PJM Generator Interconnection Request
Queue #X3-052
Essex (ECCF) 26.4kV
Feasibility/Impact Study Report

January 2012
#681755
Version 2 January 2012
Version 3 March 26, 2012

X3-052 Essex (ECCF) Feasibility/Impact Study

General

DCO Essex Energy, LLC has submitted an interconnection request for 6 MW at the Essex County Correctional Facility. In actuality the Interconnection Customer plans to connect 6.0 MW of aggregate generation consisting of two natural gas fueled 3.086 MW engine-generators. The net output to the system will not exceed 3.0 MW. The generating facility is located at 354 Doremus Avenue, City of Newark, Essex County, New Jersey.

DCO Essex Energy initially requested commercial operation as of November 1, 2011.

The intent of the Impact Study is to determine system reinforcements and associated costs and construction time estimates required to facilitate the addition of the new generating plant to the transmission system. The reinforcements include the direct connection of the generator to the system and any network upgrades necessary to maintain the reliability of the transmission system.

Direct Connection

The two proposed generators will be connected at 13.2kV within the correctional facility. A 13.2kV/26.4kV step-up transformer will connect to the existing 26.4 correctional facility 26.4kV bus. The point of interconnection shall be at the PSE&G 26.4kV taps to the C-289 and O-327 circuits at the Essex County Correctional Facility existing substation as shown in the attached single-line-diagram. See Figure #1

In order to interconnect the generation Direct Transfer Trip equipment will need to be installed that automatically disconnects the generator from the Essex County Resource Recovery substation and the PSE&G system whenever the Essex Switching Station 26kV circuits, designated O-327 and C-289 are both open. Transfer Trip will also need to be installed to Firmenich 26kV station. Additionally, PSE&G reserves the right to disconnect the generator at certain times for the purpose of performing routine line or substation maintenance.

The following equipment and work will need to be performed by PSE&G to connect the generation to the system

1. Install new transfer trip and tone equipment at Essex Switching Station to coordinate with the existing 26kV circuit breakers installed at the Essex County Correctional Facility Substation.
2. Due to system rearrangements since the L12 project estimate was developed for this project, there is now need to install remote trip facilities at Firmenich Substation in addition to Essex.

3. Perform relay testing and operational testing on the Essex County Correctional Facility new transfer trip and eliminate the non-export reverse power relay.
4. Purchase and install a new bi-directional revenue meter.
5. Add new points in existing monitoring system at Essex County Correctional Facility and Clifton Distribution Headquarters.

PSE&G has developed four cost estimatyes for interconnection for the following conditions.

Option 1 - Full generation capability into either supply line
Option 2 - Full generation capability into either supply line with operating restrictions
Option 3 - Generation capability restricted to the preferred circuit only
Option 4 - Generation capability restricted to the preferred circuit only with additional operating restrictions

Project Item		26-kV Option 1 C-289/O-327	26-kV Option 2 C-289/O-327	26-kV Option 3 C-289	26-kV Option 4 C-289
Inside Plant					
Line Position/Feeder Row		-	-	-	-
Relay Protection & Testing		$67,000	$47,000	$47,000	$27,000
Manholes/Conduit		-	-	-	-
Other/Misc.		-	-	-	-
	Sub Total	$67,000	$47,000	$47,000	$27,000
Outside Plant					
Overhead Line (Fiber Optic Cable)		$994,100	$457,500	$994,100	$457,500
Underground Line		-	-	-	-
Manholes/Conduit		-	-	-	-
Other/Misc.		-	-	-	-
	Sub Total	$994,100	$457,500	$994,100	$457,500
Metering/Monitoring					
Revenue Metering/Telemetering/SCADA		$48,700	$48,700	$48,700	$48,700
Feeder Metering		-	-	-	-
Other/Misc.		-	-	-	-
	Sub Total	$48,700	$48,700	$48,700	$48,700
Total Cost		**$1,109,800**	**$553,200**	**$1,089,800**	**$533,200**
Acceptable Generation Export Level		**Up to 3.0 MW**	**Up to 3.0 MW**	**Up to 3.0 MW**	**Up to 3.0 MW**

