



DANSKAMMER ENERGY CENTER

Case No. 18-F-0325

1001.5 Exhibit 5

Electric System Effects

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Appendix 5-1. System Reliability Impact Study

Appendix 5-2. Heat Balance Diagrams

Exhibit 5: Electric System Effects

This Exhibit includes a discussion of the electric system effects of the Project. On January 25, 2019, Danskammer submitted a Large Facility Interconnection Request to repower the existing Danskammer Generating Station Site (Site). Danskammer is proposing to repower its existing 511-megawatt (MW) (nameplate capacity) generating facility (the Danskammer Generating Station or the Station) located in the Town of Newburgh, Orange County, New York with a state-of-the-art natural gas-fired combined-cycle power generation facility (the Danskammer Energy Center or the Project).

5(a) System Reliability Impact Study

A System Reliability Impact Study (SRIS) was issued in July 2019 for the Danskammer Energy Center Project by the New York Independent System Operator (NYISO) and is provided confidentially as Appendix 5-1. The SRIS evaluates a number of power flow base cases, as provided by the NYISO, including expected flows on the system under normal, peak, and emergency conditions to evaluate the effects on stability of the interconnection. Additionally, per the regulations of the Siting Board, technical analyses of thermal, voltage, short circuit, and stability were performed to evaluate the impact of interconnection.

The information contained in the SRIS is proprietary; therefore, Danskammer will seek the requisite trade secret protection for this information pursuant to Public Officers Law section 87(2) (d) and Section §6-1.4 of the regulations of the Public Service Commission as adopted by the Siting Board (16 NYCRR §6-1.4).

5(b) Potential Significant Impacts

The results presented in the SRIS indicate that the Project will not adversely impact the reliability and operating characteristics of the New York State Transmission System. Steady State (N-0, and N-1-1), stability (N-1 and critical clearing time), Bulk Power System designation, transfer limit, deliverability, and short circuit analysis were evaluated in making this determination. This conclusion is based on the following understandings and assumptions:

- The Project will be operated in accordance with applicable NYISO requirements, including applicable NYISO and Connecting Transmission Owner day-ahead and real-time operational procedures and limits. The NYISO will operate the Project without negatively impacting the New York State Transmission System; this may include

dispatching patterns that eliminate potential reliability issues that may exist during certain system conditions.

- The Project and associated interconnection facilities will be designed in accordance with the Applicable Reliability Standards.
- The SRIS results and conclusions are based on the studied scenarios and various assumptions related with the study methodologies, system, and project modeling information provided by Danskammer. Project modeling changes can produce different results and possible re-study.
- Danskammer has proposed to undertake, as part of the Project, elective System Upgrade Facilities (SUFs) to perform terminal upgrades on the two 115-kV lines from Danskammer to North Chelsea Substations and one 115-kV line from East Walden to Chadwick Lake. The elective SUFs will increase the ratings of the lines and are needed to support the higher generation capability of the Project.

Subject to the above, NYISO is satisfied that the Study was performed in accordance with the approved scope and in conformance with the existing Applicable Reliability Standards. Therefore, the SRIS has been approved. Additionally, the Project has been entered into the 2017-2 (closed in August 2019) Class Year, under NYISO queue request Q#791, and has started the Facility Study by executing a Facilities Study Agreement with NYISO.

5(c) Ancillary Services and Electric Transmission System Impacts

The SRIS analysis does not show the Project to have any significant adverse impact to the New York Transmission System.

The Project is technically capable of providing the following ancillary services to the grid:

- Regulation and frequency response services (which provides balance to real-time load and supply to ensure the system frequency is maintained within NYISO limits).
- 10-minute and 30-minute spinning reserve power generation (which is provided by backup generators available to run in the event of a major contingency); and
- Voltage Support Service (which is a cost-based service that generators can provide the NYISO to help maintain voltages within acceptable limits).

The combined-cycle gas turbine unit that comprises this Project will provide significant benefits and improvements to the reliability of electricity in the surrounding areas. The Project will

provide highly efficient generation by using the most advanced power generation technology commercially available today.

The combined-cycle unit can operate over a wide range of loads (approximately 293 MW to about 600 MW nominal at ISO conditions). During periods of low to intermediate load, the unit can provide a rapid increase in output from its minimum load to full load at a rate of about 4 percent per minute. The new plant will provide the system about 16 percent more capacity than the existing plant. Furthermore, the technology being applied allows the new plant to increase load at 5 to 7 percent per minute, while the existing plant is only capable of ramping at 2 to 3 percent per minute. These factors mean that the new plant will reduce the need for outside sources of power, which is especially significant during times of peak demand as the Project area is a significant load pocket and transmission capacity into the area is constrained.

