute (ANSI)
4. American Petroleum Institute (API)
5. American Society of Testing and Materials (ASTM)
6. International Building Code (IBC)
7. National Electrical Manufacturer's Association (NEMA)
8. National Electrical Code (NEC)
9. National Fire Protection Association (NFPA)
10. The International Society of Automation (ISA)

Supplier must confirm with Company if the codes listed above may be substituted for other codes utilized by Supplier.

4.0 Utility Supply Conditions

4.1 Site Conditions

See Attachment A in the Scope of Work document

4.2 Mechanical

See Attachment A for instrument air data and Attachment D for Fuel Gas Analysis in the Scope of Work Document. Fuel gas supply pressure is in the range of 700-800 psig.

4.3 Electrical

See Attachment A for motor voltages in the Scope of Work Document.

5.0 Technical Requirements

5.1 Performance Requirements :

a. Total Output: Seller's Standard

b. Emissions NOx: Lowest available from Seller.

c. Generator Voltage and Power Factor: 18 kV / 0.85 lagging

5.2 It is expected the Seller shall provide the most efficient and proven design to meet the requirements of this specification.

5.3 The supplier shall supply combustors to achieve the lowest possible ppmvd@15% O_2 of NOx emissions at all ambient temperatures between 50% to base load operating condition while operating on natural gas fuel. Seller shall provide water injection skid if necessary to control NOx emissions.

5.4 The ATG shall be located indoors, but some of the auxiliaries, such as the oil coolers, shall be located outdoors.

5.5 The ATG shall be provided with a synchronous condenser and clutch for the generator to operate in synchronous condensing mode when the grid needs VARs to improve power factor.

5.6 The ATG shall be capable of uninterrupted, continuous operation at 50% load down to a minimum pressure of 480 psig.

5.7 The ATG shall be provided with generator cooling with Seller standard cooling for the given generator size. The cooling system shall be self contained and shall not need external cooling water.

5.8 The ATG shall be provided with a lubricating oil cooling and control oil cooling systems. The Seller shall supply all necessary piping and fittings to bypass the bearings during the lubricating oil system flush.

5.9 The Seller shall provide all interconnecting piping, valves, wiring, and accessories for a complete packaged power plant.

5.10 The ATG shall be provided with a complete control system which can be integrated with the plant DCS. The ATG shall have the appropriate relays to allow automatic synchronizing with the utility power grid. The Owner shall provide relay supervised manual synchronization.

5.11 The rating of the generator shall be such that when operating at the rated power factor and at rated hydrogen pressure, if applicable, the generator shall be capable of carrying continuously the maximum output of the driving turbine and shall not limit the peak turbine output over the specified operating range.

5.12 The generator shall be capable of operating continuously at maximum rated MVA output at any power factor between the rated power factor lagging and 0.90 leading power factor and at any voltage between within +/- 5% of the rated volts, but not necessarily within guaranteed temperature limits.

5.13 The noise emission from the equipment furnished by the Seller shall not exceed levels shown on Attachment A. Seller to provide a noise attenuated enclosure if necessary.

5.14 All stairways, platforms, ladders, handrails, etc. shall conform to the requirements of OSHA, state, and local codes, NFPA, and any other regulatory agency for access and egress, design and construction details, and all other criteria.

5.15 Insulation material shall be provided for all equipment and piping surfaces specified in Exhibit 1 which reach a normal operating temperature in excess of 140 ºF in accordance with personnel protection limits in ASTM C 1055.

5.16 The ATG shall be designed for fast start up. The Seller shall advise specific features included in the design to achieve fast start up.

5.17 All equipment shall be supplied in modules with the maximum amount of prefabrication.

5.18 All valves shall meet the requirements of ASME B16.34 or equivalent.

6.0 Information and Data Requirements

6.1 Price summary and breakdown price schedule for each option

6.2 Exceptions and deviations against the Specification

6.3 Seller's bid data including:

a. Thermal Performance predictions including power output, exhaust pressure losses, exit temperatures, and efficiencies.

b. Technical data sheets including all auxiliary equipment

c. General Arrangement Drawings (plan, elevation, section)

d. Utility Consumption List (cooling water, instrument air, electricity, water washing, fuel gas)

e. Equipment Weights and anchorage details

f. Auxiliary load list including all auxiliary equipment

6.4 P&I diagrams showing the terminal points for scope of supply

6.5 Priced list for Maintenance spares and consumables

6.6 Noise Data

6.7 Control System overview with control philosophy

7.0 Additional Documents

7.1 Exhibit 1 – Scope of Supply Matrix

Exhibit 1 – Scope of Supply Matrix

ITEM	DESCRIPTION	BY MFR	BY PURCH	COMMENTS
1.0	**TURBINE**			
1.1	Engine Assembly with Bedplate	X		
1.2	Walk-in Acoustic and Weather Enclosure with Ventilation, Heating, Lighting, and Low Pressure CO_2/FM 100 Fire Protection System	X		
1.3	Load Coupling to Generator and Guard	X		
1.4	Dry Chemical Exhaust Bearing Fire Protection System including Fire Detection	X		
1.5	Insulation Blankets	X		
1.6	Low NOx Burners (wet or dry)	X		
1.7	Dual Fuel Burners			Not Required
2.0	**MECHANICAL PACKAGE**			
2.1	HVAC and Lighting	X		
2.2	Air Compressor for Pneumatic System		X	
2.3	Low Pressure CO2/FM 100 Fire Protection System	X		
2.4	Lubricating Oil System			
2.5	Oil Reservoir	X		
2.6	Accumulators	X		
2.7	Shaft Driven Oil Pump			Not Required
2.8	2 x 100% AC Driven Oil Pump	X		
2.9	DC Emergency Oil Pump with Starter	X		
2.10	2x100% Air Cooled Oil Coolers	X		
2.11	Duplex Oil Filter	X		
2.12	Oil Temperature and Pressure Control Valves	X		
2.13	Oil Vapor Exhaust Fans and Demister	X		
2.14	Oil Heaters	X		
2.15	Oil Interconnect Piping	X		Stainless Steel
2.16	Oil System Instrumentation	X		
2.17	Oil for Flushing and First Filling		X	
2.18	Control Oil System			
2.19	Oil Reservoir	X		
2.20	Accumulators	X		
2.21	Shaft Driven Oil Pump			Not Required
2.22	2 x 100% AC Driven Oil Pump	X		
2.23	DC Emergency Oil Pump with Starter	X		
2.24	2x100% Air Cooled Oil Coolers	X		
2.25	Duplex Oil Filter	X		

Exhibit 1 – Scope of Supply Matrix

ITEM	DESCRIPTION	BY MFR	BY PURCH	COMMENTS
2.26	Oil Temperature and Pressure Control Valves	X		
2.27	Oil Vapor Exhaust Fans and Demister	X		
2.28	Oil Heaters	X		
2.29	Oil Interconnect Piping	X		Stainless Steel
2.30	Oil System Instrumentation	X		
2.31	Oil for Flushing and First Filling		X	
3.0	**ELECTRICAL PACKAGE**			
3.1	HVAC and Lighting	X		
3.2	AC and DC Motor Control Centers	X		
3.3	Generator Voltage Regulating Cabinet	X		
3.4	Generator Protective Relay Cabinet	X		
3.5	DC Distribution Panel	X		
3.6	Battery Charger	X		
3.7	Batteries / Racks	X		
3.8	Low Pressure CO2 /FM 100 Fire Protection System	X		
3.9	Medium Voltage Motor Controllers		X	
3.10	Generator Isolated Phase Duct		X	
3.11	Starting Motor Transformer		X	
3.12	Auxiliary Transformer		X	
3.13	Generator Breaker		X	
3.14	Generator Step Up Transformer		X	
3.15	Cable and Conduit within Package Skids	X		
3.16	Cable and Conduit between Package Skids		X	
4.0	**FUEL SUPPLY SYSTEMS**			
4.1	Fuel Gas System			
4.1.1.	Gas Valves Including Vent, Throttle and Trip Valves	X		
4.1.2.	Gas Piping - Stainless Steel	X		
4.1.3.	Gas Filter/Separator	X		Final Filter only
4.1.4.	Gas Supply Instruments and Instrument Panel	X		
4.2	Fuel Oil System			Not Required
4.2.1.	Oil Pump and Motor (1 per CT)			
4.2.2.	Oil Pump Suction Filter			
4.2.3.	Oil Relief, Bypass, and Trip Valves			
4.2.4.	Stainless Steam Interconnecting Piping			
4.2.5.	Oil Throttle, Check, Isolation and Control Valves			

Exhibit 1 – Scope of Supply Matrix

ITEM	DESCRIPTION	BY MFR	BY PURCH	COMMENTS
4.3	Water Injection System			
4.3.1.	Water Injection Pump (1 per CT)	X		If Required
4.3.2.	Water Injection Pump Suction Filter	X		If Required
4.3.3.	Water Injection Isolation and Control Valves	X		If Required
4.3.4.	Water Injection Control Panel	X		If Required
4.3.5.	Water Injection Piping	X		If Required
4.4	Flow Divider	X		
4.5	Power Augmentation Steam Supply Piping, Valves and Controls	X		
5.0	**STARTING SYSTEM**			
5.1	Enclosure	X		
5.2	Starting Motor or Static Start System	X		
5.3	Turning Gear and Clutch Assembly	X		
5.4	Starting Clutch			Not Required
5.5	Torque Converter			Not Required
6.0	**MISCELLANEOUS**			
6.1	Interconnecting Pipe, Wire, and Cable	X		
6.2	Rotor Air Cooler (if applicable)	X		If applicable.
6.3	On Line and Off Line Water Wash System	X		If required
6.4	Fire Fighting Agent Storage Tanks	X		
6.5	ATG Wash Drain Tanks		X	Supplier to provide design capacity requirements
6.6	ATG False Start Drain Tank			Not Required
6.7	Access and boroscope openings for maintenance and Inspection	X		
6.8	Platforms, Ladders and Stairs	X		
6.9	Piping Insulation and Lagging	X		
6.10	Grounding System connections	X		
6.11	Auxiliary Cooling System (Including Pump, Fin-Fan Cooler and Interconnecting Piping)	X		If Required for generator cooling
7.0	**GENERATOR**			
8.0	Generator Type			
8.1	Hydrogen Cooled (including H2 to water and liquid level detector)	X		Provide only if Supplier Standard
8.1.1.	Generator Gas Dryer			- Ditto -

Exhibit 1 – Scope of Supply Matrix

ITEM	DESCRIPTION	BY MFR	BY PURCH	COMMENTS
8.1.2.	Seal Oil System (including Defoaming Tank, Reservoir, Seal Oil Pump, Emergency Seal Oil Pump, Vapor Extractor, and Oil Mist Eliminator)			- Ditto -
8.2	TEWAC (including circulation system, interconnecting piping and controls)	X		Provide only if Supplier Standard
8.2.1.	RTD Cooling Water Inlet and Outlet			
8.3	Direct Air Cooled (including air ducting, air filtration system and filter cleaning system)	X		Provide only if Supplier Standard
8.4	Static or Rotating Exciter (Excitation transformer to be included for a static system)	X		
8.5	Line Termination Enclosure with CTs, VTs, Surge Arrestors, and Surge Capacitors	X		
8.6	Neutral Cubicle with CT, Neutral Tie Bus, Grounding Transformer, and Secondary Resistor	X		
8.7	Generator Auxiliaries Control Enclosure	X		
8.8	Strip Heaters	X		
8.9	RTD in Stator winding	X		
8.10	RTD in Air Stream	X		
8.11	Synchronous Condensing Operation Capabilities	X		
9.0	**CONTROL SYSTEM**			
9.1	Thermocouples for measuring critical turbine and generator temperatures	X		
9.2	RTDs or Thermocouple for monitoring bearing temperature	X		
9.3	Turbine-Generator Control System with Local Control Panel (including all control and monitoring functions, data logger and sequence of events recorder)	X		
9.4	Bentley Nevada Vibration Monitoring System	X		
10.0	**OTHER MATERIAL AND SERVICES**			
10.1	Finish Painting of Lagging and Exposed Steel		X	
10.2	Prime Painting of All Steel	X		
10.3	Design drawings	X		
10.4	Foundations		X	
10.5	Foundation Design, Foundations, Anchor Bolts, and Reinforcing Steel		X	
10.6	Lifting Lugs	X		
10.7	Bed Plates, Sole Plates, Adjusting Screws, Shims	X		
10.8	Freight (FOB Jobsite)	X		See Commercial

Exhibit 1 – Scope of Supply Matrix

ITEM	DESCRIPTION	BY MFR	BY PURCH	COMMENTS
				Section for details
10.9	Crating for Export	X		"
10.10	Unloading at Jobsite	X		"
10.11	Technical Direction during Installation, Start Up & Testing	X		"
10.12	Training of Operating & Maintenance Personnel	X		"
10.13	Operating and Maintenance Manuals	X		"
10.14	Performance Test		X	
10.15	Special Tools and Tackles	X		"
10.16	Start Up and Commissioning Spare Parts	X		"
10.17	Two (2) Years Operating Spare Parts	X		
10.18	Field Erection Labor and Equipment		X	

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NEW YORK STATE ELECTIC AND GAS

SENECA COMPRESSED AIR ENERGY STORAGE PROJECT

RECUPERATOR

REQUEST FOR BUDGETARY ESTIMATE

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Revision: A

Date: June 2011

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SYNOPSIS

This document presents the design criteria for the preparation of a budgetary quotation for an Air Recuperator used within a Cycle 2 process.

Disclaimer

REV	DESCRIPTION	ORIG	REVIEW	WORLEY-PARSONS APPROVAL	DATE
A	Issued For Bid	Paul Phiambolis Digitally signed by: Paul Phiambolis DN: CN = Paul Phiambolis C = US O = WorleyParsons OU = Mechanical Department Date: 2011.06.29 17:16:01 -05'00'	Jay White Digitally signed by: Jay White DN: CN = Jay White C = US O = WorleyParsons OU = Mechanical Date: 2011.06.30 08:41:23 -05'00'	Harry G. Eisenbise Digitally signed by: Harry G. Eisenbise DN: CN = Harry G. Eisenbise C = US O = WorleyParsons OU = Eastern Operations Date: 2011.06.30 08:55:34 -05'00'	
		P. Phiambolis	Jay White	Harry Eisenbise	

1.0 General Information

The Seller shall provide a budgetary quote based on the information specified herein for an Air Recuperator which heats compressed air using CTG exhaust gas.

2.0 Scope of Supply

The equipment, material and services to be provided by the Seller shall include but not be limited to the following:

1. Material supply, erection, and commissioning of One (1) Air Recuperator per Cycle design provided by Seller.
2. All necessary controls, instrumentation, and valves necessary for proper and safe operation of the equipment.
3. Spare parts for erection, start-up and commissioning.
4. Two (2) years spare parts.
5. Special tools for erection, commissioning, operation, and maintenance.

3.0 Codes and Standards

The design, manufacture and construction of the equipment and systems shall conform to the applicable sections of the following codes and standards in addition to those indicated in the attached documents.

1. American Society of Civil Engineers (ASCE)
2. American Society of Mechanical Engineers (ASME)
3. American National Standard Institute (ANSI)
4. American Petroleum Institue (API)
5. American Society of Testing and Materials (ASTM)
6. International Building Code (IBC)
7. National Electrical Manufacturer's Association (NEMA)
8. National Electrical Code (NEC)
9. National Fire Protection Association (NFPA)
10. The International Society of Automation

Seller must confirm with Contractor if the codes listed above may be substituted for other codes utilized by Seller.

4.0 Utility Supply Conditions

4.1 Site Conditions

See Attachment A in the Scope of Work Document.

4.2 Mechanical

See Attachment A for instrument air data in the Scope of Work Document.

4.3 Electrical

See Attachment A for motor voltages in the Scope of Work Document.

5.0 Technical Requirements

5.1 The Seller shall provide the most suitable Recuperator designs to meet the performance guarantees for each CTG option provided by the Seller. The CTG for the final design shall be chosen later by Owner. All guarantee conditions shall be at the Seller terminal point.

5.2 The air will be from a salt cavern and the Seller shall provide all necessary air filtration equipment necessary before the air enters the Recuperator.

5.3 The high pressure air shall flow through the tubesheets and the gas through the shell.

5.4 The Recuperator shall be designed to prevent tube surface temperatures from falling below the sulfuric acid dew point for all operating load conditions. The gas turbine will operate on natural gas fuel only.

5.5 The Recuperator shall be capable of variable pressure operation down to 45% of maximum operating pressure. It is the Company's expectation that the Recuperator is adequate for all transient and steady-state operating conditions of the CTG model indicated.

5.6 An SCR and CO catalyst shall be provided within the Recuperator to limit the emissions leaving the stack to 2 ppmvd@15% O_2 for both NOx and CO. The SCR system shall be design to use a 19% aqueous ammonia stream which will need to be vaporized. Ammonia slip shall be limited to 5 ppmvd@15% O_2.

5.7 The Recuperator shall be designed with the maximum amount of shop fabrication possible and be shipped in modules.

5.8 The terminal point for all air piping will be at the pipe bridge level (approximately 5 feet above grade) and two feet out from the side of the Recuperator.

5.9 The Recuperator will be located outdoors and shall be designed with the proper weather protection for cold weather and other conditions shown in Attachment A.

5.10 A steel stack 80 feet in height shall be provided and be fitted with a stack damper, silencer, and emission ports for a CEMS with a 360º EPA standard test port access platform and stairway. In the case of vertical design, the flue gas exit shall be greater than or equal to 80 feet.

5.11 The heat transfer modules shall be supported by a structural steel frame with a gas-tight, seal welded, steel (10 gauge minimum) outer pressure casing designed for the maximum gas turbine exhaust pressure but not less than 20 in H_2O. Structural support column bases shall include slide plates and base plates.

5.12 Inlet ductwork shall have a shop installed internal layer of insulation covered by 12 gauge stainless steel liner panels. The Recuperator casings shall have a shop installed internal layer of insulation covered by 16 gauge stainless steel liner panels.

5.13 Air and GT Exhaust gas piping supports shall be provided by the Seller up to the terminal points.

5.14 The Recuperator shall be controlled from the plant DCS based on the control philosophy and logic diagrams provided by the Seller. All necessary instrumentation and valves for this control shall be provided by the Seller.

5.15 Flow Accelerated Corrosion (FAC) issues shall be addressed and the Seller shall submit a description of design features that are included to prevent FAC.

5.16 The tubing, headers, safety valves and all pressure parts and trim piping shall be designed, fabricated, and tested in accordance with the requirements of Section 1 of the ASME Boiler and Pressure Vessel Code.

5.17 All valves shall meet the requirements of ASME B16.34 or equivalent.

5.18 All structural steel shall comply with ASTM A-36 and the AISC Manual of Steel Construction.

5.19 Materials shall be identified by their applicable ASME number or equivalent ASTM number.

5.20 A stair tower shall be supplied with the Recuperator for access.

5.21 Sufficient space shall be provided in the heat transfer sections to allow for water washing. Drains shall be provided in the casings for draining water.

5.22 The casings shall have access doors for maintenance. An access platform and ladder to grade shall be provided at each casing door.