Notes: Option 1 - Full generation capability into either supply line
Option 2 - Full generation capability into either supply line with operating restrictions
Option 3 - Generation capability restricted to the preferred circuit only
Option 4 - Generation capability restricted to the preferred circuit only with additional operating restrictions
Above costs do not include transfer trip equipment and installation at the customer's facility
which will be required to be purchased and installed by the customer to PSE&G specifications.

Material Required

- RFL Transfer Trip Equipment
- Relay Panel
- Miscellaneous Equipment/Material/Tags
- Bi-directional Revenue Metering

PSE&G has reviewed the cost estimates (including risk and contingencies) to permit DCO Energy, LLC to export up to 3 MW of generation from the Essex County Correctional Facility located in Newark, New Jersey utilizing dedicated phone line communications rather than FiberOptic cables. As previously specified and discussed, various plans for operation and associated costs were developed including:

Option 1 - Full generation capability into either supply line (3 interconnection paths)
Option 2 - Full generation capability into either supply line with operating restrictions (2 interconnection paths)
Option 3 - Generation capability restricted to the preferred circuit only (2 interconnection paths)
Option 4 - Generation capability restricted to the preferred circuit only with additional operating restrictions (1 interconnection path)

The revised costs for the various options to provide the requested export capability utilizing dedicated phone line communications are detailed as follows:

	Option 1	Option 2	Option 3	Option 4
Transfer Trip Equip/Testing -	$ 75,000	$ 50,000	$ 50,000	$ 27,000
26-kV Sectionalizing Switches -	$ 50,000	$ NA	$ 50,000	$ NA
Metering/SCADA -	$ 48,700	$ 48,700	$ 48,700	$ 48,700
Total Cost -	$ 173,700	$ 98,700	$ 148,700	$ 75,700

This cost is exclusive of work required to be performed by the developer as specified in PSE&G's Information & Requirements for Electric Service Handbook. Above costs do not include phone line costs, transfer trip equipment and installation at the customer's facility which will be required to be purchased and installed by the customer to PSE&G specifications. Phone line requirements for the Options identified above are as follows:

Option 1 - 3 lines (Essex-ECCF(C-289), Essex-ECCF(O-327), Firmenich-ECCF(C-289))
Option 2 - 2 lines (Essex-ECCF(C-289), Essex-ECCF(O-327))
Option 3 - 2 lines (Essex-ECCF(C-289), Firmenich-ECCF(C-289))
Option 4 - 1 line (Essex-ECCF(C-289))

Project Timeline

Project Initiation

ISA and CSA are fully executed and authorization is received to proceed with construction

Long lead time construction material is placed on order

1-2 Weeks from Project Initiation

Developer submits preliminary site plan, 26-kV switchgear one-line diagram and equipment specifications for approval

3-4 Weeks from Project Initiation

PSE&G provides comments on project lay-out and design

6-7 Weeks from Project Initiation

Developer submits final site plan, 26-kV switchgear one-line diagram and equipment specifications for approval

8-10 Weeks from Project Initiation

PSE&G commences line construction

10-12 Weeks from Project Initiation

PSE&G provides final comments and approval of 26-kV switchgear lay-out and design

