Appendix C:
Revised 2-29-12

Received
State of Nebraska
Power Review Board
Filed at 8:09 am This 1
day of April 2026
By: Sara Bukilly
Title: Paralegal

STATE OF NEBRASKA
NEBRASKA POWER REVIEW BOARD

IN THE MATTER OF THE APPLICATION OF, Village of Stuart, Nebraska, 109 West 1ST Street, Stuart, NE 68780-0177, Power Plant Production Capacity Increase	)	Application for authority to construct or acquire an electric generation facility (ies) and/or related facility (ies).
	)	Application No.: PRB- 4078-G
	)	Applicant File No.: 220364.00

Village of Stuart, Nebraska applies to the Nebraska Power Review Board for an order authorizing it to construct or acquire electric generation facilities and/or related facilities in Holt, Nebraska, as hereinafter set forth below:

(1) Description of proposed electric generation facilities:

A. Size of Unit:

Unit Retirements:	1- 300 kW unit and 1 – 250 kW unit
Unit Additions (2024-25):	1 – 1,880 kW unit
Existing Units to Remain:	1 – 675 kW unit and 1 – 784 kW unit
Capacity after Modifications:	3,339 kW

B. Location of alternate locations: None, installed in existing plant located at Section 1, Township 30N, Range16W, Holt County

C. Type of unit or alternate types: Unit #1, existing 675 kW dual fuel, Unit #4, existing 784 kW diesel fuel only, & Unit #5, used 1,880 kW diesel fuel only; all internal combustion emergency backup units.

D. If nuclear, type of reactor: Not Applicable

E. Have engineering feasibility studies been completed in regard to this facility? Yes ☒ No ☐. If so, has a copy of the same been filed with the Nebraska Power Review Board? Yes ☒ (With Application) No ☐

F. Has a consulting engineer for design and construction management been retained? JEO Consulting Group, Inc. has been retained to assist the Owner with the design and construction management of the project.

(2) Overall project schedule:

A. Estimated completion date of all engineering studies: 6/12/2024

B. Estimated date of commencement of construction: 11/27/23

C. Estimated date the facility will engage in commercial operation: May 31, 2024

(3) Total Estimated Cost:

A. Total cost of generation station: $1,410,000

B. Total cost of substations and switch yards or any other related facilities, not including transmission lines: $340,000

C. Total estimated cost: $1,750,000

D. How is the proposed facility to be financed: Self-funding and combined revenue bonds:
Piper Sandler & Co., 2900 S 70TH Street, Suite 310, Lincoln, NE 68506
First National of Nebraska, 1620 Dodge Street, Omaha, NE 68197

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(4) Description of related facilities:
The Village of Stuart (Owner) has converted their electrical distribution system from 2,400V to 4,160/2,400V to decrease system losses and increase overall efficiencies. The voltage upgrade required the output of each generator to either be reconfigured or have the generator replaced with the appropriate voltage. The Owner has decommissioned and removed Engine No. 2 (300 kW) and Engine No. 3 (250 kW) which were classified as 'emergency only'; the respective exhaust stack and silencer for each engine have been removed too. The generator for Engine No. 1 (675 kW) was reconfigurable, thus the Owner has completed the necessary electrical changes to achieve an output voltage of 4,160V. The generator for Engine No. 4 (784) was not reconfigurable, so the Owner had the unit rewound with an output voltage of 4,160V. The Owner has purchased an existing generator set and other ancillary equipment from another municipality in Nebraska and labeled it, Unit/Engine No. 5. Engine No. 5 is rated for 1,880 kW with an output voltage of 4,160V. The Owner has installed the necessary catalyst/silencer combination unit, monitoring equipment, and 18" diameter exhaust stack with a height of 40' above finished grade to comply with RICE/NESHAP requirements.

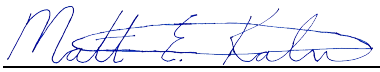
The Owner believes the proposed plan is the least cost option to provide additional redundancy and reliability to their region. Nebraska Public Power District does not oppose the Owner's plan to help improve the existing loading limitations within the immediate area.