6.0 Information and Data Requirement

6.1 Price summary and breakdown price schedule for each option

6.2 Exceptions and deviations against the Specification

6.3 Thermodynamic Performance of each Recuperator Design

6.4 Seller's bid data including:

a. Technical data sheets including all auxiliary equipment

b. General Arrangement Drawings (plan, elevation, section)

c. Utility Consumption List (instrument air, electricity, water washing)

d. Equipment Weights and Anchorage Details

e. Auxiliary load list including all auxiliary equipment

6.4 P&I diagrams showing the terminal points for scope of supply

6.5 Priced list for Maintenance spares and consumables

6.6 Noise Data

6.7 Preliminary control philosophy

7.0 Additional Documents

7.1 Exhibit 1 – Scope of Supply Matrix

Exhibit 1 – Scope of Supply Matrix

ITEM	DESCRIPTION	BY MFR	BY OTHERS	COMMENTS
1.0	**RECUPERATOR INLET**			
1.1	CT Exhaust Expansion Joint	X		Incl. hardware and gaskets
1.2	Gas Inlet Turning Vanes	X		If Required
1.3	Gas Inlet Flow Distributor	X		If Required
1.4	Gas Inlet Silencer	X		If Required
1.5	CT Exhaust to Recuperator Inlet Duct	X		
1.6	CT Simple Cycle Exhaust Stack			Not Required
1.7	CT Exhaust Bypass Diverter/Damper			Not Required
1.8	CT Exhaust Bypass Silencer			Not Required
1.9	CT Exhaust Bypass Expansion Joint			Not Required
1.10	Blanking Plates			Not Required
2.0	**TRIM AND INSTRUMENTATION**			
	Per Separate List Below			
3.0	**MAIN HEAT TRANSFER SECTION**			
3.1	Heat Transfer Surface	X		
3.2	Temperature control valves	X		
3.3	Safety and Relief Valve Silencers incl. anchors, and supports.	X		with Stacks. Max 85dbA.
3.4	Startup Vent Silencers incl.anchors, and supports.	X		with Stacks. Max 85 dbA.
3.5	Operating Vent Silencers incl. anchors, and supports.	X		with Stacks. Max 85 dbA.
3.6	Structural Steel for Supporting Tubes, Duct, Modules, Stairs, Platforms, etc.	X		
3.7	Insulation for Casing and Ducts	X		
3.8	Internal Liner for Casing and Ducts	X		
3.9	Insulation and lagging for Interconnect Piping	X		
4.0	**ACCESSORY EQUIPMENT**			
4.1	Inlet air filtration equipment	X		
4.2	Soot Blowers, Controls, Piping			Not Required
5.0	**RECUPERATOR EXHAUST**			
5.1	Stack	X		
5.2	Transition Duct to Stack	X		
5.3	Expansion Joint in Transition Duct to Stack	X		
5.4	Full perimeter flange for attachment of expansion joint	X		
5.5	Stack Silencer	X		If Required
5.6	EPA Test Connections and Access	X		
5.7	Continuous Emissions Monitoring System		X	
5.8	FAA Lighting and Obstruction Marking for Stack incl. control panel and rods	X		

Exhibit 1 – Scope of Supply Matrix

ITEM	DESCRIPTION	BY MFR	BY OTHERS	COMMENTS
5.9	Stack Damper	X		
5.10	Insulation and lagging for personnel protection	X		
6.0	**DUCT BURNER SYSTEM**			Not Required
7.0	**NO_X REDUCTION SYSTEM**			
7.1	SCR Catalyst Modules	X		
7.2	SCR Catalyst support structure	X		
7.3	SCR Catalyst lifting structure and hoist	X		
7.4	Aqueous Ammonia Storage Tank		X	
7.5	Aqueous Ammonia Forwarding Pumps		X	
7.6	Aqueous Ammonia Vaporizing Skid	X		
7.7	Dilution Air Blower	X		If Required
7.8	Ammonia Injection Grid	X		
7.9	Aqueous Ammonia Interconnect Piping and Valves from injection skid to grid	X		
8.0	**CO REDUCTION SYSTEM**			
8.1	CO Catalyst Modules	X		
8.2	CO Catalyst Support Structure	X		
8.3	CO Catalyst Monorail and Hoist	X		
9.0	**MISCELLANEOUS**			
9.1	Instrument and Service Air Piping		X	
9.2	Interconnect Piping and valves within ASME Limits	X		
9.3	Electrical Power and Control Wiring, and Instrument Tubing	X		
9.4	Connections with isolation valves, gaskets, and blinds.	X		
9.5	Earthing and lightning protection	X		
9.6	Grounding pads	X		
10.0	**OTHER MATERIAL AND SERVICES**			
10.1	Platforms, Walkways, Ladders, and Stairs	X		Access to all drums, valves, and EPA test ports
10.2	Hardware for Complete Assembly and Accessories	X		
10.3	Special Tools	X		As Required
10.4	Special Rigging devices including lifting devices (one per site)	X		As Required
10.5	Lifting Lugs	X		As Required
10.6	Finish Painting of Exposed Structural Steel and Casing	X		
10.7	Prime Painting of All Steel	X		
10.8	Drawings of all Mfg. supplied equipment with sufficient details for installation and maintenance	X		
10.9	Foundation detail design		X	

Exhibit 1 – Scope of Supply Matrix

ITEM	DESCRIPTION	BY MFR	BY OTHERS	COMMENTS
10.10	Baseplates, Anchor Bolts, and Embedment	X		
10.11	Review of Contractor Foundation Design by Seller.	X		
10.12	Crating for Export	X		
10.13	Packing for Outdoor Storage	X		
10.14	Delivery to FOB port	X		
10.15	Field Erection Supervision	X		
10.16	Field Erection Labor and Equipment	X		
10.17	Training of Operating & Maintenance Personnel	X		
10.18	Project Review Meetings	X		
10.19	Constructability Review	X		
10.20	Operating and Maintenance Manuals	X		
10.21	Startup and Testing Field Assistance	X		
10.22	Recuperator Purge		X	
10.23	Performance Test		X	
10.24	Special instruments for performance test (loan basis)	X		
10.25	Start Up and Commissioning Spare Parts	X		
10.26	Two (2) year spare parts and consumables.	X		
10.27	Shop inspection and testing	X		
10.28	Field touch up materials	X		

Exhibit 1 – Scope of Supply Matrix

Trim and Instrumentation List

The following table provides a general list of the trim and instrumentation to be provided by the Seller. Seller shall provide a trim and instrumentation list with the size and quantity of each item (list must included all items tables identified as by manufacturer). For multi-pressure units, each trim and instrumentation item applies to all pressure levels.

TYPE	DESCRIPTION	OPERATOR	BY MANUF	BY OTHERS
Control Valves	Air Flow Control	Pneumatic		X
Check Valve	Air Inlet	-	X	
	Air Outlet		X	
Block Valve	Air Flow Control Isolation	Manual		X
	Air Inlet	Manual	X	
	Pressure Gauge Isolation	Manual	X	
Drain Valve	Air Tubes	Manual	X	
	Stack	Manual	X	
Vent Valve	Air Tube Vents	Manual	X	
Safety Valve	Air Inlet Pipe	-		X
Flow Elements	Air Inlet	-		X
	Air Outlet	-		X
Transmitters	Air Inlet Pressure		X	
	Air Outlet Pressure	-	X	
	Casing and Duct Side Pressure	-	X	
Thermowells	Air Inlet with temperature element	-	X	
	Air Exit with Temperature Element	-	X	
	Steam Outlet-Test	-	X	
	Steam Outlet with Temperature Element	-	X	
	Gas side Recuperator Inlet, Exhaust Duct, and Casing with Temperature Element	-	X	
Miscellaneous	Air Outlet Pressure and Temperature gage	-	X	
	Air Inlet pressure and temperature gauge	-	X	

WorleyParsons
resources & energy

EcoNomics

NEW YORK STATE ELECTIC AND GAS

SENECA COMPRESSED AIR ENERGY STORAGE PROJECT

COMBUSTION TURBINE GENERATOR

REQUEST FOR BUDGETARY QUOTATION

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Date: September 2011

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SYNOPSIS

This document presents the design criteria for the preparation of a budgetary quotation for a Combustion Turbine Generator used within a CAES 2 process.

Disclaimer

REV	DESCRIPTION	ORIG	REVIEW	WORLEY-PARSONS APPROVAL	DATE
A	Issued For Bid	Paul Phiambolis Digitally signed by: Paul Phiambolis DN: CN = Paul Phiambolis C = US O = WorleyParsons OU = Mechanical Department Date: 2011.09.26 10:42:44 -05'00' P. Phiambolis	Harry G. Eisenbise Digitally signed by: Harry G. Eisenbise DN: CN = Harry G. Eisenbise C = US O = WorleyParsons OU = Eastern Operations Date: 2011.09.27 16:02:09 -05'00' Harry Eisenbise	Harry G. Eisenbise Digitally signed by: Harry G. Eisenbise DN: CN = Harry G. Eisenbise C = US O = WorleyParsons OU = Eastern Operations Date: 2011.09.27 16:02:40 -05'00' Harry Eisenbise	

Exhibit 1 – Scope of Supply Matrix

1.0 General Information

The Seller shall provide a budgetary quote based on the information specified herein for a Combustion Turbine Generator (CTG). The Supplier shall select a CTG model that provides the best cycle performance based on the plant output requirements stated in the Scope of Work document.

2.0 Scope of Supply

The equipment, material and services to be provided by the Seller shall include but not be limited to the following:

1. Seller Suggested CTG packages and auxiliaries per Exhibit 1 – Scope of Supply Matrix.
2. All necessary controls, instrumentation, and valves necessary for proper and safe operation of the equipment.
3. Spare parts for erection, start-up and commissioning.
4. Two (2) years spare parts.
5. Special tools for erection, commissioning, operation, and maintenance.

3.0 Codes and Standards

The design, manufacture and construction of the equipment and systems shall conform to the applicable sections of the following codes and standards in addition to those indicated in the attached documents.

1. American Society of Civil Engineers (ASCE)
2. American Society of Mechanical Engineers (ASME)
3. American National Standard Institute (ANSI)
4. American Petroleum Institute (API)
5. American Society of Testing and Materials (ASTM)
6. International Building Code (IBC)
7. National Electrical Manufacturer's Association (NEMA)
8. National Electrical Code (NEC)
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Seller must confirm with Contractor if the codes listed above may be substituted for other codes utilized by Seller.

Exhibit 1 – Scope of Supply Matrix

4.0 Utility Supply Conditions

4.1 Site Conditions

See Attachment A in Scope of Work Document

4.2 Mechanical

See Attachment A for instrument air data and Attachment D for Fuel Gas Analysis in Scope of Work Document

4.3 Electrical

See Attachment A for motor voltages in Scope of Work Document.

5.0 Technical Requirements

5.1 Performance Requirements :

a. Fuel Performance Heating: No.

b. Emissions NOx: 9 ppmvd @15% O_2 or lowest offering.

c. Generator Voltage and Power Factor: 18 kV / 0.85 lagging.

5.2 The CTG shall be a new, commercially available machine that operates within OEM warranty conditions.

5.3 The CTG shall be industrial heavy duty type, dry low NOx combustor design, suitable for operating on natural gas. Natural gas will be the only fuel used in this application.

5.4 The combustion turbines shall be fitted with Dry Low NOx emission combustors to achieve the lowest possible ppmvd @15% O_2 of NOx emissions at all ambient temperatures between the lowest possible minimum load to base load operating condition while operating on natural gas fuel.

5.5 The CTG shall be located indoors, but some of the auxiliaries, such as air inlet filters, shall be located outdoors.

5.6 The CTG shall be provided with generator cooling (air or hydrogen as standard with the Seller).

5.7 The CTG shall be provided with a lubricating oil cooling and control oil cooling systems. The lubricating and control system shall be provided with stainless steel piping for both supply and return systems. The Seller shall supply all necessary piping and fittings to bypass the bearings during the lubricating oil system flush.

5.8 The Seller shall provide all interconnecting piping, valves, wiring, and accessories for a complete packaged system.

Exhibit 1 – Scope of Supply Matrix

5.9 The combustion turbine generators shall be provided with a complete and stand alone control system which can be datalinked with the plant DCS.

5.10 The CTG shall be capable of operating in the ambient temperature range specified in Attachment A and be designed for load changes up to 10% per minute at any ambient temperatures.

5.11 The CTG will operate in parallel with other electrical generating equipment connected to the transmission system.

5.12 The rating of the generator shall be such that when operating at the rated power factor and at rated hydrogen pressure, if applicable, the generator shall be capable of carrying continuously the maximum output of the driving turbine and shall not limit the peak turbine output over the specified operating range. The insulation class shall be Class F type and with Class B temperature rise.

5.13 The generator shall be capable of operating continuously at maximum rated MVA output at any power factor between the rated power factor lagging and 0.90 leading power factor and at any voltage between within +/- 5% of the rated volts, but not necessarily within guaranteed temperature limits.

5.14 The noise emission from the equipment furnished by the Seller shall not exceed levels shown on Attachment A. Seller to provide a noise attenuated enclosure if necessary.

5.15 The air inlet system shall be provided with snow and rain hood, evaporative cooler, silencer, and ducting system. The filters shall be self cleaning type. An anti-icing system shall be provided if deemed necessary by Seller.

5.16 All stairways, platforms, ladders, handrails, etc. shall conform to the requirements of OSHA, state, and local codes, NFPA, and any other regulatory agency for access and egress, design and construction details, and all other criteria.

5.17 Insulation material shall be provided for all equipment and piping surfaces specified in Exhibit 1 which reach a normal operating temperature in excess of 140 ºF in accordance with personnel protection limits in ASTM C 1055.

5.18 The CTG shall be designed for fast start up. The Seller shall advise specific features included in the design to achieve fast start up.

5.19 All equipment shall be supplied in modules with the maximum amount of prefabrication.

Exhibit 1 – Scope of Supply Matrix

6.0 Requested Performance Data

Guaranteed performance data including output, heat rate, exhaust flow, exhaust temperature, and emissions data shall be provided for the following conditions:

a. -2ºF / 50% RH @min emissions load, 75%, 100%

b. 45ºF / 60% RH @min emissions load, 75%, 100%

c. 87ºF / 46% RH @min emissions load, 75%, 100%

7.0 Information and Data Requirements

7.1 Price summary and breakdown price schedule for each option.

7.2 Exceptions and deviations against the Specification

7.3 Seller's bid data including:

a. Technical data sheets including all auxiliary equipment.

b. General Arrangement Drawings (plan, elevation, section).

c. Utility Consumption List (instrument air, electricity, water washing, fuel gas requirements).

d. Equipment Weights and Anchorage Details

e. Auxiliary load list including all auxiliary equipment.

7.4 P&I Diagrams showing the terminal points for scope of supply.

7.5 Priced list for Maintenance spares and consumables.

7.6 Noise Data.

7.7 Control System overview with control philosophy.

8.0 Additional Documents

8.1 Exhibit 1 – Scope of Supply Matrix

Exhibit 1 – Scope of Supply Matrix

ITEM	DESCRIPTION	BY MFR	BY PURCH	COMMENTS
1.0	**TURBINE**			
1.1	Engine Assembly with Bedplate	X		
1.2	Walk-in Acoustic and Weather Enclosure with Ventilation, Heating, Lighting, and Low Pressure CO_2/FM 100 Fire Protection System	X		
1.3	Load Coupling to Generator and Guard	X		
1.4	Dry Chemical Exhaust Bearing Fire Protection System including Fire Detection	X		
1.5	Insulation Blankets	X		
1.6	Dry Low NOx Burners	X		
1.7	Dual Fuel Burners			Not Required
2.0	**MECHANICAL PACKAGE**			
2.1	HVAC and Lighting	X		
2.2	Air Compressor for Pneumatic System		X	
2.3	Low Pressure CO2/FM 100 Fire Protection System	X		
2.4	Lubricating Oil System			
2.5	Oil Reservoir	X		
2.6	Accumulators	X		
2.7	Shaft Driven Oil Pump			Not Required
2.8	2 x 100% AC Driven Oil Pump	X		
2.9	DC Emergency Oil Pump with Starter	X		
2.10	2x100% Oil Coolers	X		
2.11	Duplex Oil Filter	X		
2.12	Oil Temperature and Pressure Control Valves	X		
2.13	Oil Vapor Exhaust Fans and Demister	X		
2.14	Oil Heaters	X		
2.15	Oil Interconnect Piping	X		Stainless Steel
2.16	Oil System Instrumentation	X		
2.17	Oil for Flushing and First Filling		X	
2.18	Control Oil System			
2.19	Oil Reservoir	X		
2.20	Accumulators	X		
2.21	Shaft Driven Oil Pump			Not Required
2.22	2 x 100% AC Driven Oil Pump	X		
2.23	DC Emergency Oil Pump with Starter	X		
2.24	2x100% Oil Coolers	X		
2.25	Duplex Oil Filter	X		

Exhibit 1 – Scope of Supply Matrix

ITEM	DESCRIPTION	BY MFR	BY PURCH	COMMENTS
2.26	Oil Temperature and Pressure Control Valves	X		
2.27	Oil Vapor Exhaust Fans and Demister	X		
2.28	Oil Heaters	X		
2.29	Oil Interconnect Piping	X		Stainless Steel
2.30	Oil System Instrumentation	X		
2.31	Oil for Flushing and First Filling		X	
3.0	**ELECTRICAL PACKAGE**			
3.1	HVAC and Lighting	X		
3.2	AC and DC Motor Control Centers	X		
3.3	Generator Voltage Regulating Cabinet	X		
3.4	Generator Protective Relay Cabinet	X		
3.5	DC Distribution Panel	X		
3.6	Battery Charger	X		
3.7	Batteries / Racks	X		
3.8	Low Pressure CO2 /FM 100 Fire Protection System	X		
3.9	Medium Voltage Motor Controllers		X	
3.10	Generator Isolated Phase Duct		X	
3.11	Starting Motor Transformer		X	
3.12	Auxiliary Transformer		X	
3.13	Generator Breaker		X	
3.14	Generator Step Up Transformer		X	
3.15	Cable and Conduit within Package Skids	X		
3.16	Cable and Conduit between Package Skids		X	
4.0	**INLET AND EXHAUST SYSTEMS**			
4.1	Inlet Louver with Screen	X		
4.2	Inlet Duct and Silencers	X		
4.3	Self Cleaning Filters	X		
4.4	Evaporative Cooler System	X		
4.5	Inlet Air Chilling Coil			Not Required
4.6	Anti – Icing System	X		If Required
4.7	Inlet Support Structure	X		
4.8	Maintenance Hoists for Filter removal	X		
4.9	Inlet Expansion Joint	X		
5.0	**FUEL SUPPLY SYSTEMS**			
5.1	Fuel Gas System			