Developer begins construction based on approved design

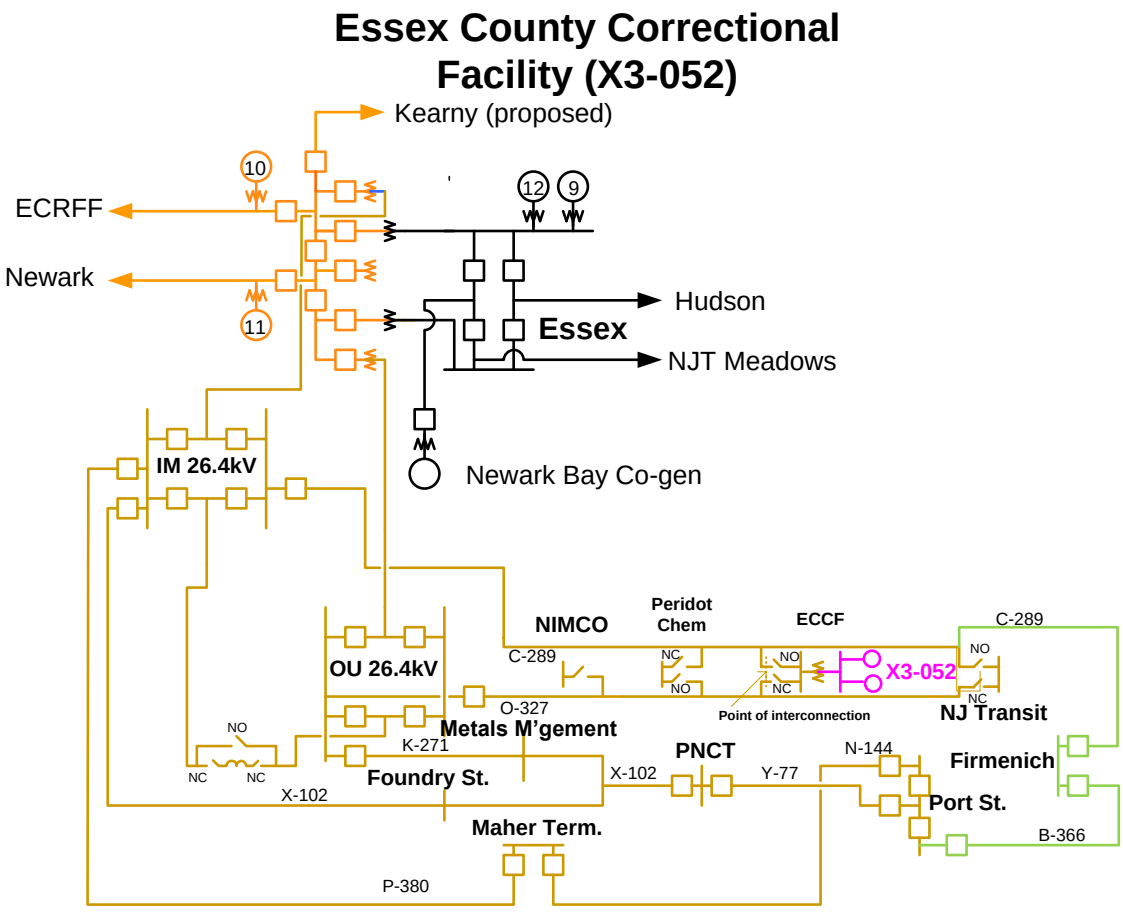
18-20 Weeks from Project Initiation

Switchgear inspection and approval by PSE&G

24-26 Weeks from Project Initiation

Completion of interconnection work and service cut-in

Figure #1



The Essex County Correctional Facility project commercial date of November 1 2011 cannot be met. PSE& G expects to have its work done by November 1, 2012 provided that the ISA and ICSA are executed by October 21, 2009.

Interconnection Customer Interconnection Facilities Requirements (Constructed by Interconnection Customer)

DCO Essex Energy LLC will be responsible for the following items to assure the viability of the interconnection of the generation with the system.

1. Meet PSE&G Distribution System standards if posted on the PJM website under PSE&G "Applicable Technical Requirements and Standards", if any, and included in the Interconnection Service Agreement among Essex County Correctional Facility, PSEG and PJM.