(5) The owners of electric generation facilities, electric transmission lines, and/or related facilities, and any other persons or organizations known to the applicant whom the applicant believes to be interested in this application are:
Nebraska Public Power District, 1414 15TH Street, Columbus, NE 68602
Niobrara Valley Electric Membership Corporation, 427 N 4TH Street, O'Neill, NE 68763
Municipal Energy Agency of Nebraska, 8377 Glynoaks Drive, Lincoln, NE 68516

(6) Waivers and consents from the following are attached:
Nebraska Public Power District, 1414 15TH Street, Columbus, NE 68602 (to be sent upon receipt)
Niobrara Valley Electric Membership Corporation, 427 N 4TH Street, O'Neill, NE 68763
Municipal Energy Agency of Nebraska, 8377 Glynoaks Drive, Lincoln, NE 68516

(7) The proposed electric generation facilities and/or related facilities will serve the public convenience and necessity, and the applicant can most economically and feasibly supply the electric service resulting from the proposed constructing or acquisition without unnecessary conflict and duplication.

Dated this 1st day of April, 2026



Signature of preparer

By Matt E. Kalin, PE
On behalf of Village of Stuart
Title Electrical Senior PM
Address 109 W 1st Street
Stuart, Nebraska 68780-0177

SUBTRANSMISSION IMPACT STUDY FOR THE 3,394 KW STUART DIESEL GENERATION PROJECT

June 12, 2024

The Village of Stuart has proposed an upgrade to their existing diesel generation facility located at 111 West 2nd Street, across 1st Street from the NPPD Stuart 69 kV Substation. The upgraded 3,394 kW generation output (650 kW Unit 1, 784 kW Unit 4, 1960 kW Unit 5) of this project will be connected to the 4.16 kV distribution system operated by the Village of Stuart served from the subtransmission system via the NPPD Stuart 69 kV Substation. This report examines the impact that the diesel facility will have on the subtransmission system in the area. The Village of Stuart is also constructing a solar photovoltaic generation facility capable of generating 525 kW at full output in 2024. The solar generation is included in certain analysis cases for the impact study as it shares a point of interconnection with the diesel facility from a subtransmission perspective.

The purpose of this study is to identify capacity issues associated with the existing infrastructure that might preclude the successful operation of the project as designed. The following items are evaluated per the information supplied in the K450 form submitted by the developer and drawings supplied with the K450:

- Power Quality criteria compliance at 69 kV local load buses
- Voltage regulation capability
- Transmission transformer inflows for normal and contingency switching (Sub-T)
- Sub-T breaker inflows
- Transmission transformer capacity
- High-level protection issues - line PT's, breakers, etc.
- Metering

Analysis and Discussion:

The proposed generation interconnection is normally served through the 115 to 69 kV transformer (T1) at the Bassett 115 kV substation and is alternatively served through the 115 to 69 kV parallel transformers (T1||T2) at the O'Neill 115 kV substation.

NPPD Voltage Fluctuation Criteria limits voltages fluctuations to the lessor of 3% or the Borderline of Irritation curve from IEEE Standard 1453. NPPD measures flicker using IEC 61000-4-15 and IEEE 1453 compliant flicker meters and require the facility to comply with a short-term flicker (Pst less than 0.9) and long-term flicker (Plt less than 0.7) measurements. NPPD also requires compliance with IEEE-519-2022 for harmonic control.

Pst - A measure of the short-term flicker perception from a ten-minute interval, the standard output of an IEC compliant flicker meter.

Plt - A measure of the long-term flicker perception obtained for a two-hour period, the standard output of an IEC compliant flicker meter.

To investigate the magnitude of possible system voltage fluctuations, an analysis was performed to track the percent dip of a single event output swing of 3,394 kW. The results are discussed for the normal switched case from Bassett 604 and contingency case from O'Neill 604 in the Results section of this study.

Results:

- Power Quality criteria compliance at 69 kV local load buses:

  The Synergi model was used to estimate the voltage change during normal and contingency switching when the generator output swings from 3,394 kW to 0 kW in a short period of time to simulate the worst-case scenario. The percent change in voltage was determined at the point of interconnection at the 69 kV substation with the facility operating at three different power factors for both normal and contingency service.