Exhibit 1 – Scope of Supply Matrix

ITEM	DESCRIPTION	BY MFR	BY PURCH	COMMENTS
5.1.1.	Gas Valves Including Vent, Throttle and Trip Valves	X		
5.1.2.	Gas Piping - Stainless Steel	X		
5.1.3.	Gas Filter/Separator	X		Final Filter
5.1.4.	Gas Supply Instruments and Instrument Panel	X		
5.2	Fuel Oil System			
5.2.1.	Oil Pump and Motor (1 per CT)			Not Required
5.2.2.	Oil Pump Suction Filter			Not Required
5.2.3.	Oil Relief, Bypass, and Trip Valves			Not Required
5.2.4.	Stainless Steam Interconnecting Piping			Not Required
5.2.5.	Oil Throttle, Check, Isolation and Control Valves			Not Required
5.3	Water Injection System			
5.3.1.	Water Injection Pump (1 per CT)			Not Required
5.3.2.	Water Injection Pump Suction Filter			Not Required
5.3.3.	Water Injection Isolation and Control Valves			Not Required
5.3.4.	Water Injection Control Panel			Not Required
5.3.5.	Water Injection Piping			Not Required
5.4	Flow Divider	X		
5.5	Power Augmentation Steam Supply Piping, Valves and Controls			Not Required
6.0	**STARTING SYSTEM**			
6.1	Enclosure	X		
6.2	Starting Motor or Static Start System	X		
6.3	Turning Gear and Clutch Assembly	X		
6.4	Starting Clutch			Not Required
6.5	Torque Converter			Not Required
7.0	**MISCELLANEOUS**			
7.1	Interconnecting Pipe, Wire, and Cable	X		
7.2	Rotor Air Cooler (if applicable)	X		
7.3	On Line and Off Line Water Wash System	X		
7.4	Fire Fighting Agent Storage Tanks	X		
7.5	CT Wash Drain Tanks		X	Seller to provide design capacity requirements
7.6	CT False Start Drain Tank			Not Required
7.7	Access and boroscope openings for maintenance and Inspection	X		

Exhibit 1 – Scope of Supply Matrix

ITEM	DESCRIPTION	BY MFR	BY PURCH	COMMENTS
7.8	Platforms, Ladders and Stairs	X		
7.9	Piping Insulation and Lagging	X		
7.10	Grounding System connections	X		
7.11	Auxiliary Cooling System (Including Pump, Fin-Fan Cooler and Interconnecting Piping)	X		
8.0	**GENERATOR**			
9.0	Generator Type			
9.1	Hydrogen Cooled (including H2 to water and liquid level detector)	X		Provide only if Seller Standard
9.1.1.	Generator Gas Dryer			- Ditto -
9.1.2.	Seal Oil System (including Defoaming Tank, Reservoir, Seal Oil Pump, Emergency Seal Oil Pump, Vapor Extractor, and Oil Mist Eliminator)			- Ditto -
9.2	TEWAC (including circulation system, interconnecting piping and controls)	X		Provide only if Seller Standard
9.2.1.	RTD Cooling Water Inlet and Outlet			
9.3	Direct Air Cooled (including air ducting, air filtration system and filter cleaning system)	X		Provide only if Seller Standard
9.4	Static or Rotating Exciter (Excitation transformer to be included for a static system)	X		
9.5	Line Termination Enclosure with CTs, VTs, Surge Arrestors, and Surge Capacitors	X		
9.6	Neutral Cubicle with CT, Neutral Tie Bus, Grounding Transformer, and Secondary Resistor	X		
9.7	Generator Auxiliaries Control Enclosure	X		
9.8	Strip Heaters	X		
9.9	RTD in Stator winding	X		
9.10	RTD in Air Stream	X		
10.0	**CONTROL SYSTEM**			
10.1	Thermocouples for measuring critical turbine and generator temperatures	X		
10.2	RTDs or Thermocouple for monitoring bearing temperature	X		
10.3	Turbine-Generator Control System with Local Control Panel (including all control and monitoring functions, data logger and sequence of events recorder)	X		
10.4	Bentley Nevada Vibration Monitoring System	X		

Exhibit 1 – Scope of Supply Matrix

ITEM	DESCRIPTION	BY MFR	BY PURCH	COMMENTS
11.0	**OTHER MATERIAL AND SERVICES**			
11.1	Finish Painting of Lagging and Exposed Steel		X	
11.2	Prime Painting of All Steel	X		
11.3	Design drawings	X		
11.4	Foundations		X	
11.5	Foundation Design, Foundations, Anchor Bolts, and Reinforcing Steel		X	
11.6	Lifting Lugs	X		
11.7	Base Plates, Sole Plates, Adjusting Screws, Shims	X		
11.8	Freight (FOB Jobsite)	X		See Commercial Section for details
11.9	Crating for Export	X		"
11.10	Unloading at Jobsite	X		"
11.11	Technical Direction during Installation, Start Up & Testing	X		"
11.12	Training of Operating & Maintenance Personnel	X		"
11.13	Operating and Maintenance Manuals	X		"
11.14	Performance Test		X	
11.15	Special Tools and Tackles	X		"
11.16	Start Up and Commissioning Spare Parts	X		"
11.17	Two (2) Years Operating Spare Parts	X		
11.18	Field Erection Labor and Equipment		X	

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NEW YORK STATE ELECTRIC AND GAS

SENECA COMPRESSED AIR ENERGY STORAGE PROJECT

AUXILIARY TRANSFORMER

REQUEST FOR BUDGETARY QUOTATION

Document: CAES-1-SP-UBBO

Revision: A

Date: August 2011

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SENECA COMPRESSED AIR ENERGY STORAGE PROJECT
AUXILIARY TRANSFORMER
REQUEST FOR BUDGETARY QUOTATION

SYNOPSIS

This document presents the design criteria for the preparation of a budgetary quotation for the Auxiliary Transformer.

Disclaimer

REV	DESCRIPTION	ORIGINATOR	REVIEWER	APPROVER	DATE
A	Issued for Bid	G. PANNO	D. STERNER	G. PANNO	08/31/2011

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1. SCOPE

This engineering standard is applicable to outdoor, auxiliary type, oil-filled power transformers, 65 degrees C temperature rise unless otherwise specified in the Datasheet, for use in power generating plant distribution systems.

2. CODES AND STANDARDS

A. Unit Auxiliary Transformers shall be designed, manufactured and tested to comply with the latest revisions of applicable standards of each of the following organizations together with all he latest addenda, amendments or additions, as of the date of Contract:

1.	ANSI C57.12	Family of standards covering power transformers
2.	ASTM	American Society for Testing of Materials
3.	AWS	American Welding Society
4.	IEEE	Institute of Electrical & Electronics Engineers
5.	ISA	Instrument Society of America
6.	NEC	National Electrical Code
7.	NEMA	National Electrical Manufacturer's Association
8.	NFPA	National Fire Protection Association

B. Where the above referenced codes, standards, and guides contain recommendations in addition to requirements, the recommendations shall be considered requirements and shall be followed, unless stated otherwise by this Specification.

C. In case of any conflict between the reference codes, or this Specification and codes, the more stringent applies.

3. GENERAL

A. All Manufacturers shall comply fully with the complete requirements of this standard specification and the data sheets, which are to be used in tandem. Any deviations must be clearly defined in the Proposal.

B. Performance guarantees shall be provided for the following:

1. No load losses.

2. Full load losses

3. Percent impedance, both positive and zero sequence, between the various windings.

4. DESIGN AND CONSTRUCTION FEATURES

A. The Auxiliary Transformers shall be rated per CAES-1-DS-UBBO.

B. The transformer shall be sealed tank construction with a nitrogen preservation system that includes a single stage gas regulator, pressure switch, alarm circuit, dual cylinders connected with a manifold, reserve supply cylinder with valve, piping system to gas inlet on transformer tank and a supply line to the gas cylinder. Gas pressure shall be maintained between 0.5 and 9 psi. Alarm circuits will be provided for both low and high nitrogen bottle pressure.

C. The transformer shall be designed for rolling or skidding in any direction.

D. The transformer windings shall be copper and constructed from a cylindrical, tubular metal element having a straight polygonal section.

E. The transformer tank shall be of sealed construction and shall be capable of withstanding rated vacuum. The transformer tank cover shall be welded on. A manhole shall be provided on the transformer cover, at least 20 inches in diameter.

F. Transformer design, including internal conductors and bushings, shall be suitable for the additional kVA allowed by the forced-air cooling fans and fan control.

1. Fans shall be three-phase, per the Datasheet, and wired to an auxiliary cooling equipment control panel for power connection by Others.

2. Fans shall be individually fused or otherwise thermally protected.

3. Fan supports shall be bolted or welded on the transformer tanks.

4. Fans will be controlled by the winding hot spot temperature.

5. Fans shall have local on / off control switches for maintenance testing

G. Copper grounding pads shall be provided at opposite corners of the tank base. A NEMA 4-hole compression type lug for connection of a 500 kcmil ground cable to the station ground grid shall be provided for each ground pad. The transformer neutral bushing ground connection shall be bussed to the tank base and provided with a NEMA 4-hole

compression type lug for connection of a 500 kcmil ground cable to the station ground grid.

H. The transformer shall have a de-energized tap changer in the high-voltage winding with steps at +5%, +2.5%, 0%, -2.5% and -5%. The tap changer shall be suitable for operation from ground level when the transformer is de-energized. The tap changer handle shall have provisions for padlocking. Visible indication of tap position shall be provided and the drive shaft shall not be brought out through the tank. The tap changer will have a caution nameplate, a stainless steel plate mounted by the tap changer handle to read “CAUTION – NO-LOAD TAP CHANGER. Do not operate when transformer is in service. De-energize both the high and low voltage windings before changing tap position.”

I. The following devices shall be provided and installed on the transformers by the Manufacturer:

1. Magnetic liquid level indicator with alarm contacts and threaded conduit hub. This device shall have two set points and two sets of alarm contacts per set point.

2. Liquid filling and filter press connection in the top and bottom of the tank.

3. Combination drain and bottom filter valve with sampler.

4. Dial type liquid thermometer and temperature indicating switch with alarm contacts, maximum read pointer and threaded conduit hub. This device shall have two set points and two sets of alarm contacts per set point.

5. Gas accumulation gauge.

6. Vacuum pressure gauge with bleeder.

7. Lifting hooks on the tank, lifting eyes on the cover and provisions for jacking.

8. Stops shall be provided to prevent over-compression of gaskets.

9. As far as practical, gaskets below oil level will be eliminated unless isolating valves are provided.

10. Pressure relief device with alarm contacts and threaded conduit hub.

11. A hot spot dial-type winding temperature indicator with alarm contacts shall be provided for each high voltage and low voltage winding, for a minimum of two (2) per transformer. Each winding temperature indicator shall have two set points and two sets of alarm contacts per set point.

12. A sudden pressure, or Bucholtz relay (Device 63), shall be provided. The sudden pressure relay shall be supplied with seal-in contacts in an enclosure with a threaded conduit hub and “loss of DC indication.”

13. Stainless steel nameplates and tap changer warning/instruction plates. Nameplates shall not be attached to radiators.

14. Each transformer shall be supplied with a transformer identifier (tag number) nameplate. This nameplate shall be of laminated phenolic material (or agreed upon equivalent) with black letters on a white background.

15. The radiators shall be equipped with bolted flanges and valves to permit the removal of any radiator without draining the oil from the transformer or any other radiator. Lifting eyes shall be provided on each radiator/cooler group.

16. Connection provisions shall be made in the cooling equipment controls circuit to allow external interlocking with the Owner’s transformer protective relaying scheme, such that operation of normally closed contacts of the transformer protection lockout relay (86T) will shut down the cooling equipment in the event of an internal transformer fault.

17. Supplier shall make a statement on the alarm termination sheet defining which set of contacts are open in the alarm state.

18. An additional temperature detection system shall be furnished for the remote logging of top oil temperature. The temperature shall be transmitted via 4-20ma signal to the Buyer’s control system.

19. An instrument shall be provided that reads hydrogen concentration and water concentration. It shall produce 4-20mA signals for remote monitoring to the Buyer’s control system.

J. The transformer tank shall be shipped with dry nitrogen. The oil shall be shipped to the site separately. The Manufacturer shall be responsible to fill the tank with oil. The transformer shall be provided with the necessary amount of high grade insulating oil that

contains no detectable PCBs and the oil shall be manufactured and tested in accordance with the requirements of ASTM D3487, "Standard Specification for Mineral Insulating Oil Used in Electrical Apparatus." Identification of non-PCB liquid shall be placed on outside of tank.

K. Accessory wiring shall be installed in rigid galvanized steel conduit, except the final 18 inches to the device may be exposed SOW cable.

L. Internal, multi-ratio, bushing-type current transformers (CT) shall be provided as required is Section 4.A. All CT secondary terminals shall be wired to shorting terminal blocks using ring type lugs.

M. Bushing mounted, station-type lightning arrestors shall be provided in accordance with the Section 4.A. Arrestor ratings shall be coordinated with the transformer insulation level.

N. A throat or flange shall be provided for isolated-phase bus duct connections on the primary bushings of the transformer, the secondary connection shall be via an air terminal chamber suitable for cable bus.

O. All control wiring shall be 600 volt, 90 degrees C, and XLPE insulation, with stranded copper wire, No. 12 AWG (minimum) for power, No. 14 AWG (minimum) for controls, and No. 10 AWG (minimum) for current transformers. Terminal blocks shall be rated for 600 volts and accept conductors sized #18 through # 8 AWG. An additional 20% spare terminal blocks shall be provided. Heat shrink wire markers are required.

P. A core grounding strap shall be provided and shall be accessible from a tank top man-way.

Q. The Auxiliary Cooling Equipment Control shall meet the following requirements:

1. Two (2) fully independent power feeds and control circuits with automatic transfer between normal and backup power sources (480V, 3-PH, 3-W) in the event that one fails. Provide Form C alarm contact for loss of normal power/ transfer to backup.

2. Two (2) banks of cooling equipment controls shall be provided, which each powered by separate circuit breakers located in the control panel. Circuit breakers shall be ambient-compensated thermal-magnetic type.

3. Loss of auxiliary cooling power alarm (fans not running).

R. The Auxiliary Cooling Equipment Control Cabinet shall meet the following requirements:

1. The Control Cabinet components shall be mounted in a weatherproof enclosure of NEMA 4X design, as a minimum.

2. The Control Cabinet shall be welded construction throughout with no bolts or rivets visible on exterior.

3. The Control Cabinet shall have vertically hinged doors, with devices to secure the door in the fully open position, and include provisions for pad-locking.

4. The Control Cabinet shall have a removable aluminum bottom plate with double-door construction if opening is 42-inches wide, or greater.

5. The Control Cabinet and terminal block enclosures will be provided with space heater(s) and internal illumination by standard lamps(s), 120-VAC, with a door-activated On-Off switch and guard for lamp.

6. Each auxiliary control device will have a minimum of one normally open and one normally closed contact wired to terminal blocks for future use.

7. All alarm contacts shall be wired to indicators on a panel and a single common alarm. Common alarm will use ‘0’ as its alarm state.

S. A metal enclosed outdoor neutral grounding resistor, made of stainless steel shall be provided.

T. The transformer tank, core, coils, anchorage, appendages, bushings and surge arresters shall be qualified for the seismic forces.

5. TESTING

A. The "Routine" tests called for in ANSI/IEEE C57.12.00, Table 18, shall be performed for each transformer in accordance with ANSI/IEEE C57.12.90. For Class II transformers, these tests shall also include those defined as "Routine" per the notes to Table 18. When a temperature rise test is required in accordance with the Datasheet, only one transformer of each identical size shall be tested.

B. Owner reserves the right to inspect the equipment at the Manufacturer's plant prior to shipment, and to witness any or all testing. The manufacturer shall notify the Owner about the dates for the tests. The Owner or a designated representative will either witness the tests when performed or authorize the manufacturer to proceed without a witness and furnish a full report upon conclusion.

C. Owner shall be notified immediately and before shipment if the transformer fails to pass any test.

D. All insulation power factor tests for transformers and associated outdoor apparatus bushings will be performed with Doble™ or Frammel™ test equipment and associated procedures.

E. No load losses and excitation current will be measured at 90-100-110% rated voltage. Impulse, phase to ground and insulation power factor testing will be required with No-load losses, excitation current, impedance voltage and load loss testing will be performed both before and after impulse testing. Both sets of tests will be recorded on Certified Test Reports.

F. Production tests for outdoor apparatus bushings will be made and include:

1. Test for unintentional core grounds on core type transformers immediately prior to shipment.

2. Gas-in-oil analysis before the start of testing and again after all testing is complete; any differences will be explained to the satisfaction of the owner. Gas content of the oil, in parts per million, will be reported for the following gasses: Nitrogen, Carbon Monoxide, and Ethane.

3. Routine and design tests will be required for all current transformers, and metering CT's will be certified.

6. SPARE PARTS

A. Along with the equipment specified above the Manufacturer is required to provide individual prices for the following spare parts in the Proposal. The spare parts may be purchased with the order.

1. High voltage winding bushing and gasket

2. High voltage lightning arrestor (if applicable)

3. Low voltage winding bushing and gasket

7. GUARANTEES

As required by Section 3.D of this specification.

8. OTHER REQUIREMENTS

A. Cleaning and Painting:

1. Equipment openings, terminals and connections shall be protected against entrance of dirt, dust moisture, or other deleterious elements. All surfaces shall be protected from corrosion and oxidation in accordance with the Contractor's standard methods.

2. Steel surfaces shall be thoroughly cleaned and properly prepared for painting, following Manufacturer's standard painting procedure. One gallon of finish enamel shall be supplied for field touch-up.

3. The transformer shall be painted ANSI #70, light gray.

B. Preservation, Packing, Marking, Shipping and Storage:

1. Equipment openings, entrances to internal wiring, control devices and the like to be protected against entrance of dirt, dust, moisture, or other deleterious elements. All connections shall be protected by metal covers to prevent damage during shipment.

2. Transformer shall be as fully shop-assembled as possible within shipping and handling limitations. Internal bracing shall be provided to facilitate tanking and un-tanking, and to prevent movement of the core during shipment or seismic disturbances.

3. Lightning arrestors and cover mounted porcelain bushings shall be separately packaged for shipment.

4. Transformer shall have all valves sealed and effectively crated to prevent tampering or removal while in transit. Means shall be provided to allow measurement of gas pressure without release of the gas on arrival at destination. Valves shall be securely covered by a pipe cap or other tamper-proof cap.

5. A storage box shall be mounted on the transformer for storing removable cover plates and miscellaneous hardware used for shipment.

6. Complete installation instructions for any parts shipped separate from the tank and core assembly shall accompany the transformer shipment.

7. Flanged connections separated for shipment shall be suitably protected by means of blind cover plates, or similar closures, to exclude foreign matter. Valve openings shall be equipped with pipe plugs.

8. Cover-mounted porcelain bushings shall be separately packaged for shipment in substantial crating acceptable to the Contractor's transportation company.

9. Detachable radiators, expansion tanks, and other accessory devices which are removed for shipment shall be adequately crated to ensure protection from transit damage and exposure to weather.

10. Where it is necessary to prepare the transformer for shipment with a temporary "top-hat" or enclosure, construction of the enclosure shall be such as to be gas-tight and to permit removal in the field without the possibility of weld splatter entering the main tank.

11. All packaging shall be suitable for up to one year of outdoor storage.

12. Packaging shall be labeled and numbered so that each section or assembly may be identified upon arrival at the jobsite. Any items not fully assembled shall be packaged separately.