2. Procure, Design, Engineer and install RFL transfer trip equipment at the customer's facility. PSE&G will provide the ordering information, drawings will be provided by RFL. PSE&G will perform operational testing prior to generator export operation.
3. Pull cables for additional monitoring points into the existing SCADA unit and terminate at station equipment. PSE&G will terminate all cables inside the cabinet.
4. Licensing and Environmental issues, if any, will be the responsibility of the Interconnection Customer and is not included in this scope of work.

Metering and Data Transmittal to PJM

In order to be a Capacity resource the Interconnection Customer must install metering, as described in PJM Manual M-14D, to transmit the following real time data to PJM.

a. Instantaneous net MW for the plant
b. Instantaneous net MVAR for the plant

In addition, the Interconnection Customer is responsible for assuring the following non real-time data is transmitted to PJM.

a. Hourly compensated MWh delivered by the plant.
b. Hourly compensated MWh received by the plant.
c. Hourly compensated MVARh delivered by the plant
d. Hourly compensated MVARh received by the plant

Interconnection Customer Telecommunication Requirements

Remote Trip Equipment

PSE&G will order two (2) dedicated full duplex, four-wire data circuits, 4800 baud w/C-2 conditioning for the remote trip circuits. The circuits will be from Essex Switching Station to the Project. There will also be two (2) dedicated circuits from Port Street station to the Project. Essex County Correctional Facility will be billed monthly for these circuits.

Project Control Room

PSE&G requires one voice grade circuit that can be an extension of the Project's main switchboard. This phone line shall be for the exclusive use of coordinating generator operations with PSE&G Electric System Operations and Distribution Operations.

Network Impacts

The Queue Project #X3-052 was studied as a(n) 3.0MW(Capacity 0.0MW) injection at Essex 26kV substation in PSEG area. Project #X3-052 was evaluated for compliance with reliability criteria for summer peak conditions in 2015. Potential network impacts were as follows:

Generator Deliverability

(Single or N-1 contingencies for the Capacity portion only of the interconnection)

No problems identified

Multiple Facility Contingency

(Double Circuit Tower Line, Line with Failed Breaker and Bus Fault contingencies for the full energy output)

No problems identified

Short Circuit

(Summary form of Cost allocation for breakers will be inserted here if any)

No problems identified

Stability

Not required because the project is under 30 MW.

System Reinforcements

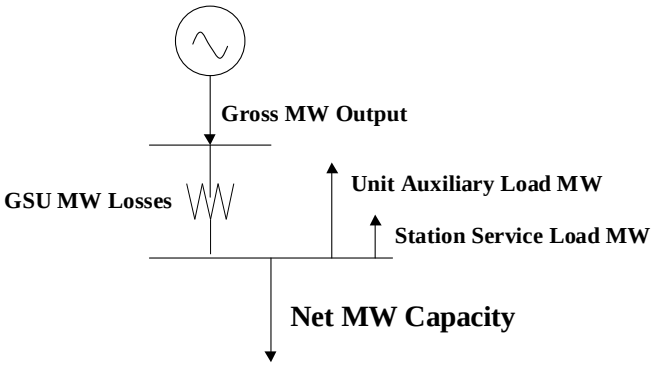
None.

Cost Allocation

The X3-052 project is responsible for 100% of the estimated $324,000 cost for the direct connection facilities described above.

ATTACHMENT #1

Unit Capability Data



Net MW Capacity = (Gross MW Output - GSU MW Losses* – Unit Auxiliary Load MW - Station Service Load MW)

Queue Letter/Position/Unit ID:_____ V2-012

Primary Fuel Type: _____ Natural Gas

Maximum Summer (92º F ambient air temp.) Net MW Output**: _____6

Maximum Summer (92º F ambient air temp.) Gross MW Output: _____ 6.2

Minimum Summer (92º F ambient air temp.) Gross MW Output:_____

Maximum Winter (30º F ambient air temp.) Gross MW Output:_____

Minimum Winter (30º F ambient air temp.) Gross MW Output: _____

Gross Reactive Power Capability at Maximum Gross MW Output – Please include Reactive Capability Curve (Leading and Lagging): _____

Individual Unit Auxiliary Load at Maximum Summer MW Output (MW/MVAR): _____

Individual Unit Auxiliary Load at Minimum Summer MW Output (MW/MVAR): _____

Individual Unit Auxiliary Load at Maximum Winter MW Output (MW/MVAR): _____

Individual Unit Auxiliary Load at Minimum Winter MW Output (MW/MVAR): _____

Station Service Load (MW/MVAR): _____

* GSU losses are expected to be minimal.