  1. 80% power factor or supplying VARs to the 69 kV system
  2. Unity power factor or zero VARs
  3. -80% power factor or absorbing VARs from the 69 kV system

Percent Voltage Change 100% Load, 3,394 kW to 0 kW Transition			
69 kV Source	**80% PF**	**Unity PF**	**-80% PF**
Bassett 604	2.06%	1.04%	0.02%
O'Neill 604	3.06%	1.57%	0.02%

Further analysis was completed to observe the total generation output from the diesel facility combined with the 525 kW Stuart solar facility in a short period of time to simulate the worst-case scenario. The percent change in voltage was again determined

interconnection point at the 69 kV substation with the solar facility operating at three different power factors for both normal and contingency service.

Percent Voltage Change 100% Load, 3,919 kW to 0 kW Transition			
69 kV Source	**80% PF**	**Unity PF**	**-80% PF**
Bassett 604	2.26%	1.25%	0.20%
O'Neill 604	3.36%	1.89%	0.32%

The results indicate that there is potential for power quality criteria violations in contingency switching, but this can be mitigated by operating the diesel generators at a power factor between 100% and 80% leading.

While the study identified the magnitude of possible voltage fluctuations (smaller is better), the other variable is frequency of the fluctuations. As per the IEEE Standard 141, "Borderline of Irritation" Curve, a 0.1% change is well under the border line of irritation curve while 1% corresponds to 20 dips per minute, 2% is 1 dip per minute, while a 3% change corresponds to 10 dips per hour. If the variable output of the plant causes unacceptable voltage variations based on magnitude and frequency, the output of the plant may need to be reduced.

- Voltage Regulation Capacity:

The system was analyzed during light loads (10% of peak or 1.8 MVA) on Bassett 604 during normal and contingency switching to study the impacts of the generation on steady state voltages. The generation was modelled at 3,394 kW and again the generation power factor was varied from 80% to unity to -80%. The concern at light loads is the capacitive effect of lightly loaded sub-transmission lines in combination with the generation causing voltage criteria violations. NPPD upper voltage criteria for generation interconnection is 1.05 per unit which equates to a voltage of 72.45 kV on a 69 kV system and is based on IEEE C84.1.

Maximum P.U. Voltage @ 10% Peak Load, 3,394 kW Generation			
69 kV Source	**80% PF**	**Unity PF**	**-80% PF**
Bassett 604	1.0575	1.0479	1.0382
O'Neill 604	1.0579	1.0449	1.0314

Point of Interconnect P.U. Voltage @ 10% Peak Load, 0 kW Generation	
Bassett 604	1.039
O'Neill 604	1.033

Analysis was continued to include the combined output of the generation during light loads to observe the additional voltage rise when considering the two facilities operating in unison.