13. The transformers core and coil assembly shall be shipped in an upright position in its own tank. The transformers shall be shipped without oil and with the tank filled with dry air to maintain the internals in a dry condition. Pressure regulating valve shall be provided with inlet and outlet gauges for monitoring during storage.

14. Transformers shall be shipped with a minimum of two tamper-proof tri-directional impact recorders. The recorder shall be a continuous recording type using either a chart or strip output or digital memory for a minimum of 60 days or from the factory floor to the site, whichever is longer. Daily date and time stamps shall be included in the recording. The recorder shall be mounted as close as possible to the transformer's center of gravity. The average reading during shipment shall not exceed 50 percent of full recorder scale. Upon completion of transit, the charts of the recorder shall be made available for review by the Engineer upon delivery. The owner reserves the right to be supplied with copies of those

portions of charts which indicate switching speeds greater than 4 miles per hour and/or equivalent vertical shocks.

15. All shipping locks, bindings, etc, shall be clearly marked so that their removal prior to energization is assured. Any special precautions that must be observed in the removal of these shipping restraints shall be clearly marked on the shipping containment or crate.

16. If radiators or bushings are shipped loose, sufficient make-up oil shall be shipped to fill the transformer.

17. Adequate means to be provided for lifting by forklifts and cranes and for moving the units on rollers.

18. Where sections must be separated for shipment, all materials and Equipment to facilitate reassembly and reconnection of interconnection bus work and wiring in the field shall be furnished by the contractor.

19. The contractor shall prepare and submit to the Engineer written procedures for handling storage, shipping, and preserving of the Equipment to prevent degradation of the supplied Equipment prior to installation. This procedure shall include recommendations for onsite storage indoors or outdoors for up to six months, which shall be submitted to the Engineer for review.

20. Packaging and shipping shall be in accordance with the Special Conditions, Appendices A, B, and C.

C. Quality Assurance

1. The Contractor shall employ a quality plan in accordance with the requirements of Section IV, Quality Requirements.

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NEW YORK STATE ELECTRIC & GAS

NYSEG COMPRESSED AIR ENERGY STORAGE PROJECT

Continuous Emissions Monitoring System

REQUEST FOR BUDGETARY QUOTE

CYCLE 1

Document: CAES-1-SP-VDA2

Revision: A

Date: August 2011

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NYSEG COMPRESSED AIR ENERGY STORAGE PROJECT
CONTINUOUS EMISSIONS MONITORING SYSTEM
REQUEST FOR BUDGETARY QUOTE

SYNOPSIS

This document presents the design criteria for the preparation of a budgetary quotation for a Continuous Emissions Monitoring System used within a Cycle 1 process.

Disclaimer

REV	DESCRIPTION	ORIGINATOR	REVIEWER	APPROVER	DATE
A	Issued for Bid	N. Kelly	S. Kaley	S. Kaley	18-Mar-11

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1. SCOPE

1.1 General

A. This specification covers the engineering, design, assembly, configuration, shop testing, technical field assistance during erection, Certification testing, and technical field assistance during start-up of the Continuous Emissions Monitoring Systems (CEMS) for the NYSEG Cycle 1 Compressed Air Energy Storage (CAES) Project.

B. The Contractor shall supply one (1) microprocessor-based CEMS enumerated in this specification. Any hardware, software, or other items required by the unique nature of the Contractor's system design, as well as coordination with the Engineer and Owner needed to design, implement and install these functions, shall also be provided.

C. The Contractor shall design (including attending Design and Coordination Review Meetings), engineer, manufacture, deliver (CIP Jobsite, including freight and risk of loss), and test the CEMS, in accordance with the Contract Documents and drawings, which may not be a complete listing, to bring into successful operation one (1) Continuous Emissions Monitoring System, for the Burners.

D. The CEMS is required to monitor, record, and report the exhaust gas emissions of NOX, O2, CO, and any other constituents in accordance with the State of New York, and any other applicable governing agency requirements. The CEMS will be designed to include all monitoring requirements for the State of New York, and any other applicable governing agency.

E. All materials and components for the complete design, assembly, and testing of all Equipment shall be the responsibility of the Contractor. Any omission in this Specification does not relieve the Contractor of its responsibility to provide all Equipment and accessories complete in every respect for a reliable, and functional system.

1.2 Equipment and Services to be furnished by Contractor

A. Complete full extractive type sampling system including, but not limited to, the following items:

1. NOX, O2, and CO flue gas analyzers for main stack measurements.

2. Sample probes.

3. All necessary sample conditioning equipment.

4. Heated sample umbilical and necessary accessories for each sample probe.

5. Sample controller and data acquisition system, including an Ethernet interface to control room computer and hardwired signals to the Owner's Distributed Control System (DCS). The Ethernet interface to the control room computer shall be over fiber optic cable provided by Others. If necessary, media converters on both ends shall be provided by the Contractor.

6. All required system cabinets, racks and panels.

7. Thermocouples, temperature transmitters, pressure transmitters and all other instrumentation necessary to provide information to the CEMS required for reporting emissions per the applicable regulatory agencies.

8. Any additional accessories and equipment (including tubing, purge systems, valves, pumps, etc.) required by the Contractor's design to meet the applicable regulatory agencies reporting requirements.

9. All interconnection cabling within the CEMS Shelter for Contractor supplied equipment unless indicated below as “Furnished by Others”.

B. Data Acquisitions and Reporting

1. Personal Computer (PC) based system for data storage, retrieval and manipulating, calculations, alarm generation and report generation with printers, color LCD monitors, and other accessories as specified herein.

   a. Windows 7 based PC

   b. 56k internal modem for electronic submittal of regulatory reports, and vendor troubleshooting.

   c. Network Interface Card (NIC) with at least two (2) ports

   d. One additional Computer/LCD terminal to be located in the CEMS Enclosure including cables, connectors, and any necessary hardware and software

2. All necessary hardware, software, virus protection, and programming to provide a complete functional system.

C. CEMS Enclosure

1. Designing and furnishing of one weatherproof and climate controlled CEMS Enclosures. The Enclosure shall be manufactured and furnished in accordance with Contract documents. The CEMS Enclosure shall be sized to accommodate the Contractor's CEMS equipment and shall be located at base of the stack.

2. As a minimum the following items shall be included as part of each CEMS Enclosure:

   a. 480/208/120V AC Transformer including disconnect switch (mounted outside of the Enclosure).

   b. 120/208V AC Power Distribution Panel fed by the transformer (general service – A/C, lighting, etc.)

   c. 120V AC UPS Backed Distribution Panel.

   d. Lighting

   e. HVAC

   f. Provisions for Fire Protection Equipment – smoke detector, pull station, and fire extinguisher.

   g. Workbench

   h. Telephone and modem connection for Contractor diagnostic interface to sample controller and/or local LCD.

3. Calibration gas bottle rack and enclosure, attached to CEMS shelter and including pressure regulators, gauges, tubing required for connecting to the CEMS.

D. Other

1. Any special tools required for the installation, operation, and maintenance of the equipment.

2. All calibration gas gauged regulators, manifolds, hoses, and spare parts necessary for complete system start-up, certification, and initial operation up to commercial operation of the plant.

3. Schedules, procedures, drawings, instruction manuals, test and inspection reports, and other information and documents specified in Contract documents.

4. All required cleaning, painting (including additional paint if field touchup is required), packaging, and shipment of equipment and accessories specified herein.

5. Services of a qualified field representative to provide technical direction during installation of the Contractor's supplied Equipment and when requested by Owner to supervise site pre-certification and compliance testing; these services will be for a minimum 10 days (3 trips).

6. Factory Acceptance Testing (FAT) including calibration, adjustment, and testing of all equipment furnished.

7. Operational test and certification of the CEMS in the field including certification of all software (referred to as "Site Performance Test").

8. Training sessions, including supplementary training, as specified in Base Specification. Training shall be conducted at the Owner's site for operating, maintenance, and engineering personnel.

1.3 Equipment and Services to be furnished by Other's

The Owner will furnish the following permanent materials, equipment, labor, and services under the conditions described below. However the failure of the Owner to furnish any materials, equipment, labor, or services shall not relieve the Contractor of its responsibility to properly perform the Work.

A. Standard electrical cables for connection to Contractor supplied equipment, excluding wiring within skid-mounted packages, which is the responsibility of the Contractor.

B. Connections on stack liner for sample probes and other instrumentation.

C. 480VAC, 60 Hz power to CEMS Enclosure (Contractor's termination point).

D. 120VAC, 60 Hz, UPS power to CEMS Enclosure (Contractor's termination point).

E. Instrument and control air, 60 to 120 psig, clean, dry, dew point –40°F (Contractor's termination point).

F. All supervision and labor for unloading, storing, handling, and erecting, including preserving, cleaning up (including disposal of waste chemicals), and inspecting during and after storage. The Contractor shall state any specific items along with the space and environmental requirements in its proposal.

G. Concrete foundations, grouting, foundation bolts, nuts, washers, and leveling plates.

H. Access ladders, platforms, grating, steel, and handrail, except that specified as being part of Contractor-supplied skids and equipment, or that, which is integral to or normally furnished with such equipment.

I. Storage facilities. Storage and handling requirements shall be identified in the proposal.

J. Final field touchup painting. Contractor to supply paint.

K. Installation of the umbilical hoses from the sample probes to the CEMS enclosure.

L. Fire Protection Equipment – smoke detector, pull station, and fire extinguisher.

1.4 Design and Coordination Review Meetings

During the design phase, the Contractor shall implement systematic design review meetings, in addition to other meetings as necessary, with the Owner and the Engineer. The design review meetings shall present the status of design, review design parameters, obtain Owner and Engineer input, and review compliance with Contract requirements. The Contractor's project manager and appropriate design personnel shall conduct these meetings.

2. CODES AND STANDARDS

A. The latest edition and published addenda of the following publications in effect on the date of Contract Award are a part of this Specification and, where referred to by title or by basic designation only, are applicable to the extent indicated by the specific reference or equivalent national standards:

1. Compressed Gas Association (CGA)

   a. E-4, "Standard for Gas Pressure Regulators"

   b. V-1, "Standard for Compressed Gas Cylinder Valve Outlet and Inlet Connections"

2. Institute of Electrical and Electronic Engineers (IEEE)

   a. 518 – Guide for the Installation of Electrical Equipment to Minimize Electrical Noise Inputs to Controllers from External Sources

   b. 802.3, "Information Technology - Telecommunications and Information Exchange between Systems - Local and Metropolitan Area Networks"

   c. 1100, "Recommended Practice for Powering and Grounding Electronic Equipment"

   d. C37.90.1, "Surge Withstand Capability (SWC) Tests for Relays and Relay Systems Associated with Electric Power Apparatus"

3. The International Society of Automation (ISA)

   a. 37.1, "Electrical Transducer Nomenclature and Terminology"

   b. 50.00.01, "Compatibility of Analog Signals for Electronic Industrial Process Instruments"

   c. 51.1, "Process Instrumentation Terminology"

4. National Electrical Manufacturers Association (NEMA)

a. ICS 1, "Industrial Controls and Systems General Requirements"

b. ICS 4, "Application Guideline for Terminal Blocks"

c. 250, "Enclosures for Electrical Equipment (1000 Volts Maximum)"

5. Occupational Safety and Health Administration (OSHA) 29CFR, Part 1910

6. National Fire Protection Association (NFPA)

a. 70, “National Electrical Code”

b. 75, “Standard for the Protection of Information Technology Equipment”

7. U.S. Environmental Protection Agency (EPA)

a. 40 CFR Part 60, "Standards of Performance for New Stationary Sources"

b. 40 CFR Part 60, Appendix B, "Performance Specifications"

c. 40 CFR Part 60, Appendix F, "Quality Assurance Procedures"

d. 40 CFR Part 63, "National Emission Standards for Hazardous Air Pollutants for Source Categories"

e. 40 CFR Part 64, "Compliance Assurance Monitoring"

f. 40 CFR Part 75, "Continuous Emission Monitoring"

8. New York DEP

9. New York Building Code (NYSBC)

B. Where the above referenced codes, standards, and guides contain recommendations in addition to requirements, the recommendations shall be considered requirements and shall be followed, unless stated otherwise by this Specification.

C. In case of any conflict between the reference codes, or this Specification and codes, the more stringent applies.

3. GENERAL

A. All Manufacturers shall comply fully with the complete requirements of this standard specification. Any deviations shall be clearly defined in the Proposal.

B. The CEMS system specified will be used for the Cycle 1 Compressed Air Energy Storage Project to monitor the Cycle 1 Burner emissions.

C. The plant will be located in the county of Seneca, in the state of New York.

4. INFORMATION AND DATA REQUIREMENTS

4.1 Submittals

A. P&ID's showing the terminal points for scope of supply.

B. Price summary and breakdown price schedule for each option.

C. Exception and deviation against the specification.

D. An online exhaust gas emission monitoring concept shall be provided. This concept shall include listing and description of the proposed online monitoring equipment.

E. Completed datasheets, drawings and documents as required for providing details of supplied equipment.

F. Outline Dimensioned Drawings of the equipment and auxiliaries identifying weights, clearance, and maintenance requirements, including lifting and installation guidelines.

G. General arrangement drawings.

H. Foundation design information, including embedded parts and anchor bolt arrangement drawing.

I. Utility consumption list.

J. Customer connection list.

K. Drawing submission list and schedule after contract.

L. Performance and availability guarantees.

M. Priced list for Maintenance spares and consumables – for normal operation of the plant.

N. Supplier's experience or reference list with specific model / type.

O. Inspection & test item list (to show the witness point for the Owner / Contractor).

5. TESTING

A. Shop tests shall be performed in order to assure the correctness and completeness of all Equipment covered under the Contract. Shop tests shall verify the ability of all Equipment to perform its intended functions within the applicable tolerances and performance guarantees, such that when the Equipment is shipped and correctly connected to external devices, the complete system is operable as intended.

B. All Equipment associated with the CEMS shall be tested during the Factory Acceptance Test. The Contractor shall demonstrate the system's ability to meet the requirements of the Specification. The system shall be fully configured and calibrated for the test. The test shall include monitoring of simulated exhaust gas to verify reporting.

C. The Contractor shall furnish the services of a qualified representative to provide technical direction during commissioning of the CEMS and related accessories. The field personnel provided by the Contractor shall be capable, qualified, and able to perform the duties required to the satisfaction of the Owner and shall be vested with authority to make decisions binding on the Contractor. The Contractor 's representative shall verify the proper installation of the Equipment.

6. SPARE PARTS

Contractor shall provide all spares required for commissioning, startup, testing and operation of the CEMS until commercial operation of the plant.

7. GUARANTEES

7.1 Performance Guarantees

A. The Contractor shall guarantee that all continuous emissions monitoring equipment will successfully meet all requirements listed herein. The equipment shall also be guaranteed to pass the RATA, certification, and all acceptance tests. Failure of equipment to meet these requirements will require that the Contractor make the necessary adjustments to the equipment and retest the equipment at no cost to the Owner.

B. The Contractor shall guarantee that after a one year period, if the Owner follows proper maintenance procedures as recommended by the Contractor, that the CEMS will pass the annual RATA requirements specified in 40 CFR Part 75 and 40 CFR Part 60, where applicable.

C. Availability Guarantee: The Contractor shall guarantee performance availability as required by EPA 40CFR60. The Contractor shall guarantee 95% quality-assured data availability as defined in 40CFR75.

8. OTHER REQUIREMENTS

Not Used

WorleyParsons
resources & energy

EcoNomics

NEW YORK STATE ELECTRIC & GAS

NYSEG COMPRESSED AIR ENERGY STORAGE PROJECT

Continuous Emissions Monitoring System

REQUEST FOR BUDGETARY QUOTE

CYCLE 2

Document: CAES-1-SP-VDA3

Revision: A

Date: August 2011

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NYSEG COMPRESSED AIR ENERGY STORAGE PROJECT
CONTINUOUS EMISSIONS MONITORING SYSTEM
REQUEST FOR BUDGETARY QUOTE

SYNOPSIS

This document presents the design criteria for the preparation of a budgetary quotation for a Continuous Emissions Monitoring System used within a Cycle 2 process.

Disclaimer

REV	DESCRIPTION	ORIGINATOR	REVIEWER	APPROVER	DATE
A	Issued for Bid	N. Kelly	S. Kaley	S. Kaley	18-Mar-11

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1. SCOPE

1.1 General

A. This specification covers the engineering, design, assembly, configuration, shop testing, technical field assistance during erection, Certification testing, and technical field assistance during start-up of the Continuous Emissions Monitoring Systems (CEMS) for the NYSEG Cycle 2 Compressed Air Energy Storage (CAES) Project.

B. The Contractor shall supply one (1) microprocessor-based CEMS enumerated in this specification. Any hardware, software, or other items required by the unique nature of the Contractor's system design, as well as coordination with the Engineer and Owner needed to design, implement and install these functions, shall also be provided.

C. The Contractor shall design (including attending Design and Coordination Review Meetings), engineer, manufacture, deliver (CIP Jobsite, including freight and risk of loss), and test the CEMS, in accordance with the Contract Documents and drawings, which may not be a complete listing, to bring into successful operation one (1) Continuous Emissions Monitoring Systems, for the Combustion Turbine Generator.

D. The CEMS is required to monitor, record, and report the exhaust gas emissions of NOX, O2, CO, and any other constituents in accordance with the State of New York, and any other applicable governing agency requirements. The CEMS will be designed to include all monitoring requirements for the State of New York, and any other applicable governing agency.

E. All materials and components for the complete design, assembly, and testing of all Equipment shall be the responsibility of the Contractor. Any omission in this Specification does not relieve the Contractor of its responsibility to provide all Equipment and accessories complete in every respect for a reliable, and functional system.

1.2 Equipment and Services to be furnished by Contractor

A. Complete full extractive type sampling system including, but not limited to, the following items:

1. NOX, O2, and CO flue gas analyzers for main stack measurements.

2. Sample probes.

3. All necessary sample conditioning equipment.

4. Heated sample umbilical and necessary accessories for each sample probe.

5. Sample controller and data acquisition system, including an Ethernet interface to control room computer and hardwired signals to the Owner's Distributed Control System (DCS). The Ethernet interface to the control room computer shall be over fiber optic cable provided by Others. If necessary, media converters on both ends shall be provided by the Contractor.

6. All required system cabinets, racks and panels.

7. Thermocouples, temperature transmitters, pressure transmitters and all other instrumentation necessary to provide information to the CEMS required for reporting emissions per the applicable regulatory agencies.

8. Any additional accessories and equipment (including tubing, purge systems, valves, pumps, etc.) required by the Contractor's design to meet the applicable regulatory agencies reporting requirements.

9. All interconnection cabling within the CEMS Shelter for Contractor supplied equipment unless indicated below as “Furnished by Others”.