** Your project's declared MW, as first submitted in Attachment N, and later confirmed or modified by the Impact Study Agreement, should be based on either the 92° F Ambient Air Temperature rating of the unit(s) or, if less, the declared Capacity rating of your project.

Unit Generator Dynamics Data

Queue Letter/Position/Unit ID:_____ V2-012/ Two identical units

MVA Base (upon which all reactances, resistance and inertia are calculated):3.8575MVA_____

Nominal Power Factor:_____ 0.8

Terminal Voltage (kV): _____ 13.2

Unsaturated Reactances (on MVA Base)

- Direct Axis Synchronous Reactance, $X_{d(i)}$: _____ 3.319
- Direct Axis Transient Reactance, X'd(i): _____ 0.7671
- Direct Axis Sub-transient Reactance, X"d(i):_____ 0.4238
- Quadrature Axis Synchronous Reactance, Xq(i):_____ 2.0397
- Quadrature Axis Transient Reactance, X'q(i): _____ 2.0397
- Quadrature Axis Sub-transient Reactance, X"q(i):_____ 0.5339
- Stator Leakage Reactance, Xl: _____ 0.2474
- Negative Sequence Reactance, X2(i):_____ 0.4789
- Zero Sequence Reactance, X0: _____ 0.0602

Saturated Sub-transient Reactance, X"d(v) (on MVA Base): _____ 0.4494

Armature Resistance, Ra (on MVA Base):_____ 0.0066

Time Constants (seconds)

- Direct Axis Transient Open Circuit, T'_{do}:_____ 3.352
- Direct Axis Sub-transient Open Circuit, T''_{do}: _ _____ 0.034
- Quadrature Axis Transient Open Circuit, T'_{qo}:_____ 0.67
- Quadrature Axis Sub-transient Open Circuit, T''_{qo}: _____ 0.017
- Inertia, H (kW-sec/kVA, on KVA Base):_____

Speed Damping, D:_____

Saturation Values at Per-Unit Voltage [S(1.0), S(1.2)]:_____

Units utilize a Generator model

Unit GSU1 Data

Queue Letter/Position/Unit ID:_____ L12
Generator Step-up Transformer MVA Base: _____ 7.5
Generator Step-up Transformer Impedance (R+jX, or %, on transformer MVA Base):0.005+J0.0649
Generator Step-up Transformer Reactance-to-Resistance Ration (X/R):_____ 12.98
Generator Step-up Transformer Rating (MVA): _____
Generator Step-up Transformer Low-side Voltage (kV):_____ 13.2
Generator Step-up Transformer High-side Voltage (kV): _____ 26.4
Generator Step-up Transformer Off-nominal Turns Ratio: _____
Generator Step-up Transformer Number of Taps and Step Size:_____

Unit GSU2 Data

Queue Letter/Position/Unit ID:_____ L12
Generator Step-up Transformer MVA Base: _____ 7.5
Generator Step-up Transformer Impedance (R+jX, or %, on transformer MVA Base):0.0051+J0.0649
Generator Step-up Transformer Reactance-to-Resistance Ration (X/R):_____ 12.73
Generator Step-up Transformer Rating (MVA): _____
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The intent of the Impact Study is to determine system reinforcements and associated costs and construction time estimates required to facilitate the addition of the new generating plant to the transmission system. The reinforcements include the direct connection of the generator to the system and any network upgrades necessary to maintain the reliability of the transmission system.