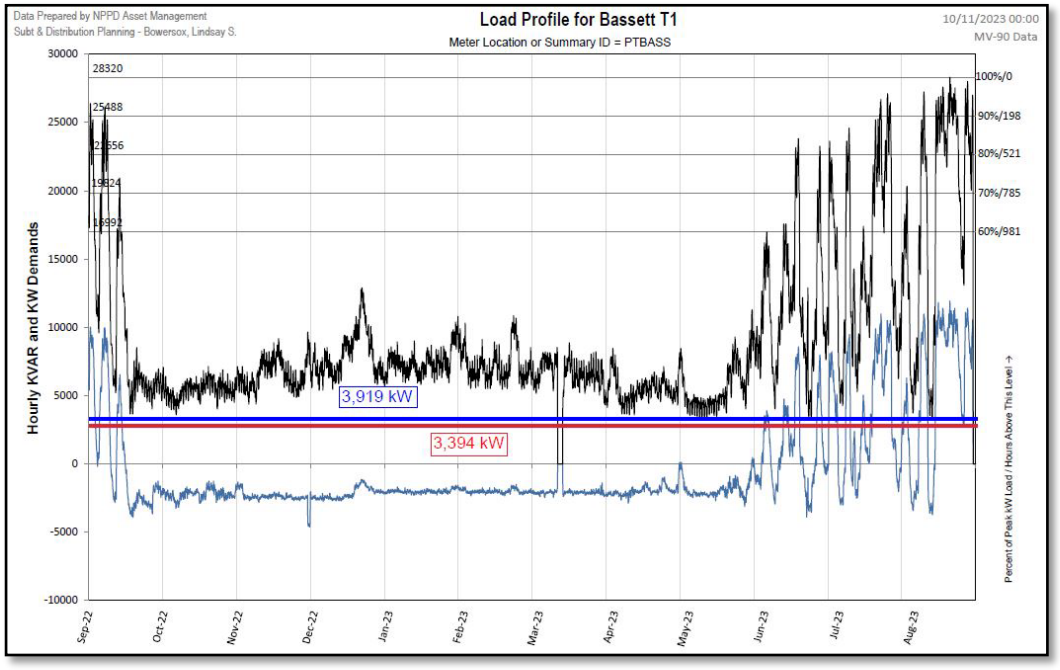
Maximum P.U. Voltage @ 10% Peak Load, 3,919 kW Generation			
69 kV Source	**80% PF**	**Unity PF**	**-80% PF**
Bassett 604	1.0593	1.0498	1.0401
O'Neill 604	1.0605	1.0475	1.0341

Point of Interconnect P.U. Voltage @ 10% Peak Load, 0 kW Generation	
Bassett 604	1.039
O'Neill 604	1.033

The results for this analysis show that there are concerns of high voltage violations in normal switching and contingency switching conditions. As with the power quality analysis, this can be resolved by operating the diesel generation with a power factor between 100% and 80% leading.

- Transmission Transformer Inflows:

The profile for Bassett T1 shows that during normal switching configuration the minimum load will approach 4.5 MW. With a maximum generation of 3,919 kW at the point of interconnection there is potential to exceed the load on Bassett T1 in possible contingency cases where load was transferred from Bassett T1 to another transmission source.

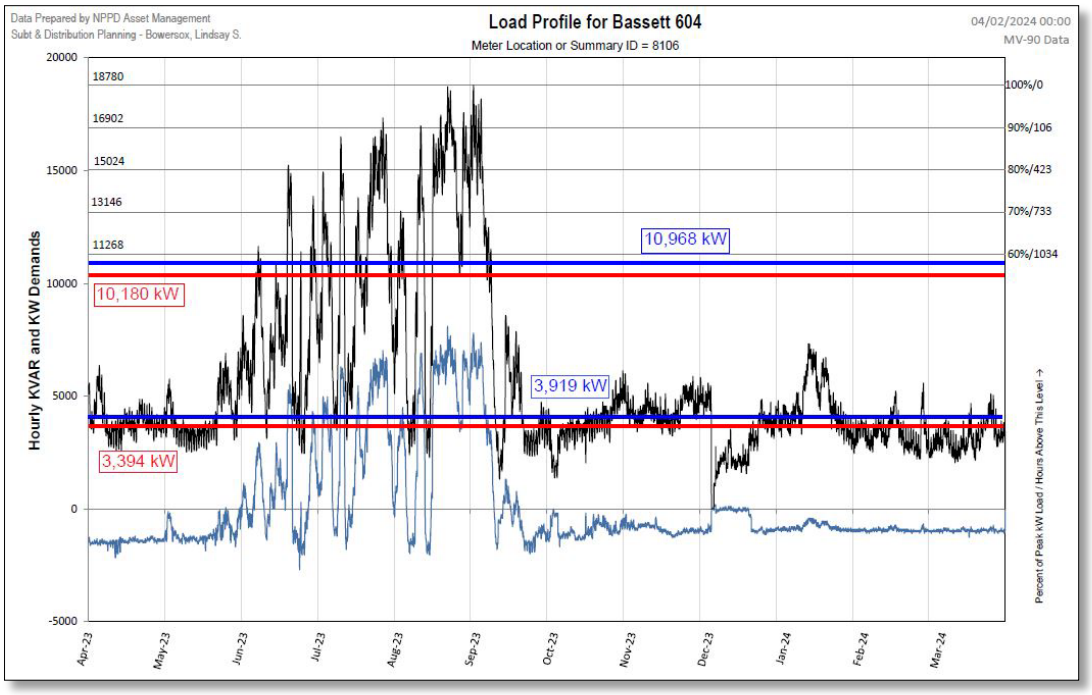


- Basset 604 Inflows:

The generation will normally be connected to Bassett 604 which had a peak loading in July 2023 of 19.1 MW. During spring and fall months, loads are typically in the 1.5 to 4 MW range. Flow back onto the Bassett 69 kV bus is possible at some times throughout the year.

- Load to Generation Ratio:

The load to generation ratio on the Subtransmission breaker is evaluated to determine whether the distributed generation could potentially sustain the load during an unintentional islanding situation. If during the timeframes that an unintentional island can be supported a line to ground fault occurs, the generation will cause the voltage on the other phase(s) to approach 1.73 times nominal voltage and has the potential to fail all Subtransmission arresters on the circuit. The review is based on the total load on Bassett 604 divided by the total generation on this Sub-T breaker. The initial screening of the Stuart diesel generation site was evaluated based on a simple visual that the minimum loading on Bassett 604 maintains a minimum load to generation ration of 3:1 throughout the year. In addition, the solar would also need to meet a 1.5:1 load to generation ratio. With loading reaching well below the minimum of 10.18 MW there is a possibility that the generation can support an island and mitigation is required, a control scheme to limit generation will be required. There are two options for mitigation, 1) install a grounding transformer with associated protection equipment, or 2) installing a power curtailment scheme on the generation. The grounding transformer would need to be installed at the delta-wye connection point which is at the NPPD Stuart 69 kV Substation. In addition to the grounding transformer a 69 kV breaker and relay would need to be installed to isolate the generation. The other option is a power curtailment scheme where an RTU is installed and receives a signal for the loading on Bassett 604. When Bassett 604 loading does not exceed 3 times the generation it will shut off the generation. The only other alternative is to not parallel with the grid, which will require to isolate then pick up the load with the diesel generation.



- Transformer Capacity:

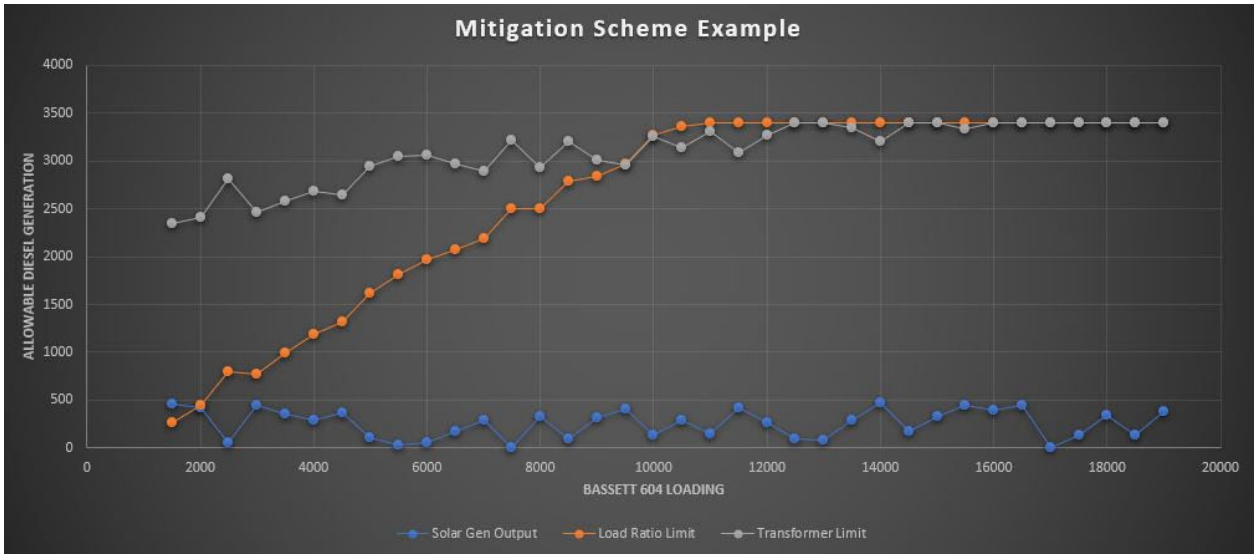
The 115 to 69 kV Bassett T1 transformer has a capacity of 63 MVA and is adequate for the output of all generation at the point of interconnection.