B. Data Acquisitions and Reporting

1. Personal Computer (PC) based system for data storage, retrieval and manipulating, calculations, alarm generation and report generation with printers, color LCD monitors, and other accessories as specified herein.

   a. Windows 7 based PC

   b. 56k internal modem for electronic submittal of regulatory reports, and vendor troubleshooting.

   c. Network Interface Card (NIC) with at least two (2) ports

   d. One additional Computer/LCD terminal to be located in the CEMS Enclosure including cables, connectors, and any necessary hardware and software

2. All necessary hardware, software, virus protection, and programming to provide a complete functional system.

C. CEMS Enclosure

1. Designing and furnishing of one weatherproof and climate controlled CEMS Enclosures. The Enclosure shall be manufactured and furnished in accordance with Contract documents. The CEMS Enclosure shall be sized to accommodate the Contractor's CEMS equipment and shall be located at base of the stack.

2. As a minimum the following items shall be included as part of each CEMS Enclosure:

   a. 480/208/120V AC Transformer including disconnect switch (mounted outside of the Enclosure).

   b. 120/208V AC Power Distribution Panel fed by the transformer (general service – A/C, lighting, etc.)

   c. 120V AC UPS Backed Distribution Panel.

   d. Lighting

   e. HVAC

   f. Provisions for Fire Protection Equipment – smoke detector, pull station, and fire extinguisher.

   g. Workbench

   h. Telephone and modem connection for Contractor diagnostic interface to sample controller and/or local LCD.

3. Calibration gas bottle rack and enclosure, attached to CEMS shelter and including pressure regulators, gauges, tubing required for connecting to the CEMS.

D. Other

1. Any special tools required for the installation, operation, and maintenance of the equipment.

2. All calibration gas gauged regulators, manifolds, hoses, and spare parts necessary for complete system start-up, certification, and initial operation up to commercial operation of the plant.

3. Schedules, procedures, drawings, instruction manuals, test and inspection reports, and other information and documents specified in Contract documents.

4. All required cleaning, painting (including additional paint if field touchup is required), packaging, and shipment of equipment and accessories specified herein.

5. Services of a qualified field representative to provide technical direction during installation of the Contractor's supplied Equipment and when requested by Owner to supervise site pre-certification and compliance testing; these services will be for a minimum 10 days (3 trips).

6. Factory Acceptance Testing (FAT) including calibration, adjustment, and testing of all equipment furnished.

7. Operational test and certification of the CEMS in the field including certification of all software (referred to as "Site Performance Test").

8. Training sessions, including supplementary training, as specified in Base Specification. Training shall be conducted at the Owner's site for operating, maintenance, and engineering personnel.

1.3 Equipment and Services to be furnished by Other's

The Owner will furnish the following permanent materials, equipment, labor, and services under the conditions described below. However the failure of the Owner to furnish any materials, equipment, labor, or services shall not relieve the Contractor of its responsibility to properly perform the Work.

A. Standard electrical cables for connection to Contractor supplied equipment, excluding wiring within skid-mounted packages, which is the responsibility of the Contractor.

B. Connections on stack liner for sample probes and other instrumentation.

C. 480VAC, 60 Hz power to CEMS Enclosure (Contractor's termination point).

D. 120VAC, 60 Hz, UPS power to CEMS Enclosure (Contractor's termination point).

E. Instrument and control air, 60 to 120 psig, clean, dry, dew point –40°F (Contractor's termination point).

F. All supervision and labor for unloading, storing, handling, and erecting, including preserving, cleaning up (including disposal of waste chemicals), and inspecting during and after storage. The Contractor shall state any specific items along with the space and environmental requirements in its proposal.

G. Concrete foundations, grouting, foundation bolts, nuts, washers, and leveling plates.

H. Access ladders, platforms, grating, steel, and handrail, except that specified as being part of Contractor-supplied skids and equipment, or that, which is integral to or normally furnished with such equipment.

I. Storage facilities. Storage and handling requirements shall be identified in the proposal.

J. Final field touchup painting. Contractor to supply paint.

K. Installation of the umbilical hoses from the sample probes to the CEMS enclosure.

L. Fire Protection Equipment – smoke detector, pull station, and fire extinguisher.

1.4 Design and Coordination Review Meetings

During the design phase, the Contractor shall implement systematic design review meetings, in addition to other meetings as necessary, with the Owner and the Engineer. The design review meetings shall present the status of design, review design parameters, obtain Owner and Engineer input, and review compliance with Contract requirements. The Contractor's project manager and appropriate design personnel shall conduct these meetings.

2. CODES AND STANDARDS

A. The latest edition and published addenda of the following publications in effect on the date of Contract Award are a part of this Specification and, where referred to by title or by basic designation only, are applicable to the extent indicated by the specific reference or equivalent national standards:

1. Compressed Gas Association (CGA)

   a. E-4, "Standard for Gas Pressure Regulators"

   b. V-1, "Standard for Compressed Gas Cylinder Valve Outlet and Inlet Connections"

2. Institute of Electrical and Electronic Engineers (IEEE)

   a. 518 – Guide for the Installation of Electrical Equipment to Minimize Electrical Noise Inputs to Controllers from External Sources

   b. 802.3, "Information Technology - Telecommunications and Information Exchange between Systems - Local and Metropolitan Area Networks"

   c. 1100, "Recommended Practice for Powering and Grounding Electronic Equipment"

   d. C37.90.1, "Surge Withstand Capability (SWC) Tests for Relays and Relay Systems Associated with Electric Power Apparatus"

3. The International Society of Automation (ISA)

   a. 37.1, "Electrical Transducer Nomenclature and Terminology"

   b. 50.00.01, "Compatibility of Analog Signals for Electronic Industrial Process Instruments"

   c. 51.1, "Process Instrumentation Terminology"

4. National Electrical Manufacturers Association (NEMA)

a. ICS 1, "Industrial Controls and Systems General Requirements"

b. ICS 4, "Application Guideline for Terminal Blocks"

c. 250, "Enclosures for Electrical Equipment (1000 Volts Maximum)"

5. Occupational Safety and Health Administration (OSHA) 29CFR, Part 1910

6. National Fire Protection Association (NFPA)

a. 70, “National Electrical Code”

b. 75, “Standard for the Protection of Information Technology Equipment”

7. U.S. Environmental Protection Agency (EPA)

a. 40 CFR Part 60, "Standards of Performance for New Stationary Sources"

b. 40 CFR Part 60, Appendix B, "Performance Specifications"

c. 40 CFR Part 60, Appendix F, "Quality Assurance Procedures"

d. 40 CFR Part 63, "National Emission Standards for Hazardous Air Pollutants for Source Categories"

e. 40 CFR Part 64, "Compliance Assurance Monitoring"

f. 40 CFR Part 75, "Continuous Emission Monitoring"

8. New York DEP

9. New York Building Code (NYSBC)

B. Where the above referenced codes, standards, and guides contain recommendations in addition to requirements, the recommendations shall be considered requirements and shall be followed, unless stated otherwise by this Specification.

C. In case of any conflict between the reference codes, or this Specification and codes, the more stringent applies.

3. GENERAL

A. All Manufacturers shall comply fully with the complete requirements of this standard specification. Any deviations shall be clearly defined in the Proposal.

B. The CEMS system specified will be used for the Cycle 2 Compressed Air Energy Storage Project to monitor the General Electric 7EA or 6FA gas turbine generator machines operating in recuperation mode. The turbine will be fired on natural gas only. All equipment and systems shall be designed for a plant life of 30 years.

C. The plant will be located in the county of Seneca, in the state of New York.

4. INFORMATION AND DATA REQUIREMENTS

4.1 Submittals

A. P&ID's showing the terminal points for scope of supply.

B. Price summary and breakdown price schedule for each option.

C. Exception and deviation against the specification.

D. An online exhaust gas emission monitoring concept shall be provided. This concept shall include listing and description of the proposed online monitoring equipment.

E. Completed datasheets, drawings and documents as required for providing details of supplied equipment.

F. Outline Dimensioned Drawings of the equipment and auxiliaries identifying weights, clearance, and maintenance requirements, including lifting and installation guidelines.

G. General arrangement drawings.

H. Foundation design information, including embedded parts and anchor bolt arrangement drawing.

I. Utility consumption list.

J. Customer connection list.

K. Drawing submission list and schedule after contract.

L. Performance and availability guarantees.

M. Priced list for Maintenance spares and consumables – for normal operation of the plant.

N. Supplier's experience or reference list with specific model / type.

O. Inspection & test item list (to show the witness point for the Owner / Contractor).

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A. Shop tests shall be performed in order to assure the correctness and completeness of all Equipment covered under the Contract. Shop tests shall verify the ability of all Equipment to perform its intended functions within the applicable tolerances and performance guarantees, such that when the Equipment is shipped and correctly connected to external devices, the complete system is operable as intended.

B. All Equipment associated with the CEMS shall be tested during the Factory Acceptance Test. The Contractor shall demonstrate the system's ability to meet the requirements of the Specification. The system shall be fully configured and calibrated for the test. The test shall include monitoring of simulated exhaust gas to verify reporting.

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6. SPARE PARTS

Contractor shall provide all spares required for commissioning, startup, testing and operation of the CEMS until commercial operation of the plant.

7. GUARANTEES

7.1 Performance Guarantees

A. The Contractor shall guarantee that all continuous emissions monitoring equipment will successfully meet all requirements listed herein. The equipment shall also be guaranteed to pass the RATA, certification, and all acceptance tests. Failure of equipment to meet these requirements will require that the Contractor make the necessary adjustments to the equipment and retest the equipment at no cost to the Owner.

B. The Contractor shall guarantee that after a one year period, if the Owner follows proper maintenance procedures as recommended by the Contractor, that the CEMS will pass the annual RATA requirements specified in 40 CFR Part 75 and 40 CFR Part 60, where applicable.

C. Availability Guarantee: The Contractor shall guarantee performance availability as required by EPA 40CFR60. The Contractor shall guarantee 95% quality-assured data availability as defined in 40CFR75.

8. OTHER REQUIREMENTS

Not Used

WorleyParsons
resources & energy

EcoNomics

NEW YORK STATE ELECTIC AND GAS

SENECA COMPRESSED AIR ENERGY STORAGE PROJECT

COOLING TOWER

REQUEST FOR BUDGETARY QUOTATION

Document: CAES-1-SP-MWA3

Revision: A

Date: July 2011

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Reading, PA 19607
USA
Telephone: +1 610 855 2000
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SYNOPSIS

This document presents the design criteria for the preparation of a budgetary quotation for the Cooling Tower used within the Compressed Air Energy Storage (CAES) project.

Disclaimer

REV	DESCRIPTION	ORIG	REVIEW	WORLEY-PARSONS APPROVAL	DATE
A	Issued For Bid	Christopher J. Hartline Chris Hartline	Harry G. Eisenbise Harry Eisenbise	Harry G. Eisenbise Harry Eisenbise	July 2011

1.0 General Information

The Supplier shall provide a budgetary quote based on the information specified herein for a mechanical draft cooling tower.

The equipment / system specified herein will be used in a Second Generation Compressed Air Energy Storage plant located in Reading Center, NY. The air used in the process is compressed and stored within a salt cavern. When in generation mode, the air is heated through a recuperator and expanded to generate power. Site Specific Data (CAES-1-LI-022-0001) includes climate, structural and utility supply data. English units shall be the system of units.

2.0 Scope of Supply

The equipment, material, and services to be provided by the Supplier shall include but not be limited to the following:

1. One counterflow, mechanical draft, plume abated cooling tower with equipment as defined in this specification and Exhibit 1 – Scope of Supply Matrix.

3. Additional equipment and systems as specified in Exhibit 2 – FRP Cooling Tower Data Sheets.

In the case of any contradiction, the information contained in the Exhibit 1 - Scope of Supply Matrix take precedence over these Technical Specification requirements.

3.0 Codes and Standards

The design, manufacture and construction of the equipment and systems shall conform to the applicable sections of the following codes and standards in addition to those indicated in the attached documents.

1. American Society of Mechanical Engineers (ASME)
2. American National Standard Institute (ANSI)
3. American Society of Testing and Materials (ASTM)
4. International Building Code (IBC)
5. National Electrical Manufacturer's Association (NEMA)
6. National Electrical Code (NEC)
7. National Fire Protection Association (NFPA)
8. Cooling Tower Institute (CTI)

Supplier must confirm with Company if the codes listed above may be substituted for other codes utilized by Supplier.

4.0 Utility Supply Conditions

4.1 Makeup Water Conditions

The presented municipal water characteristics are tentative and for Bidders' information only. The numbers represent water data found during a search of Seneca Lake water quality.

Parameter	Unit	max
Calcium	(ppm)	42
Magnesium	(ppm)	11
Sodium (Na)	(ppm)	134
Chloride (Cl)	(ppm)	139
Sulfate (SO4)	(ppm)	38
Phosphate (PO4)	(ppm)	10.7
Total Alkalinity	(ppm CaCO3)	106
Nitrate (NO3)	(ppm)	0.5
Chlorine (Cl2)	(ppm)	2
Silica as SiO2	(ppm)	1.8
Suspended Solids	(ppm)	1.5
Turbidity	(NTU)	2.0

4.2 Design Case Thermal Conditions

Design Case				
Parameter	**Units**	**Value**	**Guaranteed By**	
			WorleyParsons	Vendor
Ambient Conditions				
Temperature	°F	87	--	--
Humidity	RH %	46	--	--
Inlet Wet Bulb	°F	71	--	--
Approach to Wet Bulb	°F	9		
Hot Water Return				
Temperature	°F	100	X	
Flow	gpm	60,000	X	
Cold Water Return				
Temperature	°F	80		X
Flow	gpm	60,000		X
Cooling Duty	10^9Btu/hr	0.5		
Cycles of Concentration		8		

4.3 Site Conditions

See CAES-1-LI-022-0001.

4.4 Electrical

See CAES-1-LI-022-0001 for motor voltages.

5.0 Technical Requirements

5.1 The Seller shall be responsible for the final selection of the number of cells to accommodate the above requirements.

5.2 The cooling tower structure shall be constructed from fiberglass materials.

5.3 All connectors to the cooling tower shall be made from materials compatible with the makeup water and its constituents when cycled eight (8) times.

5.4 The cooling tower shall be designed so individual cells can be isolated from water and air flows without short circuiting adjacent operating cells.

5.5 Air inlet face velocities shall be less than 1100 feet per minute.

5.6 Fill and drift eliminator air velocities shall be less than 700 feet per minute.

5.7 Fill shall be 15mil after forming.

5.8 Tower fill, drift eliminators, and fan stacks shall have a flame spread rate less than 25 per ASTM E–84.

5.9 Fill shall be in accordance with CTI Code STD-136.

5.10 Field testing shall include electrical (including electrical resistance), water distribution, fan blade pitch optimization, and performance testing.

5.11 Water from Seneca Lake will be used for cooling tower make-up. Full partition, 20 minute rated fire walls shall be provided between each cell, per NFPA 214. A dry-pipe sprinkler system shall be offered as a pricing option for the above alternatives.

6.0 Information and Data Requirements

6.1 Price summary and breakdown price schedule for each option.

6.2 Exceptions and deviations against the specification.

6.3 Seller's bid data including:

a. Completed technical data sheets.

b. General Arrangement Drawings (plan, elevation, section).

c. Utility Consumption List (cooling water, instrument air, electricity).

d. Equipment Weights.

e. Auxiliary load list including all equipment.

6.4 Priced list for maintenance spares and consumables.

6.5 Noise Data.

7.0 Additional Documents

7.1 Exhibit 1 – Scope of Supply Matrix

7.2 Exhibit 2 – FRP Cooling Tower Data Sheets

7.3 CAES-1-LI-022-0001 – Site Specific Data

Exhibit 1 – Scope of Supply Matrix

ITEM	DESCRIPTION	BY MFR	BY OTHERS	COMMENTS
1.0	**COOLING TOWER ASSEMBLY**			
1.1	Cooling tower including the support structure, all outer enclosures, fill, fans, fan stacks, fan drivers, gear reducers, lube oil systems, drift eliminators, stairwells, handrails, ladders, partitions, decks, access doors, equipment removal system, and instrumentation.	X		
1.2	Fiberglass Composite structure (FRP)	X		
1.3	Fans with single speed motors	X		
	Fans with two speed motors			
	Fans with variable frequency drive motors			
1.4	Below Grade circulating water supply header		X	
1.5	Risers with manual isolation valves and supports	X		
1.6	Cold Weather Bypass System	X		50% capacity
1.7	Noise Attenuation Panels as Required	X		
1.8	Fire Detection and Deluge System	X		Option price
1.9	Reducing Gear Boxes	X		
1.10	Gear Box Oil Pumps	X		If required
1.11	Gear Box Oil Heaters	X		If required
1.12	Jib Crane			Not Required
1.13	Ladders, Platforms, Stairways, Handrails, decks, access doors	X		Access to Mfg. Equipment
2.0	**MECHANICAL PACKAGE**			
2.1	Circulating water pumps		X	
2.2	Auxiliary Cooling water pumps		X	
2.3	Pump Intake Screens		X	
2.4	Circulating Water testing and treatment system		X	
2.5	Control valves		X	
3.0	**ELECTRICAL PACKAGE**			
3.1	Lighting	X		
3.2	Lightning Protection	X		
3.3	Heat Tracing		X	
3.4	Grounding		X	
3.5	Provisions for Performance Testing including Test Ports, Thermowells, Instrumentation	X		

Exhibit 1 – Scope of Supply Matrix

ITEM	DESCRIPTION	BY MFR	BY OTHERS	COMMENTS
3.6	Fan Drive Power and Control Wiring including Motor Control Center and DCS interface		X	
3.7	Electrical cable, wiring, conduit and cable trays		X	
4.0	**NOT USED**			
5.0	**NOT USED**			
6.0	**NOT USED**			
7.0	**STRUCTURAL PACKAGE**			
7.1	In-ground reinforced concrete cooling tower basin including necessary excavation		X	
7.2	Foundations		X	
7.3	Anchor bolts	X		
7.4	Site preparation and improvement	X		
7.5	Grout	X		
7.6	Civil bulk material		X	
7.7	Structural bulk material		X	
7.8	Foundation Sole Plates, Adjusting Screws, Shims	X		
7.9	Basin Epoxy Coating		X	
8.0	**MISCELLANEOUS**			
9.0	**OTHER MATERIAL AND SERVICES**			
9.1	Hardware for Complete Assembly and Accessories	X		
9.2	Special Tools	X		
9.3	Special Rigging devices including lifting devices	X		As Required
9.4	Lifting Lugs	X		
9.5	Piping Insulation and Lagging		X	
9.6	Finish Painting of Lagging and Exposed Steel	X		
9.7	Prime Painting of All Steel	X		
9.8	Drawings of all Mfg. supplied equipment with sufficient details for installation and maintenance	X		
9.9	Outline drawings	X		
9.10	Quantity, weight and size of modules	X		
9.11	Trim and Instrumentation List	X		
9.12	Erection labor requirements	X		
9.13	Schedule for manufacture and delivery of all units (FOB location in Site Specific Data).	X		
9.14	Review of Foundation Design by Purchaser for Mfg. Supplied Equipment	X		
9.15	Crating for Export	X		
9.16	Packing for Outdoor Storage	X		
9.17	Unloading at CIP Job Site	X		
9.18	Field Erection Supervision	X		
9.19	Field Erection Labor and Equipment			Option