Direct Connection

The two proposed generators will be connected at 13.2kV within the correctional facility. A 13.2kV/26.4kV step-up transformer will connect to the existing 26.4 correctional facility 26.4kV bus. The point of interconnection shall be at the PSE&G 26.4kV taps to the C-289 and O-327 circuits at the Essex County Correctional Facility existing substation as shown in the attached single-line-diagram. See Figure #1

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4. Purchase and install a new bi-directional revenue meter.
5. Add new points in existing monitoring system at Essex County Correctional Facility and Clifton Distribution Headquarters.

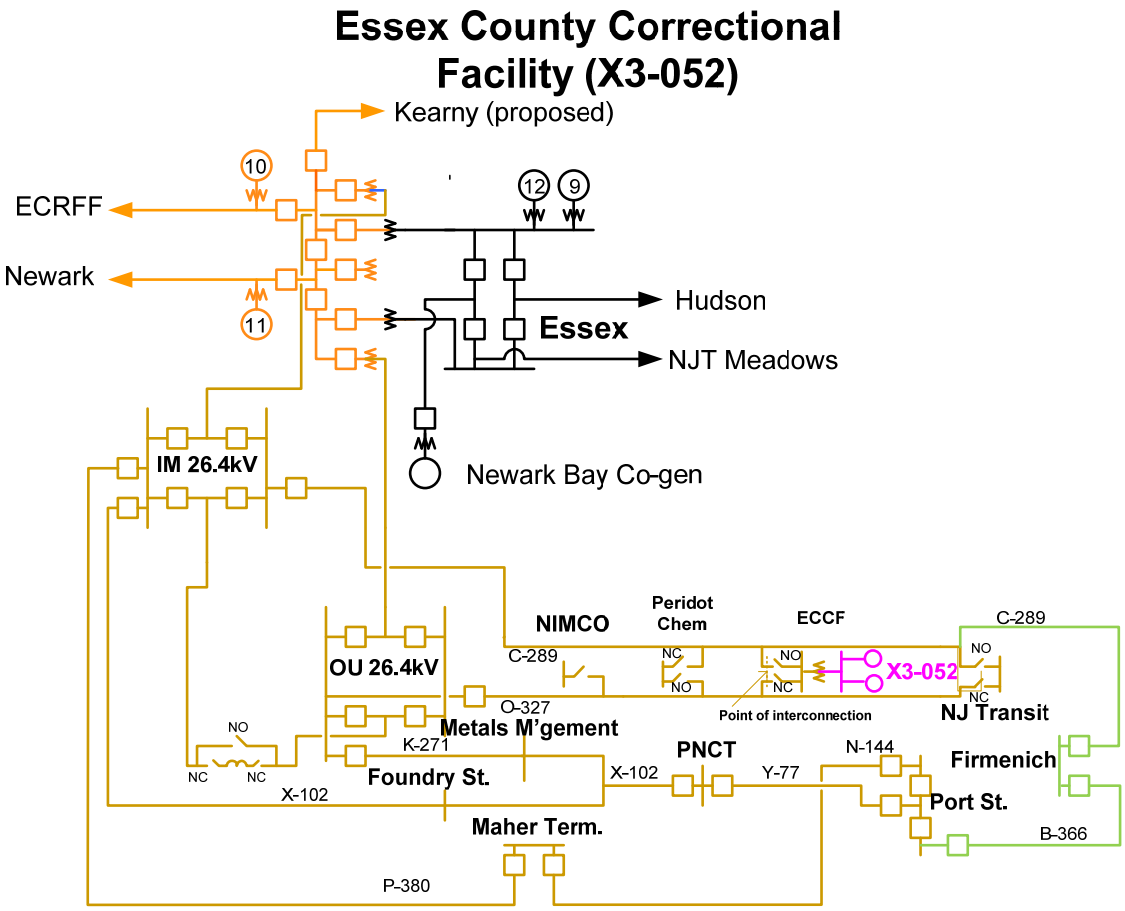
The estimated cost for the PSE&G Company work to interconnect the project is itemized below.