Regarding voltage support (providing leading and lagging reactive power [VARs]), the Project will provide significant improvement in maintaining voltage control by a combination of increased generating capability and state-of-the-art voltage control systems.

5(d) Reasonable Alternatives to Mitigate Adverse Reliability Impacts

Under the Minimum Interconnection Standard (MIS), potential adverse reliability impacts identified by the Interconnection Study that can be managed through the normal operating procedures of the NYISO will not be identified as a degradation of system reliability or noncompliance with the North American Electric Reliability Corporation (NERC), Northeast Power Coordinating Council (NPCC), New York State Reliability Council (NYSRC), or Central Hudson Gas & Electric (CHGE) reliability standards. The owners and operators of the proposed facility will be subject to and shall abide by the applicable NYISO operating procedures (e.g., security constrained economic dispatch, meaning that as a pre-contingency, the system will be dispatched continually to not violate the post-contingency applicable limits). Consequently, under the NYISO MIS requirements, no SUFs other than local SUFs are required to mitigate any potential adverse reliability impacts. The Project does not present any significant adverse impacts to the reliability of the affected transmission systems.

5(e) Estimate of the Total Transfer Capacity across each Affected Interface

The transfer analysis was performed for summer peak cases for both pre-Project and post-Project cases. The thermal, voltage, and stability transfer analysis were performed for NY-NE open and closed, NE-NY open and closed, Total East open and closed, UPNY-SENY open and

closed, and UPNY-CONED open and closed interfaces. The thermal, voltage, and stability transfer capability showed that the addition of the Project reduces the transfer limits of NY-NE, NE-NY, Total East, and UPNY-SENY (open and closed) interfaces and increased the transfer limit of the UPNY-CONED (open and closed) interface.

The UPNY-CONED open and closed normal thermal transfer limits were increased by 0.3 percent and the reductions in the transfer limits of the interface are less than the NYISO criteria of 25 MW. Therefore, the Project has no adverse impact on the transfer limits of the studied interfaces.

5(f) Criteria, Plans, and Protocols for Generation and Ancillary Facilities

(1) Engineering Codes, Standards, Guidelines and Practices

As a Generator Owner in NYISO, applicable provisions of the following standards, criteria, and rules are expected to apply to the Danskammer Energy Center:

- NERC, per NYISO's NERC-Standard Guidance Matrix;
- NPCC Regional Reliability Standards;
- NYSRC Reliability Rules; and
- NYISO tariffs and Market Rules.

The Project will follow the necessary Central Hudson standards that apply to the Project facilities.

The Project will substantively comply with applicable provisions of the following general engineering codes, standards, guidelines, and practices:

- Town of Newburgh Local Building Code (which implements the NYS Uniform Fire Prevention and Building Code);
- National Electric Code;
- National Electric Safety Code; and
- Lightning Protection Code (NFPA #780).

Refer to Section 11.12 of Exhibit 11: Preliminary Design Drawings for a list of codes, standards, and guidelines that the design, construction, and operation and maintenance of the Project will comply.

(2) Generation Facility Certification

Danskammer will meet the National Board of Boiler and Pressure Vessel Inspections certification for this type of generation facility and is unaware of additional required certifications.

(3) Procedures and Controls for Facility Inspection, Testing, and Commissioning

Throughout the construction of the Project, structures and components will be commissioned in accordance with the requirements of the Article 10 Certificate to be issued by the Siting Board and applicable codes and regulations, as detailed in this Application and in the Compliance Filing to be submitted. Formal procurement, construction, and commissioning specifications and procedures will be used at various times throughout the course of construction to assure the quality of components and structures with regard to manufacturing, shipment, installation, commissioning, and testing. The Project will incorporate quality assurance practices for compliance with applicable laws and regulations, as well as Project specifications. These QA practices will include documented hold/witness points, where appropriate, as well as formalized documentation of non-conforming conditions and their associated resolution, as mutually agreed to by Danskammer and construction contractors and equipment and material suppliers. Appendix 12-1 provides a Quality Assurance and Quality Control Plan for the Project.