FRP Cooling Tower Data Sheets							
PROJECT:	Seneca CAES Project			**CUSTOMER:**	New York State Electric and Gas		
PLANT LOC:	Reading Center, NY			**REV:**	A	**DATE:**	20-Jul-11
COST CODE:	MWA3	**EQ Tags:**					
To be completed by Purchaser							
Refer to Site Specific Conditions List in Engineering Requisition for Design Ambient Conditions							
Tower Type		Counter Flow			Mechanical Draft		
Max Plan Area	Diameter		Length		Width		ft
Configuration (Rectangular/Circular)					Rectangular		
Basin Depth (Normal Water Depth)					5		ft
Freeboard					1		ft
Final Grade Elevation							ft
Cell Sizing Criteria:							
Spare Cell Required (Yes/No)					NO		
Maximum Fan Blade Tip Speed					12,000		ft/min
Max Motor Name Plate					250		HP
Design Thermal Performance:							
Circulating Water Flow					60,000		gpm
Design Heat Load							MBTU/hr
Design Inlet Wet Bulb Temp					71		deg F
Inlet Circulating Water Temp					100		deg F
Outlet Circulating Water Temp					80		deg F
Drift Limit (including blowout from basin)					0.0005		%
Platform Live Loads:							
Fan Deck					60		lb/ft^2
Platforms					60		lb/ft^2
Makeup Water Analysis:							
Calcium					42		ppm Ca
Magnesium					11		ppm Mg
Sodium					134		ppm Na
Potassium					2.7		ppm K
Total Alkalinity					106		ppm $CaCO_3$
Chloride					139		ppm Cl
Sulfate					38		ppm SO_4
Nitrate					0.5		ppm NO_3
Phosphate					10.7		ppm PO_4
Total Silica					1.8		ppm SiO_2
Chlorine					2		ppm Cl_2
Total Suspened Solids					1.5		ppm PO_4
Turbidity					2		NTU

FRP Cooling Tower Data Sheets						
PROJECT:	Seneca CAES Project		**CUSTOMER:**	New York State Electric and Gas		
PLANT LOC:	Reading Center, NY		**REV:**	A	**DATE:**	20-Jul-11
COST CODE:	MWA3	**EQ Tags:**				
Circulating Water Concentrations:						
Maximum					8	
Design					8	
Circulating Water Pump Data:						
Quantity of Pumps					2	
Capacity per pump					30000	gpm
Electrical Requirements:						
Fan Motor					250 max	HP
Fan Motor		460	Volts		60	Hz
Fan Speed (Single/Dual/Variable)					Single	
Reversing Fans (Yes/No)					No	
Lighting		208	Volts		60	Hz
Space Heaters		240/120	Volts		60	Hz
Control Power Voltage					120	Volts
Control Power (AC/DC)					AC	
Control Power Frequency					60	Hz
Water Distribution System Design:						
Pressure					75	psig
Temperature					130	deg F
Accessories:						
Cooling Tower Bypass System				YES		
Fan Deck Lighting				YES		
Fan Deck Emergency Lighting				NO		
Cell Access Door System & Walkway				YES		
Fan Deck Equipment Removal System				NO		
Convenience Outlets				YES		
Construction Lightning Protection System				YES		
Permanent Lightning Protection System				YES		
Plume Abatement System				YES		

FRP Cooling Tower Data Sheets						
PROJECT:	Seneca CAES Project		**CUSTOMER:**	New York State Electric and Gas		
PLANT LOC:	Reading Center, NY		**REV:**	A	**DATE:**	20-Jul-11
COST CODE:	MWA3	**EQ Tags:**				

To be completed by Seller						
Bidder						
Proposal Number						
Model Number						
Construction Type						
Tower Type						
PERFORMANCE:						
Total Guaranteed Electric Power Consumption						kW
Pump Head:						
Static Head above top of basin curb at Interface						ft
Velocity Head at Interface						ft
Pipe Centerline Elevation at Interface						ft
Max. Capacity of Distribution System (w/o overflow)						gpm
Water Loading (fill cross section)						gpm/ft^2
Dirft Loss as percent of Circulating Water Flow						%
Evaporation Loss						gpm
Liquid to Gas Ratio (L/G), dry air						
Fan Draft:						
Resistance of Air Inlet						
Resistance of Fill						
Resistance of Drift						
Resistance of Stack						
Total Resistance						
Dry Air Through Tower						cfm
Air Inlet Face Velocity						ft/min
Fan Stack Exit Velocity						ft/sec
Noise (fill in attached noise data sheets)						
STRUCTURE:						
Number of Cells						
Inside Basin Dimensions (Length x Width or Diameter)						ft
Inside Basin Depth						ft
Nominal Cell Dimensions (Length x Width or Diameter)						ft
Overall Tower Dimensions (Length x Width or Diameter)						ft
Height Basin Curb to Fan Deck						ft
Fan Stack Height						ft
Overall Tower Height						ft
Stack Diameter at Inlet, Throat, and Outlet						ft
Total Weight of Cooling Tower	Dry		Operating			lb
Fan Deck Live						lb/ft^2
Fan Deck Snow Loading						lb/ft^2
WATER DISTRIBUTION SYSTEM						
Interface Connection Qty.						
Interface Connection Nom. Diameter						ft
Manifold Nom. Diameter						ft
Height of Distributors above Basin Curb						ft
Design Pressure of Distribution System						lb/in^2

FRP Cooling Tower Data Sheets

PROJECT:	Seneca CAES Project			**CUSTOMER:**	New York State Electric and Gas	
PLANT LOC:	Reading Center, NY			**REV:**	A	**DATE:** 20-Jul-11
COST CODE:	MWA3	**EQ Tags:**				
Acceptable Interface Conn. Nozzle Loads		X/Y/Z				lb
Maximum Allowable Cooling Tower Flow with one cell out of service						gpm
Distribution Manifold Valve Manufacture No.						
Distribution Manifold Valve Model No.						
Cold Weather Bypass System						
Capacity						gpm
Design Backpressure						ft
Number of Connections						
Connection Size						in
Connection Type						
FILL (per cell)						
Type of Fill						
Plan Area						sq ft
Fill Dimensions		Height		Diameter		ft
Number of Film Pack Tiers						
Thickness of Film Pack Sheets		Top		Other		in
Spacing between Sheets						in
Total Fill Volume						ft^3
Total Fill Effective Surface						sq ft
Height of Bottom of Fill Above Basin Curb						ft
DRIFT ELIMINATORS						
Manufacture No.						
Model Number						
Type						
Number of Passes						
MATERIALS OF CONSTRUCTION						
Frame						
Casing (outer enclosure)						
Louvers						
Partitions						
Drift Eliminators						
Drift Eliminator Spacers						
Fill						
Fill Supports						
Fill Hangers						
Fan Deck						
Strairway						
Access Platforms						
Access Walkways						
Handrail						
Grating and Grating treads						
Fan Stacks						
Fan Blades						
Fan Hub						
Fan Shafts						
Fan Couplings						

FRP Cooling Tower Data Sheets						
PROJECT:	Seneca CAES Project		**CUSTOMER:**	New York State Electric and Gas		
PLANT LOC:	Reading Center, NY		**REV:**	A	**DATE:**	20-Jul-11
COST CODE:	MWA3	**EQ Tags:**				
Hardware						
Fastners						
Anchor Bolts						
Electrical Conduit						
FANS						
Manufacture No.						
Model Number						
Type						
Number of Blades per Fan						
Diameter						ft
Maximum Fan Blade Tip Clearance						in
	Low Speed			**High Speed**		
Fan Speed						RPM
Blade Tip Speed						MPS
Brake Horsepower (driver output)						HP
Total Static Pressure (at design density)						in H2O
Velocity Pressure (at design density)						in H2O
Total Press. (including vel. Recovery at design density)						in H2O
Air Delivery per Fan						ft^3/hr
Fan Static Efficiency						%
Fan Total Efficiency						%
SPEED REDUCER:						
Manufacture No.						
Model Number						
Type						
AGMA Horsepower Rating						HP
Service Factor at rated HP						
Reduction Ratio						
Anti-Reverse Mechanism Provided?						
Radial and Thrust Bearings:						
Manufacturer						
Type						
L_{10} Life						Hrs
DRIVE SHAFT:						
Manufacture No.						
Model Number						
Type						
Length						ft
Diameter CM						in
Rated Horsepower						HP
Service Factor at rated HP						
Coupling Manufacturer						
Coupling Type						
FAN DRIVER:						
Manufacture No.						
Model Number						

FRP Cooling Tower Data Sheets

PROJECT:	Seneca CAES Project			**CUSTOMER:**	New York State Electric and Gas		
PLANT LOC:	Reading Center, NY			**REV:**	A	**DATE:**	20-Jul-11
COST CODE:	MWA3	**EQ Tags:**					

Enclosure Type						
Frame Size						
Operating Speeds						RPM
Electric Power		Volts		Phase		Hz
Nameplate Horsepower Rating						HP
Service Factor						
Efficiency						%
Full Load Amps						Amps
Locked Rotor Amps						Amps
FLAME SPREAD INDEX:						
Fill						
Fill Supports						
Drift Eliminators						
Fan Deck						
Fire Wall Partitions						
INSTRUMENTATION:						
Vibration Switch Manufacturer						
Vibration Switch Model						
Oil Level Switch Manufacturer						
Oil Level Switch Model						
Oil Differential Pressure Switch Manufacturer						
Oil Differential Pressure Switch Model						
ELECTRICAL:						
Lighting Fixtures Manufacturer						
Lighting Fixtures Model						
Lighting Fixtures Quantitiy						
Emergency Lighting Fixtures Manufacturer						
Emergency Lighting Fixtures Model						
Emergency Lighting Fixtures Quantity						
Lighting Protection?						
SITE CONSTRUCTION INFORMATION:						
Required Laydown Area	Length		Width		ft	

SITE SPECIFIC DATA

General:

Location:	Reading Center, New York
Elevation (feet above mean sea level)	1,000
Outdoor Ambient Temperature Range:	(-)2 to 87 °F
Outdoor Ambient Design Temperature for HVAC (ASHRAE 2009)	
Summer (1.0% cooling):	87°F DB, 71°F WB
Winter (99.6% heating):	(-) 2°F DB
Design Indoor Temperature Range (Control Room, DCS Room, Office Areas, Electrical Rooms):	70 to 75°F
Design Indoor RH Range (Control Room, DCS Room, Office Areas, Electrical Rooms):	40 to 60% RH
Design Indoor Temperature Range for Ventilated Areas	45 to 90° F

Structural Data:

Building Design Codes:	IBC 2006 ASCE 7-05
Wind Load	
Exposure Category (IBC 2006, Section 1609.4)	C
Basic Wind Speed, V (IBC 2006), mph	90
Occupancy Category of Buildings and Structures (IBC 2006, Table 1604.5)	III
Importance Factor, I (ASCE 7-05, Table 6-1)	1.15
Snow Load	
Ground Snow Load, p_g (IBC 2006, Figure 1608.2)	35 psf
Exposure Category (IBC 2006, Section 1609.4)	C
Exposure Factor C_e (ASCE 7-05, Table 7-2)	1.0
Occupancy Category of Buildings and Structures (IBC 2006, Table 1604.5)	III
Importance Factor, I (ASCE 7-05, Table 7-4)	1.1
Rainfall	
Annual Average, inches	36
10 yr, 24 hr, inches	3.9
25 yr, 24 hr inches	4.5
Earthquake Loads	
Site Class (IBC 2006 Table 1613.5.2)	C
Mapped Spectral Response Acceleration, short period, Ss (IBC 2006 Figure 1613.5(1))	0.162 g
Mapped Spectral Response Acceleration, 1 second period, S_1 (IBC 2006 Figure 1613.5(2))	0.054g
Seismic Design Category (IBC 2006 Table 1613.5.6(1) & Table 1613.5.6(2))	A
Occupancy Category of Buildings and Structures (IBC 2006, Table 1604.5)	III
Importance Factor, I (ASCE 7-05, Table 11.5-1)	1.25

Electrical Data:

AC Power			
Medium Voltage	13.8 kV	3P, 3W	60 Hz
Low Voltage Power	480 V	3P, 3W	60 Hz
	208/120V	3P, 4W	60 Hz
Motors			
<= 1/3 hp motor (Except MOVs)	115 V	1P, 2W	60 Hz
> 1/3 hp but < 250 hp motor and MOVs	460 V	3P, 3W	60 Hz
>= 250 hp motor	13.2 kV	3P, 3W	60 Hz
Welding Receptacles	480 V	3P, 3W	60 Hz
Lighting	480 V	3P, 4W	60 Hz
DC Power			
Control Circuits	125 VDC	NA	NA
Instrument Power	120 VAC	1P, 2W	60 Hz

Mechanical Data:

Maximum Cooling Water Temperature, deg F	80
Site Air	
Instrument Air Maximum Pressure, psig	125
Instrument Air Dewpoint, ºF	-40
Service Air Maximum Pressure, psig	125
Instrument / Service Air Maximum Temperature, ºF	100
Noise Requirements	
Near Field (3 feet horizontally, 5 feet vertically from machine baseline	90 dBA
Far Field (Plant equiment measured 400' from plant site)	45 dBA

Notes:

None

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EcoNomics

NEW YORK STATE ELECTIC AND GAS

SENECA COMPRESSED AIR ENERGY STORAGE PROJECT

BRIDGE AND GANTRY CRANES

REQUEST FOR BUDGETARY QUOTATION

Document: CAES-1-SP-MHAD

Revision: B

Date: September 2011

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SYNOPSIS

This document presents an equipment specification for Bridge and Gantry Cranes for the NYSEG Compressed Air Energy Storage Project.

Disclaimer

REV	DESCRIPTION	ORIG	REVIEW	WORLEY-PARSONS APPROVAL	DATE
A	Issued For Review	J. White	Harry G. Eisenbise	Harry G. Eisenbise	July 2011
B	Issued for Bid	Harry G. Eisenbise	Chrisopher J. Hartline	Harry G. Eisenbise	September 2011

1.0 General Information

The Seller shall provide a budgetary quote based on the information specified herein for Bridge and Gantry Cranes. One budgetary price shall be provided for each of the two options specified in the Bridge and Gantry Crane Data Sheet.

The equipment / system specified herein will be used in a Compressed Air Energy Storage facility located in Reading Center, NY. All equipment and systems shall be designed for a plant life of 30 years. The system of units used in this work shall be English units.

This document identifies major equipment and components and sets minimum standards of quality. The Seller is required to furnish components for a complete, safe, reliable and functionally correct crane system in accordance with the Seller's experience, industry standards and state and local codes, even though a particular component or requirement may not be mentioned specifically by name in these documents.

Attachment A contains electrical and mechanical data specific for this application.

2.0 Scope of Supply

The equipment, material and services to be provided by the Seller shall include but not be limited to the following:

1. Overhead travelling bridge and gantry cranes each complete with a bridge, trolley, hoist(s), end trucks, drive mechanisms, cabling, controls, lights, walkways with self closing gates and accessories required for a complete crane system.

2. Crane runway rails, rail splice bars, rail clamps/clips including attachment hardware, limit stops, bumpers and runway end stops.

3. Complete crane control system for bridge travel, trolley travel, main hoist, and auxiliary hoist.

4. Power supply and distribution systems including crane conductor rail systems, collector shoes, festoon systems and disconnect panels.

5. Shop cleaning, painting and coatings.

6. Shop tests and inspection including documentation of shop testing and inspection data and results.

7. Assembly hardware including nuts, bolts and gaskets.

8. Shipping packaging for outdoor storage and marking of parts for shipment.

9. Shipping of components to the job site.

10. Spare parts, including touch-up paint, for erection, start-up, and commissioning.

11. Services of a qualified field representative on a per diem basis to provide technical direction during installation, start-up, and field testing of the cranes.

12. One complete set of special tools required for assembly, maintenance, operation, disassembly or adjustments of the cranes and hoists. The tools shall be supplied in a steel toolbox suitable for permanent storage. A list of the special tools shall be supplied.

13. Prepare and submit drawings, installation, operation, and maintenance manuals and instructions, procedures including onsite storage, protection and handling procedures, engineering and technical data, lists, and reports.

3.0 Codes and Standards

The latest edition and published addenda of the following publications, effective on the date of award are part of this Specification and shall be used for designing, fabricating, inspecting and testing the equipment specified herein.

1. Code of Federal Regulations (CFR)

2. American Gear Manufacturers Association (AGMA)

3. American National Standards Institute (ANSI)

4. Acoustic Society of America (ASA)

5. American Society of Mechanical Engineers (ASME)

6. American Society for Nondestructive Testing (ASNT)

7. American Society for Testing and Materials (ASTM)

8. American Welding Society (AWS)

9. Crane Manufacturers Association of America (CMAA)

10. National Electrical Manufacturer's Association (NEMA)

11. National Fire Protection Association (NFPA)

12. The Society for Protective Coatings (SSPC)

4.0 Technical Requirements

1. Each bridge crane shall consist of a double girder, top running, travelling bridge and a single trolley with a main hoist. All cranes to be equipped with strobe light and warning siren when operating.

2. Bridge and gantry cranes shall be designed and fabricated in accordance with the requirements of CMAA Specification No. 70.

3. Bridge and gantry cranes shall be designed, manufactured, and load tested and certified per CSA B167 and other applicable industry standards.

4. The Seller shall perform full load tests after equipment installation and shall include testing cost with the quotation.

5. Equipment over 50 pounds (23 kg) shall be furnished with lifting lugs.

6. Each crane shall be designed so parts shall have a factor of safety of at least 5 based on the ratio between the ultimate strength of the materials and the allowable design stresses.

7. The design, capacities, clearances, hook approach, and sizing requirements for the bridge cranes and hoists shall be as specified in the Bridge and Gantry Crane Data Sheet.

8. Equipment shall be provided with sufficient safety guards and cages to satisfy the requirements of OSHA safety standards and state and local codes.

9. All hoists shall have a true vertical lift and shall be of the double reeved type. Each hoist shall consist of an electric motor driving a carbon steel winding drum either directly or through a gear speed reducer using a flexible coupling.

10. All hooks shall be designed to have a maximum of 10,000 psi tension in the stem when lifting rated load.

11. Unless specified otherwise in the Bridge and Gantry Crane Data Sheet, the noise emission from equipment furnished by the Seller including the drive motor shall not exceed 85 dB(A) when measured with a standard sound level meter at slow response at 3 feet from the equipment.