The 69 to 4.16 kV Stuart T1 has three (3) 833 kVA rated single phase transformers for a total capacity of 2.5 MVA which is undersized for the full output of the diesel generators. This transformer rating is the limiting factor at Stuart, other equipment ratings are:

- Stuart 69 kV Bus - 55 MVA
- Stuart 4.16 kV Bus – 6 MVA
- Stuart 69 kV Fuse - 5.4 MVA
- Stuart 69/4.16 kV Transformer - 2.5 MVA
- Stuart 4.16 kV Regulators - 2.88 MVA
- Stuart Disconnects - 6.5 MVA
- All other equipment is owned by the City of Stuart and ratings unknown to NPPD.

The Stuart 4.16 kV regulators are rated for 2.88 MVA which is inadequate for the output of diesel generation. Currently the regulator is programmed in block mode which locks the tap changer in position when reverse power flow is detected. With the addition of the solar facility, NPPD Distribution Planning will reprogram the regulators to operate in distributed generation mode, which takes a second set of values for the LDC to utilize when reverse power flow is detected.

It is recommended that the diesel facility install a mitigation scheme that maintains a 3:1 load to generation ratio and limits the generation below the 2.5 MVA rating of the transformers. An approximation of the mitigation scheme is included below. The current philosophy for allowing distributed energy resources (DERs) to load the power transformers to 100% nameplate is under review due to some research being done by EPRI. If at a later date it is determine that DERs can only load transformer to a lower rating less than 100% nameplate, the mitigation will be required to limit it based on that level.



- High Level Protection:

  To prevent a breaker reclosing into a line energized by local generation in an out of sync condition, PT's on the line side of the breaker are typically required. A review of substation one-lines show that both Bassett 604 and O'Neill 604 have line PT's installed.

  NPPD Protection team has had an opportunity to review this diesel installation and does not have any concerns with the protection of the subtransmission system, NPPD did not review the customer owned distribution system.

- Metering:

  NPPD currently has metering on the output of each individual generator in the Stuart Generation facility and a station service meter, there is no total generation meter at the facility.

Due to the size of this distributed generation facility being greater than 500 kW, real-time telemetry data will need to be supplied to the Kearney Control Center and Doniphan Energy Supply. This will require a cellular modem that would be owned and maintained by NPPD be added to the existing NPPD-owned metering, NPPD is working to utilize a single modem with multiple ports for each generator meter. If a power curtailment system is installed, the customer will be charged upfront with 50% the net present value of the modem and cellular service costs as the equipment would be needed not just for billing purposes. In addition, the totalization meter at the NPPD Stuart 69 kV Substation will also require real-time metering to send the signal back to the City for their power curtailment scheme. That will also require upfront cost for cellular service. If the City wanted to install fiber to the NPPD totalization meter to get the data that route, that would eliminate the second cellular service charge.

The existing meter in the NPPD Stuart 69 kV substation rated for reverse power flow.

Details of system requirements of metering and telemetry can be found in section 9.1 of the NPPD Customer Owned Generation Application Manual.

Conclusion:

The 3,394 kW nameplate rating of the upgraded diesel facility exceeds the capacity of the subtransmission infrastructure when operated at full output and will need to have a mitigation scheme in place to control operation. Real-time telemetry will also be required to be added to the existing NPPD meter at the facility for Transmission and Subtransmission Billing purposes.

The City of Stuart has an Interconnection Interoperation Agreement in place, the agreement will be updated to reflect the facility upgrade.