(4) Maintenance and Management Plans, Procedures, and Criteria

The operation and maintenance will follow the industry standard best management practices (BMPs). The Project will be staffed full time with both technical and administrative employees. Specific schedules and frequency of routine operations and maintenance (O&M) activities, facility inspections and anticipated preventative maintenance and/or additional periodic activities required for the safe, reliable, and efficient operation of the Project are being developed.

5(g) Heat Balance Diagrams

Appendix 5-2 provides heat balance information for various configurations, load levels, and ambient temperatures for the Project. Heat Balance Diagrams contained in Appendix 5-2 are proprietary; therefore, Danskammer will seek the requisite trade secret protection for this information pursuant to Public Officers Law section 87(2) (d) and Section §6-1.4 of the regulations of the Public Service Commission as adopted by the Siting Board (16 NYCRR §6-1.4).

5(h) Maintenance, Management, and Procedures

(1) Turbine Maintenance and Safety Inspections

Danskammer will perform planned and routine maintenance following the Original Equipment Manufacturer's (OEM's) Planned Maintenance Inspection Plan for the gas and steam turbines. Routine inspections of the gas and steam turbines will be completed to document facility conditions and identify any potential maintenance or improvement actions that may be needed. An agent of Danskammer will complete these inspections to ensure proper maintenance. Danskammer will perform the following maintenance and safety inspections per the OEM's Planned Maintenance Inspection Plan for the equipment in Table 5-1 below:

Table 5-1. Turbine Equipment Planned Maintenance

Equipment	Inspection
Gas Turbine	Combustor Inspection
Gas Turbine	Turbine Inspection
Gas Turbine	Major Inspection
Gas Turbine	Generator Minor Inspection
Gas Turbine	Generator Major Inspection
Gas Turbine	Enhanced Cooling System Minor Inspection: <ul style="list-style-type: none">• Compressor• Intercooler• Lube Oil Device• Instrumentation• Accessories
Gas Turbine	Enhanced Cooling System Major Inspection: <ul style="list-style-type: none">• Compressor• Intercooler• Lube Oil Device• Instrumentation• Accessories
Steam Turbine	Generator Major Inspection
Steam Turbine	Valve Inspection: <ul style="list-style-type: none">• HP Stop and Control Valves• Reheat Stop Valves (RHSV)• Intercept Valves

(2) Electric Transmission, Gathering and Interconnection Line Inspections, Maintenance, and Repairs

(i) Vegetation Clearance Requirements

The generator leads crossing the Project Site will follow a path that combines overhead and trench-based. The overhead part of the leads will be in an area that has no trees. The trenched part will be within the substation. CHGE will continue to be responsible for controlling vegetation within the switchyard. There are no trees in the vicinity of the switchyard. Therefore, there is no potential threat to the electrical equipment in regard to any falling trees.

(ii) Vegetation Management Plans and Procedures

CHGE will continue to be responsible for controlling vegetation within the switchyard using the procedures and plans already in place.

(iii) Inspection and Maintenance Schedules

Routine inspections of the interconnection lines and other ancillary structures will be completed to document facility conditions and identify any potential maintenance or improvement actions that may be needed. Routine maintenance will include condition assessment for aboveground infrastructure and protective relay maintenance of the collection substation. Visual inspections of the overhead generator leads will be completed every 12 to 18 months. An agent of Danskammer will complete these inspections to ensure proper maintenance.

Specific schedules and frequency of routine O&M activities, Facility inspections, and anticipated preventative maintenance and/or additional periodic activities required for the safe, reliable, and efficient operation of the Project are being developed. Detailed plans, specifications, maintenance recommendations, performance curves, and any other manuals or documentation available for the selected turbines will be obtained from the manufacturer and maintained at the Facility for ease of reference and troubleshooting.

(iv) Notifications and Public Relations for Work in Public Right-of-Way

The electrical system will require periodic preventative maintenance. The Project's high voltage electrical systems will be located within the Project Site. No right-of-way notifications will be necessary. If necessary to enter the substation to maintain Project-owned equipment, such entry will be coordinated with CHGE following the same procedures currently in place.

***(v) Minimization of Interference with Electric and Communications
Distributions Systems***

The generator leads will comply with the safety standards referenced in this document. The overhead generator leads will be sufficient to provide adequate separation between existing electric, communication, natural gas, and other distribution lines.