5.0 Information and Data Requirements

1. Price summary and breakdown price schedule for the equipment.
2. Exceptions and deviations from this specification.
3. Technical data sheets including all auxiliary equipment.
4. Typical general arrangement drawings
5. Utility Consumption (electricity)

6.0 Additional Documents

1. Exhibit 1 – Bridge and Gantry Crane Data Sheet
2. Attachment A – Site Specific Data

EXHIBIT 1 – BRIDGE AND GANTRY CRANE DATA SHEET

Tag	Area Serviced	Capacity (tons)	Bridge Span (feet)	Runway Length (feet)	Rail Height (feet)	Hook Lift (feet)	Design Code	Style	Support	Control	Hoist Speed (ft/min)	Trolley Travel (ft/min)	Bridge Travel (ft/min)	Hook	Remarks
CRANE 1	TURBINE/COMPRESSOR BUILDING OVERHEAD CRANE TURBINE/COMPRESSOR AREA INDOORS	35	66'-8"	389'-0"	35'-0"	35'-6"	CMAA 70 Class A	OHC	Top Running	Cattron Paddle Radio Control in CAB and Hard Wired Pendant	10.0	30.0	80.0	Sister Hook	Electric motors for hoist, trolley and bridge with 5% creeping speed. 4 conductor runway power system - 480 V, 60 Hz, 3 Phase with ground. Wire rope hoist. 15 ton auxiliary hook.
CRANE 2	TURBINE/COMPRESSOR BUILDING OVERHEAD CRANE TURBINE/COMPRESSOR AREA INDOORS	80	99'-2"	420'-0"	59'-6"	59'-0"	CMAA 70 Class A	OHC	Top Running	Cattron Paddle Radio Control in CAB and Hard Wired Pendant	10.0	30.0	80.0	Sister Hook	Electric motors for hoist, trolley and bridge with 5% creeping speed. 4 conductor runway power system - 480 V, 60 Hz, 3 Phase with ground. Wire rope hoist. 15 ton auxiliary hook.

SITE SPECIFIC DATA

General:

Location:	Reading Center, New York
Elevation (feet above mean sea level)	1,000
Outdoor Ambient Temperature Range:	(-)2 to 87 °F
Outdoor Ambient Design Temperature for HVAC (ASHRAE 2009)	
Summer (1.0% cooling):	87°F DB, 71°F WB
Winter (99.6% heating):	(-) 2°F DB
Design Indoor Temperature Range (Control Room, DCS Room, Office Areas, Electrical Rooms):	70 to 75°F
Design Indoor RH Range (Control Room, DCS Room, Office Areas, Electrical Rooms):	40 to 60% RH
Design Indoor Temperature Range for Ventilated Areas	45 to 90° F

Structural Data:

Building Design Codes:	IBC 2006 ASCE 7-05
Wind Load	
Exposure Category (IBC 2006, Section 1609.4)	C
Basic Wind Speed, V (IBC 2006), mph	90
Occupancy Category of Buildings and Structures (IBC 2006, Table 1604.5)	III
Importance Factor, I (ASCE 7-05, Table 6-1)	1.15
Snow Load	
Ground Snow Load, p_g (IBC 2006, Figure 1608.2)	35 psf
Exposure Category (IBC 2006, Section 1609.4)	C
Exposure Factor C_e (ASCE 7-05, Table 7-2)	1.0
Occupancy Category of Buildings and Structures (IBC 2006, Table 1604.5)	III
Importance Factor, I (ASCE 7-05, Table 7-4)	1.1
Rainfall	
Annual Average, inches	36
10 yr, 24 hr, inches	3.9
25 yr, 24 hr inches	4.5
Earthquake Loads	
Site Class (IBC 2006 Table 1613.5.2)	C
Mapped Spectral Response Acceleration, short period, Ss (IBC 2006 Figure 1613.5(1))	0.162 g
Mapped Spectral Response Acceleration, 1 second period, S_1 (IBC 2006 Figure 1613.5(2))	0.054g
Seismic Design Category (IBC 2006 Table 1613.5.6(1) & Table 1613.5.6(2))	A
Occupancy Category of Buildings and Structures (IBC 2006, Table 1604.5)	III
Importance Factor, I (ASCE 7-05, Table 11.5-1)	1.25

Electrical Data:

AC Power			
Medium Voltage	13.8 kV	3P, 3W	60 Hz
Low Voltage Power	480 V	3P, 3W	60 Hz
	208/120V	3P, 4W	60 Hz
Motors			
<= 1/3 hp motor (Except MOVs)	115 V	1P, 2W	60 Hz
> 1/3 hp but < 250 hp motor and MOVs	460 V	3P, 3W	60 Hz
>= 250 hp motor	13.2 kV	3P, 3W	60 Hz
Welding Receptacles	480 V	3P, 3W	60 Hz
Lighting	480 V	3P, 4W	60 Hz
DC Power			
Control Circuits	125 VDC	NA	NA
Instrument Power	120 VAC	1P, 2W	60 Hz

Mechanical Data:

Maximum Cooling Water Temperature, deg F	80
Site Air	
Instrument Air Maximum Pressure, psig	125
Instrument Air Dewpoint, ºF	-40
Service Air Maximum Pressure, psig	125
Instrument / Service Air Maximum Temperature, ºF	100
Noise Requirements	
Near Field (3 feet horizontally, 5 feet vertically from machine baseline	90 dBA
Far Field (Plant equiment measured 400' from plant site)	45 dBA

Notes:

None

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EcoNomics

NEW YORK STATE ELECTRIC & GAS

NYSEG COMPRESSED AIR ENERGY STORAGE PROJECT

Distributed Control System
REQUEST FOR BUDGETARY QUOTE

REQUEST FOR BUDGETARY QUOTATION

Document: CAES-1-SP-VBB0

Revision: A

Date: August 2011

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NYSEG COMPRESSED AIR ENERGY STORAGE PROJECT
DISTRIBUTED CONTROL SYSTEM
REQUEST FOR BUDGETARY QUOTE

Disclaimer

REV	DESCRIPTION	ORIGINATOR	REVIEWER	APPROVER	DATE
A	Issued for Bid	N. Kelly	S. Kaley	S. Kaley	16-Aug-11

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ATTACHMENT A - SYSTEM I/O QUANTITIES 1

1. SCOPE

1.1 General

A. This specification covers the engineering, design, assembly, configuration, shop testing, technical field assistance during erection, and technical field assistance during start-up of the Balance of Plant Distributed Control System (DCS) for the Cycle 2 Compressed Air Energy Storage Project (CAES).

B. The Contractor shall supply a microprocessor-based DCS enumerated in this Specification. Any hardware, software, or other items required by the unique nature of the Contractor's system design, as well as coordination with the Engineer and Owner needed to design, implement, and install these functions, shall also be provided.

C. The Contractor shall design (including attending Design and Coordination Review Meetings), engineer, manufacture, deliver, and test the DCS, in accordance with the Technical Specifications and Drawings, which may not be a complete listing, to bring into successful operation one (1) DCS.

D. All materials and components for the complete design, assembly, and testing of all Equipment shall be the responsibility of the Contractor. Any omission in this Specification does not relieve the Contractor of its responsibility to provide all Equipment and accessories complete in every respect for a reliable and functional system.

1.2 Equipment and Services to be furnished by Contractor

A. The Contractor shall supply as a minimum the following:

1. One (1) Main Control Console to incorporate the following Equipment per Contract documents:

a. Three (3) Operator Workstations, each to include the following:

i. Dual 22” SVGA high resolution color flat LCD screen with electronics, Windows 7 operating system, keyboard, and optical mouse. The screens shall be mounted on stands, one above the other. Each screen shall be able to tilt for individual operator adjustment.

ii. All cables, software, and accessories required for a complete, fully functional system.

b. One (1) 42" LCD screen for displaying the alarm summary. Screen will be connected to one of the Operator Workstations. Hardware shall be provided to mount the screen on the ceiling above the Main Operator Display Console.

c. Furniture to provide a complete continuous console to hold the Operator Workstations as well as two (2) additional dual LCD workstation and one (1) additional single LCD workstation, provided by Others. The furniture shall include sufficient space for keyboards, mice, and extra space to accommodate Owner's equipment, such as an auxiliary pushbutton control panel and telephones. Furniture shall be manufactured by Panelmatic or Owner approved equal.

2. One (1) Engineering Console to incorporate the following Equipment per Contract documents:

a. One (1) Engineering/Operator Workstation, to include the following:

i. Dual 22" SVGA high resolution color flat panel LCD screens with electronics, Windows 7 operating system, keyboard, and optical mouse. The screens shall be mounted on stands, one above the other. Each screen shall be able to tilt for individual operator adjustment.

ii. Latest technology external communications and data storage such as a DVD-R/RW drive.

iii. All application software included on the Operator Workstations, including live and historical trending.

iv. Complete system management software to enable monitoring and modification of the entire DCS.

v. Database management software to enable download, retrieval, storage, and manipulation of the DCS relational database.

vi. Control configuration software to enable creation, manipulation, compilation, download to control processors, and on-line monitoring of all I/O, data acquisition, discrete, continuous, and sequential control logic executed in the control processor(s).

vii. Display builder software to enable operator display creation, manipulation, compilation, and download.

viii. Historian software to store process related measurements, operator actions, and alarms for future retrieval and analysis.

ix. Reporting software to enable creation, manipulation, and scheduling of periodic and event reports including Sequence-Of-Event (SOE) points.

x. Control functions assembled by sets of blocks and modules to execute all digital and analog control logic. Blocks and modules should have embedded comments describing the functions being performed.

xi. Self-documentation of the DCS's actual programmed logic in SAMA-like format.

xii. Datalink software to provide access to real-time and historical DCS data from Windows-based desktop applications via a fast Ethernet connection using DDE, OLE, or ODBC software to allow the data to be incorporated directly into standard Microsoft Office personal computer applications. Simultaneous access by up to ten (10) users shall be supported.

xiii. All cables, software, and accessories required for a complete, fully functional system.

3. One (1) DCS Electronics Equipment Room Console to incorporate the following Equipment per Contract documents:

a. One (1) dual LCD Domain/Database Server

b. One (1) Historical Storage and Archive System/Anti-Virus Workstation, to include the following:

i. Stand alone, dual redundant server (two (2) 100% capacity, one (1) in operation and one (1) in hot standby).

ii. Dual 22" color flat panel LCD screen with electronics, Windows 7 operating system, keyboard, and optical mouse.

iii. All cables, software, and accessories required for a complete, fully functional system.

c. One (1) dual LCD OPC/PI Workstation

d. Furniture to provide a complete continuous console to hold the Domain/DB Server, Historian/AV Workstation, and OPC/PI Workstation, as well as one (1) additional dual LCD workstation provided by Others. The furniture shall include sufficient space for keyboards, mice, and extra space to accommodate Owner's equipment, such as telephones and radios. Furniture shall be manufactured by Panelmatic or Owner approved equal.

4. One (1) Printer Stand to incorporate the following Equipment per Contract documents:

a. One (1) color laser printer for printing of display graphics from any Operator Workstation. Printer shall be capable of printing on 11X17 size paper.

b. One (1) black and white laser printer for printing alarms, events, and logs. Printer shall be capable of printing on 11X17 size paper.

c. Furniture to provide a complete enclosed console with adjustable shelving for the color laser printer and black and white laser printer, as well as two (2) additional printers provided by Others.

d. Printers shall be complete with all cables, software, and accessories required for a complete, fully functional printer.

5. Reports

a. Ten pages of pre-configured event, periodic or demand logs.

b. Sequence-Of-Events (SOE) report for a minimum of 25 DCS inputs.

6. Complete control logic programming based on eight (8) System Design and Control Criteria documents provided by the Engineer and fifteen (15) P&ID's.

7. Redundant Control Processors, cabinets, power supplies, backup power regulating transformers, communication processors, and associated hardware to meet the requirements of this document and the Contract.

8. Remote I/O Cabinets, I/O Cards, power supplies, backup power regulating transformers, communications equipment and other hardware and software to meet the requirements of this document and the Contract for the cards and locations listed herein. The as shipped DCS shall have twenty (20) percent spare wired I/O provided for each I/O type and twenty (20) percent spare slots and unwired terminations in each control and remote I/O cabinet. Spare I/O shall be equally distributed among cabinets.

9. Data Highway cables and connectors, including any required media converters. Fiber optic data highway cable between DCS Equipment not in the same room will be supplied by Others.

10. Master Clock System (GPS) and time synchronization system.

11. Remote I/O interface communication processors.

12. Hardware/software required for remote access to plant data.

B. Graphic and Display Requirements

1. Graphic displays shall consist of overviews, process type graphics, detail graphics, control displays, faceplates, trends, etc., and will be developed from equipment supplier graphic layout sketches or the Engineer's P&IDs. Base scope shall include development of fifteen (15) unique graphic.

2. The Contractor shall include a set of faceplate only type displays for group control of modulating control loops.

C. Datalinks

1. Data links shall be provided for interface to the following systems:

Datalink	Protocol	Est. Points	
Combustion Turbine #1	Modbus TCP	2000	Redundant, bi-directional
Expansion Turbine #1	Modbus TCP	2000	Redundant, bi-directional
Main Electrical Equipment PDC Protection Relays	Modbus TCP	200	Redundant
Diesel Generator	Modbus TCP	50	Redundant
Switchyard	Modbus TCP	50	Redundant
Water Treatment PLC	Modbus TCP	200	Redundant, bi-directional
Air Compressor PLC	Modbus TCP	500	Redundant, bi-directional

D. Factory Acceptance Test (FAT)

1. FAT shall include one (1) week for a Hardware FAT and one (1) week for a Software FAT.

2. FAT shall include Datalink testing. Owner will arrange support from interfaced system supplier. Contractor shall provide all interface cable for testing.

E. Training

1. Four weeks of formal class room training at Contractor's main educational facility. Training to be a mix of engineer, operator, and maintenance selected from standard course catalog.

2. Two weeks of on-site operator training to familiarize the operators with the operator workstations and display navigation. Class shall be 1-2 days and be repeated 2-3 times.

3. Contractor shall provide one operator station for every two students to facilitate each of these training courses. Base price shall include training for up to 12 operators, or six operator stations.

F. Field Service

1. Contractor shall perform Site Operational Tests to verify complete and proper operation of the Equipment following DCS energization and prior to the use of the DCS for plant process system startup activities. These tests shall verify that all

system control processors, operator stations, engineer stations, I/O cards and communication links are functioning properly and no system diagnostic errors are present.

2. Contractor assist the Owner in performing Plant System Operational Tests including verification of control strategies, characterization of feedforward signals, and control loop tuning. The tests will be coordinated with the plant operations personnel.

G. Manuals and Documentation

1. Contractor shall provide all system manuals and documentation per Contract requirements.

H. Spares

1. Contractor shall supply all required On-Site Startup and Long term spares per Contract requirements.

1.3 Equipment and Services to be furnished by Other's

The Owner will furnish the following permanent materials, Equipment, and services under the conditions described below. The furnishing by the Owner of materials, equipment, and services shall not relieve the Contractor of its responsibility to properly perform the Work.

A. Instrument and control wiring except as specified in the Technical Specifications and Drawings.

B. Fiber Optic data communications cables between control processors and remote I/O cabinets.

C. One (1) primary UPS backed 120 VAC, 60 Hz power feed and one (1) secondary 125 VDC power feed to each DCS cabinet. The Contractor shall be responsible for providing power conditioning transformers for the backup power supply and for power distribution within cabinets.

D. UPS backed 120 VAC, 60 Hz power feeds to operator workstations and printers.

E. Non-UPS backed 120VAC, 60 Hz power feeds.

F. All supervision and labor for unloading, storing, handling, and erecting, including preserving, cleaning up (including disposal of waste chemicals), and inspecting during and after storage.

G. Storage facilities.

1.4 Design and Coordination Review Meetings

During the design phase, the Contractor shall implement systematic design review meetings, in addition to other meetings as necessary, with the Owner and the Engineer. The design review meetings shall present the status of design, review design parameters, obtain Owner and Engineer input, and review compliance with Contract requirements. The Contractor's project manager and appropriate design personnel shall conduct these meetings.

2. CODES AND STANDARDS

A. The latest edition and published addenda of the following publications in effect on the date of Contract Award are a part of this Specification and, where referred to by title or by basic designation only, are applicable to the extent indicated by the specific reference or equivalent national standards:

1. American Society for Testing and Materials (ASTM)

   a. D635, "Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position"

   b. E84, "Standard Test Method for Surface Burning Characteristics of Building Materials"

2. Telecommunications Industries Association (TIA)

   a. TIA-232-F, "Interface Between Data Terminal Equipment and Data Circuit-Terminating Equipment Employing Serial Binary Data Interchange"

   b. TIA-485-A, "Electrical Characteristics of Generators and Receivers for use in Balanced Digital Multipoint Systems"

3. Institute of Electrical and Electronic Engineers (IEEE)

   a. 518 – Guide for the Installation of Electrical Equipment to Minimize Electrical Noise Inputs to Controllers from External Sources

   b. 802.3, " Information Technology - Telecommunications and Information Exchange between Systems - Local and Metropolitan Area Networks"

   c. 1100, "Recommended Practice for Powering and Grounding Electronic Equipment"

   d. C37.90.1, "Surge Withstand Capability (SWC) Test for Relays and Relay Systems Associated with Electric Power Apparatus"

4. The International Society of Automation (ISA)

a. 5.1, "Instrumentation Symbols and Identification"

b. 5.2, "Binary Logic Diagrams for Process Operations"

c. 5.3, "Graphic Symbols for Distributed Control/Shared Display Instrumentation, Logic, and Computer Systems"

d. 37.1, "Electrical Transducer Nomenclature and Terminology"

e. 50.00.01, "Compatibility of Analog Signals for Electronic Industrial Process Instruments"

f. 51.1, "Process Instrumentation Terminology"

5. Insulated Cable Engineers Association (ICEA)

6. The Measurement, Control & Automation Association (MCAA)

   a. Functional Diagramming of Instrument and Control Systems

7. National Electrical Manufacturers Association (NEMA)

   a. ICS 1, "Industrial Control and Systems General Requirements"

   b. 250, "Enclosures for Electrical Equipment (1000 Volts Maximum)"

8. Occupational Safety and Health Administration (OSHA) 29CFR, Part 1910

9. National Fire Protection Association (NFPA)

   a. 70, “National Electrical Code”

   b. 75, “Standard for the Protection of Information Technology Equipment”

10. North American Electric Reliability Council (NERC)

    a. CIP-002, "Critical Cyber Asset Identification"

    b. CIP-003, "Security Management Controls"

c. CIP-004, "Personnel and Training"

d. CIP-005, "Electronic Security Perimeter(s)"

e. CIP-006, "Physical Security of Critical Cyber Assets"

f. CIP-007, "Systems Security Management"

g. CIP-008, "Incident Reporting and Response Planning"

h. CIP-009, "Recovery Plans for Critical Cyber Assets"

B. Where the above referenced codes, standards, and guides contain recommendations in addition to requirements, the recommendations shall be considered requirements and shall be followed, unless stated otherwise by this Specification.

C. In case of any conflict between the reference codes, or this Specification and codes, the more stringent applies.

3. GENERAL

A. Manufacturer shall comply fully with the complete requirements of this standard specification. Any deviations shall be clearly defined in the Proposal.

B. The DCS specified will be used for the Cycle 2 Compressed Air Energy Storage Project (CAES) to control the balance of plant equipment in support of the one (1) General Electric Combustion Turbine operating in Recuperation mode. The turbine will be fired on natural gas only. All equipment and systems shall be designed for a plant life of 30 years.