Engineering & Design	$ 54,000
Project Management	$ 21,600
Material	$ 75,600
Construction & Testing	$ 64,800
Testing at Customer Gen.	$ 10,800
Revenue Metering	$ 5,400
Misc. Cost	$ 10,800
R & C	$ 81,000
Total	**$324,000**

Material Required

- RFL Transfer Trip Equipment
- Relay Panel
- Miscellaneous Equipment/Material/Tags
- Bi-directional Revenue Metering

Figure #1



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Network Impacts

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No problems identified

Multiple Facility Contingency

(Double Circuit Tower Line, Line with Failed Breaker and Bus Fault contingencies for the full energy output)

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Short Circuit

(Summary form of Cost allocation for breakers will be inserted here if any)

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Stability

Not required because the project is under 30 MW.

System Reinforcements

None.

Cost Allocation

The X3-052 project is responsible for 100% of the estimated $324,000 cost for the direct connection facilities described above.

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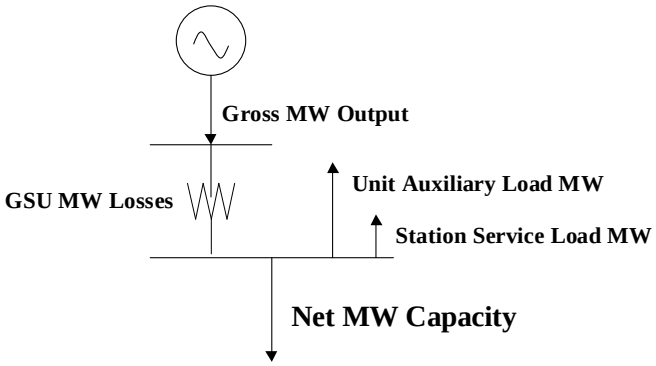

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Queue Letter/Position/Unit ID:_____ V2-012

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Gross Reactive Power Capability at Maximum Gross MW Output – Please include Reactive Capability Curve (Leading and Lagging):_____

Individual Unit Auxiliary Load at Maximum Summer MW Output (MW/MVAR): _____

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Nominal Power Factor:_____ 0.8

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Unsaturated Reactances (on MVA Base)

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- Stator Leakage Reactance, Xl: _____ 0.2474
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Time Constants (seconds)

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- Quadrature Axis Transient Open Circuit, T'_{qo}:_____ 0.67
- Quadrature Axis Sub-transient Open Circuit, $T"_{qo}$: _____ 0.017
- Inertia, H (kW-sec/kVA, on KVA Base):_____

Speed Damping, D:_____

Saturation Values at Per-Unit Voltage [S(1.0), S(1.2)]: _____

Units utilize a Generator model

Unit GSU1 Data

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Generator Step-up Transformer Reactance-to-Resistance Ration (X/R):_____ 12.98
Generator Step-up Transformer Rating (MVA): _____
Generator Step-up Transformer Low-side Voltage (kV):_____ 13.2
Generator Step-up Transformer High-side Voltage (kV): _____ 26.4
Generator Step-up Transformer Off-nominal Turns Ratio: _____
Generator Step-up Transformer Number of Taps and Step Size:_____

Unit GSU2 Data

Queue Letter/Position/Unit ID:_____ L12
Generator Step-up Transformer MVA Base: _____ 7.5
Generator Step-up Transformer Impedance (R+jX, or %, on transformer MVA Base):0.0051+J0.0649
Generator Step-up Transformer Reactance-to-Resistance Ration (X/R):_____ 12.73
Generator Step-up Transformer Rating (MVA): _____
Generator Step-up Transformer Low-side Voltage (kV):_____ 13.2
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Generator Step-up Transformer Off-nominal Turns Ratio: _____
Generator Step-up Transformer Number of Taps and Step Size:_____