5(i) Vegetation Management Practices

Vegetation management practices around the existing substations are similar to the practices and requirements discussed above in Section 5(h)(2) for overhead lines. There are no trees in the vicinity of the switchyard or overhead generator tie lines therefore there is no potential threat to the electrical equipment in regard to any falling trees. Within substation fences and the surrounding areas, it is important to eliminate aboveground growth. Vegetation in this area could come in contact with a substation's below grade grounding grid. If the vegetation extends above ground, coming in contact with a person could be dangerous in the event of an electrical system ground fault, which energizes the below grade grounding grid with high voltages and currents.

5(j) Equipment Availability and Component Delivery

Danskammer currently plans to place the Facility in service in October 2023. Based on this in-service date, major Facility components, including heat recovery steam generators, towers, turbines, transformers, and related major equipment, would be expected to arrive on Site starting in late 2020 or early 2021.

5(k) Compliance with All Applicable Reliability Criteria

Reliability criteria of the Northeast Power Coordinating Council Inc., New York State Reliability Council, and Central Hudson are identified in the SRIS, which includes input from the NYISO and Central Hudson. In addition, Danskammer consulted with DPS Staff regarding reliability criteria and they indicated that for the purposes of this Article 10 Application, the consultation completed through the SRIS is sufficient for compliance with relevant reliability criteria of the Northeast Power Coordinating Council Inc., New York State Reliability County, and CHGE.

5(l) Interconnection Facility Component Ownership

A drawing showing the demarcation of ownership between Danskammer and Central Hudson is provided as Figure 5-1.

5(m) Blackstart Capabilities

The Project will not have black start capabilities.