C. The plant will be located in the county of Seneca, in the state of New York.

D. This plant may be identified as Critical Infrastructure and shall be designed per the requirements of NERC-CIP.

4. INFORMATION AND DATA REQUIREMENTS

4.1 Submittals

A. Price summary and breakdown price schedule.

B. Exception and deviation against the specification.

C. Utility consumption list.

D. DCS Architecture Drawing.

E. Schedule.

F. Listing and description of the proposed DCS equipment.

G. Outlined dimensioned drawings of the equipment and auxiliaries identifying weights, clearances, and maintenance requirements, including lifting and installation guidelines.

H. Drawing submission list and schedule.

I. Performance and availability guarantees.

J. Priced list for maintenance spares and consumables for normal operation of the Equipment.

K. Price list for breakdown spares for plant breakdowns which could jeopardize the availability or safety of the plant (including description, identification, price, and delivery.

L. Price list for overhaul spares and consumables for programmed major and minor overhauls.

M. Inspection & test item list.

N. Description of training to be provided.

5. TESTING

A. A Factory Acceptance Test shall be performed in order to assure the correctness and completeness of all Equipment covered under the Contract. The test shall verify the ability of all Equipment to perform its intended functions within the applicable tolerances and performance guarantees, such that when the Equipment is shipped and correctly connected to external devices, the complete system is operable as intended.

B. All Equipment associated with the DCS (including but not limited to 100% I/O checkout, closed loop simulation, logic validation, graphics, reports, etc.) shall be tested during the Factory Acceptance Test. The Contractor shall demonstrate the system's ability to meet the requirements of the Specification. The system shall be fully configured for the test.

C. The Contractor shall furnish the services of a qualified representative to provide technical direction during commissioning of the DCS and related accessories. The field personnel provided by the Contractor shall be capable, qualified, and able to perform the duties required to the satisfaction of the Owner and shall be vested with authority to make decisions binding on the Contractor. The Contractor's representative shall verify the proper installation of the Equipment.

D. The Site Acceptance Test shall be performed after the installation and commissioning of the DCS. The functions and characteristics included in the test shall be the same as the factory checkout and acceptance tests, considering that the system will be connected to the process. Any abnormality encountered in this test shall be justified and corrected by the Contractor at no additional cost to the Owner.

6. SPARE PARTS

Contractor shall provide commissioning and startup spare components (IO cards, processors, termination assemblies, fuses, etc.) based on prior experience and percentage of same component devices being supplied as part of this Contract.

7. GUARANTEES

7.1 System

The Contractor shall provide a two-year guarantee, after final acceptance, on all hardware, firmware and software supplied under this specification.

7.2 Response Times

The response time of the system shall be sufficient to maintain control over the plant processes under all system operating conditions including extreme plant upset conditions with all points in alarm. The response time is the total elapsed time for transmission of data through the system communication path from input point to displays or outputs as applicable. This time shall include all communication time from control processor to control processor, I/O scans, gateways, operator stations, and other Equipment internal to the system.

7.3 Availability

Overall system availability shall be greater than 99.7% for the first year of service after completion of Site Operational Tests.

8. OTHER REQUIREMENTS

Not Used

ATTACHMENT A - SYSTEM I/O QUANTITIES

Node	AI	AO	TC	RTD	DI	DO	SOE	Total
CTG/ Recuperator Area	90	30	85	25	180	90	5	505
Electrical/ PDC Area	30	0	0	10	60	35	10	145
Expander/ Compressor Area	35	30	20	0	180	120	5	390
Balance of Plant	80	80	30	10	140	75	5	420
Total	235	145	150	50	600	330	25	1460

NOTE: The above I/O quantities do NOT include the required 20% spare.

AI: Analog Inputs, 4-20 mA dc, System or Field powered

AO: Analog Outputs, 4-20 mA dc, System powered

TC: Thermocouple Inputs, Type E or K

RTD: RTD Inputs, 100 Ohm Platinum

DI: Digital Inputs, 48VDC, 120VAC, or 125VDC

DO: Digital Outputs, Solid state or electromechanical dry contact, 120VAC or 125VDC

Total: Total I/O per node

A minimum of 25 SOE points will be required and are included in the quantity of digital inputs. The quantity of the above I/O signals may change. The above numbers are for reference only and a price addition / deduct per I/O signals shall be given in the bid documents.

WorleyParsons
resources & energy

EcoNomics

NEW YORK STATE ELECTRIC AND GAS

SENECA COMPRESSED AIR ENERGY STORAGE PROJECT

STEP-UP TRANSFORMER

REQUEST FOR BUDGETARY QUOTATION

Document: CAES-1-SP-UBAO

Revision: A

Date: August 2011

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SYNOPSIS

This document presents the design criteria for the preparation of a budgetary quotation for the Step-up Transformer.

Disclaimer

REV	DESCRIPTION	ORIGINATOR	REVIEWER	APPROVER	DATE
A	Issued for Bid	G. PANNO	D. STERNER	G. PANNO	08/31/2011

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1. SCOPE

This engineering specification is applicable to outdoor, substation type, oil-filled power transformers, base rated at a 65 degrees C temperature rise, for use as Generator Step-up Transformers in power generating plants.

2. CODES AND STANDARDS

A. The latest edition and published addenda of the following publications in effect on the date of Contract Award are a part of this Specification.

B. Generator Step-up Transformers shall be designed, manufactured and tested to comply with the latest revisions of applicable standards of each of the following organizations together with all the latest addenda, amendments or additions, as of the date of Contract:

1. ANSI - American National Standards Institute

   a. ANSI C57.12 - Family of standards covering power transformers.

   b. ANSI C57.116 - "Guide for Transformers Directly Connected to Generators".

2. ASTM - American Society for Testing of Materials

3. AWS - American Welding society

4. IEEE - Institute of Electrical & Electronics Engineers

5. ISA - Instrument Society of America

6. NEC - National Electrical Code

7. NEMA - National Electrical Manufacturer's Association

8. NFPA - National Fire Protection Association

C. Where the above referenced codes, standards, and guides contain recommendations in addition to requirements, the recommendations shall be considered requirements and shall be followed, unless stated otherwise by this Specification.

D. In case of any conflict between the reference codes, or this Specification and codes, the more stringent applies.

3. GENERAL

A. Transformers shall be directly connected to a generator.

B. All Manufacturers shall comply fully with the complete requirements of this specification. Any deviations must be clearly defined in the Proposal.

C. Performance guarantees shall be provided for the following:

1. No load losses.

2. Full load losses

3. Positive and zero sequence impedance (percent) between the various windings.

4. DESIGN AND CONSTRUCTION FEATURES

A. The GSU Transformers shall be rated per CAES-1-DS-UBAO.

B. The transformer shall have an oil preservation system. The system shall prevent direct contact between the oil and the air.

C. The transformer shall be designed for rolling or skidding in any direction.

D. The transformer windings shall be copper.

E. The transformer tank shall be of sealed construction and shall be capable of withstanding a rated vacuum. The transformer cover shall be welded on. A manhole shall be provided on the transformer cover. The manhole shall be at least 20 inches in diameter.

F. Transformer design, including internal conductors and bushings, shall be suitable for the additional kVA allowed by the forced-air cooling fans and fan control.

1. Fans shall be three-phase and wired to a terminal box for power connection by others.

2. Fans shall be individually fused or otherwise thermally protected.

3. Fan supports shall be bolted or welded on the transformer tanks.

4. Fans will be controlled by the winding hot spot temperature.

5. Fans will have the ability via local control to be tested and switched on and off by stage or all together.

G. Copper grounding pads shall be provided at opposite corners of the tank base. A NEMA 4-hole compression type lug for connection of a 500 kcmil ground cable to the station ground grid shall be provided for each ground pad. The transformer neutral bushing ground connection shall be bussed to the tank base and provided with a NEMA 4-hole compression type lug for connection of a 500 kcmil ground cable to the station ground grid.

H. The transformer shall have a de-energized tap changer in the high-voltage winding with steps at +5%, +2.5%, 0%, -2.5% and -5%. The tap changer shall be suitable for

operation from ground level when the transformer is de-energized. The tap changer handle shall have provisions for padlocking. Visible indication of tap position shall be provided and the drive shaft shall not be brought out through the tank. The tap changer will have a caution nameplate, a stainless steel plate mounted by the tap changer handle to read “CAUTION – NO-LOAD TAP CHANGER. Do not operate when transformer is in service. De-energize both the high and low voltage windings before changing tap position.”

I. Bushings

1. Transformer bushings shall be oil-filled, utilizing either the transformer's oil as the cooling and insulating fluid or the bushings own self-contained supply of oil. A sight gauge or other means shall be provided to indicate oil level.

2. Bushings above 150 kV BIL shall be condenser type, with capacitance graded layers of insulating material for the purpose of controlling the distribution of the electric field, and shall be equipped with a capacitance or power factor test tap. If the bushing is mounted in a metal enclosed bus duct, the external terminal shall be designed for connection to a bus operating at 105° C. Gaskets and paper insulation used in the assembly of the bushings shall be suitable for the required operating temperatures. All bushings shall be constructed by using wet process porcelain materials with a homogeneous surface. Porcelain parts of each bushing rated below 450 kV BIL shall be one-piece. For "draw lead" type bushings, the transformer outline drawing shall indicate the size, number of strands, and material of the bushing draw lead. Minimum creep distances shall be as specified on the Power Transformer Specification Data Sheet using millimeters per rated system voltage, mm/kVL-L. Bushing installations shall meet ANSI C2 and NEMA SG6 strike clearances distances to all equipment including the conservator tank, lightning arrestors and corona rings.

3. Outline drawings of each bushing shall be included with the transformer approval drawings. Instruction manuals for each style of bushing shall be included with the transformer's instruction manuals.

4. Each bushing with a stud type connection shall be furnished with a removable stud-to-pad four-hole terminal of sufficient size to continuously carry the maximum current. Aluminum-to-copper bimetallic transition plates shall be furnished when connecting to external aluminum conductors. At 230 kV and above, the terminals shall be corona free. System line connections will first connect to the associated surge arrester, if specified.

5. The bushing arrangements on generator step-up transformers (GSUs) shall be such that the high voltage bushing strike arc clearance shall clear a vertical plane established with the isolated phase bus rising vertically from the low voltage bushings.

J. The following devices shall be provided and installed on the transformers by the Manufacturer:

1. Magnetic liquid level indicator with alarm contacts and threaded conduit hub.

2. Liquid filling and filter press connection and valve in the top and bottom of the tank.

3. Combination drain and bottom filter valve with sampler.

4. Dial type liquid thermometer and temperature indicating switch with alarm contacts, maximum read pointer and threaded conduit hub. This device shall have two set points and two sets of alarm contacts per set point.

5. Vacuum pressure gauge with bleeder.

6. A gas accumulation gauge

7. Dissolved Gas Monitoring "Hydran" or other with remote and local monitoring

8. Lifting hooks on the tank, lifting eyes on the cover and provisions for jacking.

9. Stops shall be provided to prevent over-compression of gaskets.

10. Partial Discharge Monitoring System

11. As far as practical, gaskets below oil level will be eliminated unless isolating valves are provided.

12. Pressure relief device with alarm contacts and threaded conduit hub.

13. A hot spot dial-type winding temperature indicator with alarm contacts shall be provided for each high voltage and low voltage winding, for a minimum of two (2) per transformer. Each winding temperature indicator shall have two set points and two sets of alarm contacts per set point.

14. A sudden pressure, or Bucholtz relay (Device 63), shall be provided. The sudden pressure relay shall be supplied with seal-in contacts in housing with a threaded conduit hub and “loss of DC indication.”

15. Stainless steel nameplates and tap changer warning/instruction plates. Nameplates shall not be attached to radiators.

16. Each transformer shall be supplied with a transformer identifier (tag number) nameplate. This nameplate shall be of laminated phenolic material (or agreed upon equivalent) with black letters on a white background.

17. The radiators shall be equipped with bolted flanges and isolation valves to permit the removal of any radiator without draining the oil from the transformer or any other radiator. Lifting eyes shall be provided on each radiator/cooler group.

18. Connection provisions shall be made in the cooling equipment controls circuit to allow external interlocking with the Owner’s transformer protective relaying scheme, such that operation of normally closed contacts of the transformer protection lockout relay (86T) will shut down the cooling equipment in the event of an internal transformer fault.

19. Supplier shall make a statement on the alarm termination sheet defining which set of contacts are open in the alarm state.

20. An instrument shall be provided that reads hydrogen concentration and water concentration. It shall produce 4-20mA signals for remote monitoring to the Buyer’s control system.

K. The transformer tank shall be shipped with dry nitrogen. The oil shall be shipped to the site separately. The Manufacturer shall be responsible to fill the tank with oil. The transformer shall be provided with the necessary amount of high grade insulating oil that contains no detectable PCBs and the oil shall be manufactured and tested in accordance with the requirements of ASTM D3487, "Standard Specification for Mineral Insulating Oil Used in Electrical Apparatus.”

L. Accessory wiring shall be installed in rigid galvanized steel conduit, except the final 18 inches to the device may be exposed SOW cable.

M. Internal, multi-ratio, bushing-type current transformers (CT) shall be provided in accordance with Section 4.A. All CT secondary terminals shall be wired to shorting terminal blocks using ring type lugs.

N. Station-type lightning arrestors shall be provided in accordance with Section 4.A. Arrestor ratings shall be coordinated with the transformer insulation level.

O. A throat or flange shall be provided for isolated-phase bus duct connections on the primary bushings of the transformer. The secondary bushings shall be suitable for an overhead cable connection.

P. All control wiring shall be 600 volt, 90 degrees C, XLPE insulation, with stranded copper wire, No. 12 AWG (minimum) for power, No. 14 AWG (minimum) for controls, and No. 10 AWG (minimum) for current transformers. Terminal blocks shall be rated for 600 volts and accept conductors sized #18 through # 8 AWG. An additional 20% spare terminal blocks shall be provided. Heat shrink wire markers are required.

Q. A core grounding strap shall be provided and shall be accessible from a tank top man-way.

R. The Auxiliary Cooling Equipment Control shall meet the following requirements:

1. Two (2) fully independent power feeds and control circuits with automatic transfer between normal and backup power sources (480V, 3-PH, 3-W) in the event that one fails. Provide Form C alarm contact for loss of normal power/ transfer to backup.

2. Two (2) banks of cooling equipment controls shall be provided, which each powered by separate circuit breakers located in the control panel. Circuit breakers shall be ambient-compensated thermal-magnetic type.

3. Loss of auxiliary cooling power alarm (fans not running).

S. The Auxiliary Cooling Equipment Control Cabinet shall meet the following requirements:

1. The Control Cabinet components shall be mounted in a weatherproof enclosure of NEMA 4X design, as a minimum.

2. The Control Cabinet shall be welded construction throughout with no bolts or rivets visible on exterior.

3. The Control Cabinet shall have vertically hinged doors, with devices to secure the door in the fully open position, and include provisions for pad-locking.

4. The Control Cabinet shall have a removable aluminum bottom plate with double-door construction if opening is 42-inches wide, or greater.

5. The Control Cabinet and terminal block enclosures will be provided with space heater(s) and internal illumination by standard lamps(s), 120-VAC, with a door-activated On-Off switch and guard for lamp.

6. Each auxiliary control device will have a minimum of one normally open and one normally closed contact wired to terminal blocks for future use.

7. All alarm contacts shall be wired to indicators on a panel and a single common alarm. Common alarm will use '0' as its alarm state.

T. Steel surfaces shall be thoroughly cleaned and properly prepared, followed by the Manufacturer's standard painting procedure. Transformer finish shall be ANSI #70, light gray.

U. Equipment openings, entrances to internal wiring, control devices and the like to be protected against entrance of dirt, dust, moisture, or other deleterious elements. All connections shall be protected by metal covers to prevent damage during shipment.

V. Flanged connections separated for shipment shall be suitably protected by means of blind cover plates, or similar closures, to exclude foreign matter. Valve openings to be equipped with pipe plugs.

W. Transformer shall be as fully shop-assembled as possible within shipping and handling limitations.

X. Lightning arrestors and cover mounted porcelain bushings shall be separately packaged for shipment.

Y. Detachable radiators, expansion tanks, and other accessory devices which are removed for shipment shall be suitably crated and protected against corrosion, dampness, breakage, or vibration damage that might be encountered in transportation and handling.

Z. Transformer shall have all valves sealed and effectively crated to prevent tampering or removal while in transit. Means shall be provided to allow measurement of gas pressure

without release of the gas on arrival at destination. Valves are to be securely covered by a pipe cap or other tamper-proof cap.

AA. A storage box shall be mounted on the transformer for storing removable cover plates and miscellaneous hardware used for shipment.

BB. All shipping locks, bindings, etc. shall be clearly marked so that their removal prior to energization is assured. Any special precautions that must be observed in the removal of these shipping restraints shall be clearly marked on the shipping container or crate.

CC. If radiators or bushings are shipped loose, sufficient make-up oil shall be provided to fill the transformer.

DD. Transformers shall be shipped with tamper-proof tri-directional impact recorders. The recorder shall be a continuous recording type using either a chart or strip output or digital memory for a minimum of 60 days or from the factory floor to the site, whichever is longer. Daily date and time stamps shall be included in the recording. The recorder shall be mounted as close as possible to the transformer's center of gravity.

EE. Complete installation instructions for any parts shipped separate from the tank and core assembly shall accompany the transformer shipment.

FF. A core grounding strap shall be provided and shall be accessible from a tank top man-way.

5. TESTING

A. The "Routine" tests called for in ANSI/IEEE C57.12.00, Table 18, shall be performed for each transformer in accordance with ANSI/IEEE C57.12.90. For Class II transformers, these tests shall also include those defined as "Routine" per the notes to Table 18. When a temperature rise test is required in accordance with the Datasheet, only one transformer of each identical size shall be tested.

B. Owner reserves the right to inspect the equipment at the Manufacturer's plant prior to shipment, and to witness any or all testing. The manufacturer shall notify the Owner about the dates for the tests. The Owner or a designated representative will either witness the tests when performed or authorize the manufacturer to proceed without a witness and furnish a full report upon conclusion.

C. Owner shall be notified immediately and before shipment if the transformer fails to pass any test.

D. All insulation power factor tests for transformers and associated outdoor apparatus bushings will be performed with Doble™ or Frammel™ test equipment and associated procedures.

E. No load losses and excitation current will be measured at 90-100-110% rated voltage. Impulse, phase to ground and insulation power factor testing will be required with No-load losses, excitation current, impedance voltage and load loss testing will be performed both before and after impulse testing. Both sets of tests will be recorded on Certified Test Reports.

F. Production tests for outdoor apparatus bushings will be made and include:

1. Test for unintentional core grounds on core type transformers immediately prior to shipment.

2. Gas-in-oil analysis before the start of testing and again after all testing is complete; any differences will be explained to the satisfaction of the owner. Gas content of the oil, in parts per million, will be reported for the following gasses: Nitrogen, Carbon Monoxide, and Ethane.

3. Routine and design tests will be required for all current transformers, and metering CT's will be certified.

6. SPARE PARTS

Along with the equipment specified above the Supplier is required to provide individual prices for the following spare parts in the proposal. The spare parts may be purchased with the order:

A. HV winding bushing and gasket

B. HV lightning arrestor (if applicable)

C. LV winding bushing and gasket

7. GUARANTEES

As required by Section 3.D of this specification.

8. OTHER REQUIREMENTS

Not Used