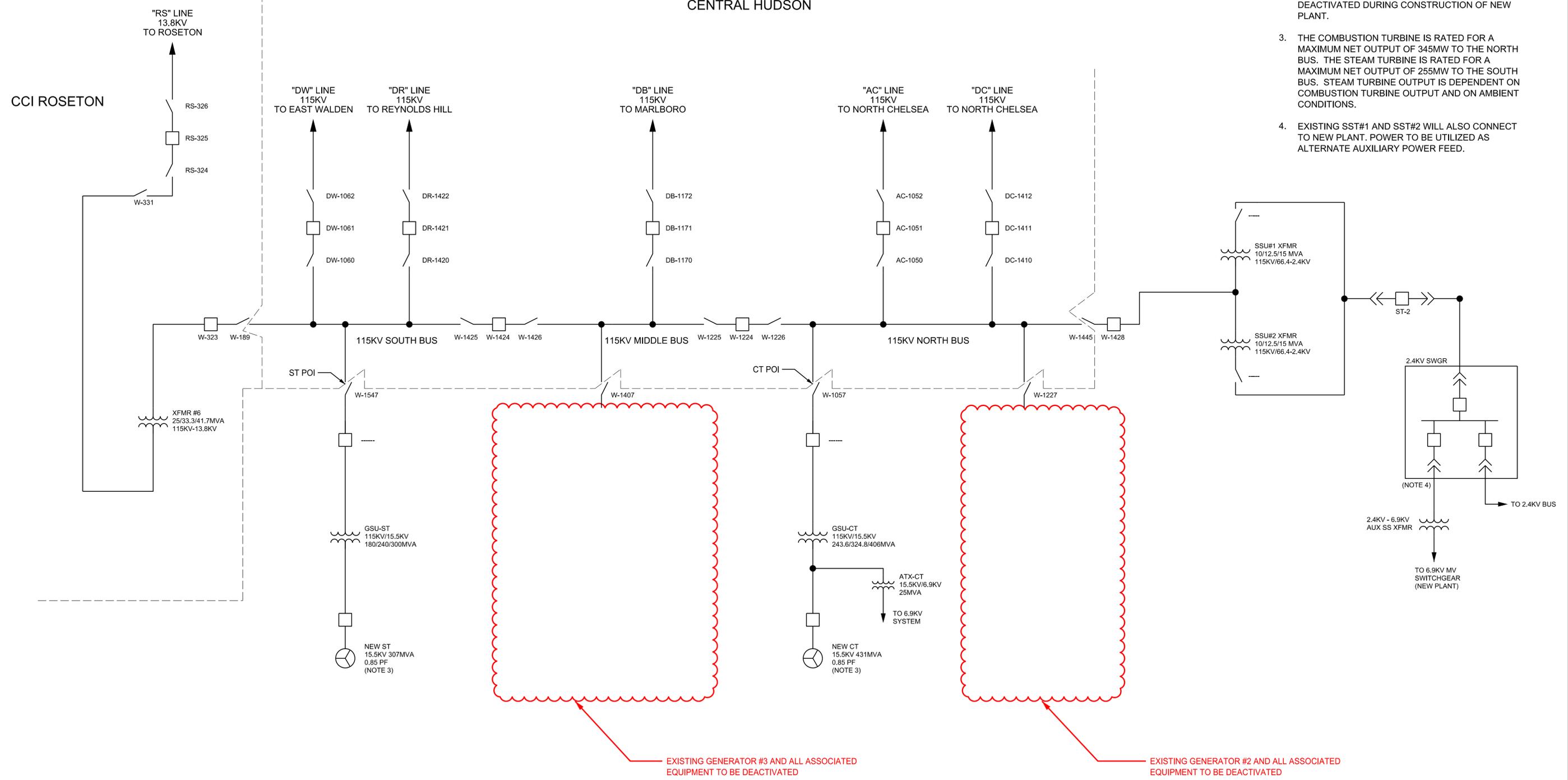
EXHIBIT 5

FIGURE

NOTES:

1. THIS DRAWING IS BASED ON CENTRAL HUDSON OPERATING DIAGRAM 1003.11-1 DATED 8-7-18.
2. EXISTING GENERATORS 1-4 WILL BE DEACTIVATED DURING CONSTRUCTION OF NEW PLANT.
3. THE COMBUSTION TURBINE IS RATED FOR A MAXIMUM NET OUTPUT OF 345MW TO THE NORTH BUS. THE STEAM TURBINE IS RATED FOR A MAXIMUM NET OUTPUT OF 255MW TO THE SOUTH BUS. STEAM TURBINE OUTPUT IS DEPENDENT ON COMBUSTION TURBINE OUTPUT AND ON AMBIENT CONDITIONS.
4. EXISTING SST#1 AND SST#2 WILL ALSO CONNECT TO NEW PLANT. POWER TO BE UTILIZED AS ALTERNATE AUXILIARY POWER FEED.

CENTRAL HUDSON



THIS DRAWING WAS PREPARED BY POWER ENGINEERS, INC. FOR A SPECIFIC PROJECT. TAKING INTO CONSIDERATION THE SPECIFIC AND UNIQUE REQUIREMENTS OF THE PROJECT, REUSE OF THIS DRAWING OR ANY INFORMATION CONTAINED IN THIS DRAWING FOR ANY PURPOSE IS PROHIBITED UNLESS WRITTEN PERMISSION FROM BOTH POWER AND POWER'S CLIENT IS GRANTED.

INTER-DISCIPLINE REVIEW							
DISC	ARCH	CIVIL	ELECT	I&C	MECH	STRUCT	
DATE							
INIT							

REV	REVISIONS	DATE	DRN	DSGN	CKD	APPD
E	REMOVED FEEDER LENGTHS	07/24/2019	RW	RW	RA	JL
D	UPDATED UAT/SST AND REMOVED BLACK START	06/27/2019	LT	LT	JP	JL
C	ADDED POI AND FEEDER LENGTHS	03/29/2019	RW	RW	RA	JL
B	REVISED EQUIPMENT RATINGS	03/11/2019	RW	RW	RA	JL
A	ISSUED FOR REVIEW	01/17/2019	RW	RW	RA	JL

SCALE	NONE
DSGN	RW 01/17/2019
DRN	RW 01/17/2019
CKD	RA 01/17/2019



DANSKAMMER ENERGY LLC	JOB NUMBER	REV
DANSKAMMER CC REPOWERING	155316	E
CONCEPTUAL ONE LINE - FINAL	DRAWING NUMBER	E1-3

APPENDIX 5-1

SYSTEM RELIABILITY IMPACT STUDY

This document contains confidential commercial information, trade secrets, or proprietary information, and/or critical infrastructure information and/or information that is statutorily exempt, as such is entitled to confidential treatment under Section 87(2) of the New York State Public Officers Law and the Commission's Rules and Regulations (16 NYCRR 6-1).

An unredacted version of this document has been submitted under separate cover pursuant to 16 NYCRR section 6-1.4.

APPENDIX 5-2

HEAT BALANCE DIAGRAM

This document contains confidential commercial information, trade secrets, or proprietary information, and/or critical infrastructure information and/or information that is statutorily exempt, as such is entitled to confidential treatment under Section 87(2) of the New York State Public Officers Law and the Commission's Rules and Regulations (16 NYCRR 6-1).

An unredacted version of this document has been submitted under separate cover pursuant to 16 NYCRR Section 6-1.4.