Facilities Study Report

For

Physical Interconnection of

PJM Generation Interconnection Request

Project ID AH1-541

“Chestnut 345kV”

Introduction

This Facilities Study has been prepared in accordance with the PJM Open Access Transmission Tariff, as well as the Application and Studies Agreement between the Project Developer and PJM Interconnection, LLC (PJM or Transmission Provider (TP)). The Transmission Owner (TO) is ComEd.

This Facility Study was performed to satisfy the Phase 2 Facility Study requirement of the PJM Tariff. The Facility Study is intended to provide scope, cost and schedule estimates for the project as currently defined and approved for Phase 2 study. In the event project changes are made during DP2 that impact this report, updates will be provided as part of the Phase 3 report. Following execution of the project's final agreement, this report will not be updated to account for other changes made as part of the agreement's modification clause and instead the scope change process will be followed.

A. Transmission Owner Facilities Study Summary

1. PROJECT DESCRIPTION

The Project Developer (PD) has proposed a Solar and Battery Generating Facility located in Macon County, Illinois with a designated PJM Project ID of AH1-541. The installed facilities will have a total Maximum Facility Output (MFO) of 92.4 MW with 27.72 MW of this output being recognized by PJM as Capacity.

Scope of Project: This Facilities Study defines the scope, cost, and schedule basis for the physical interconnection of PJM Generation Interconnection Request AH1-541 (“Chestnut 345kV”), a proposed 92.4 MW solar and battery generating facility in Macon County, Illinois, to the ComEd transmission system at TSS 95 Chestnut 345 kV via a direct connection. The scope includes establishing the Point of Interconnection and the Point of Change in Ownership (at the first dead-end structure of 345 kV L.95001 inside the substation fence line) and identifying required interconnection facilities on both sides of the ownership boundary: Project Developer-designed/owned equipment and protection/communications on the developer side, and ComEd-designed/owned transmission owner interconnection facilities and substation upgrades (including a 345 kV termination, metering, and associated protection and communications) on the ComEd side. The study also provides an indicative milestone schedule for ComEd work (estimated 58 months from full execution of the Generation Interconnection Agreement), subject to detailed engineering, procurement lead times, permitting, and outage availability.

2. POINT OF INTERCONNECTION (POI)

The Generating Facility will interconnect with the ComEd transmission system via a direct connection into the TSS 95 Chestnut 345kV substation.

The proposed generation interconnection is shown on the single line diagram in Attachment #1.

3. POINT OF CHANGE IN OWNERSHIP

The Point of Change in Ownership will be located at the first dead-end structure of L.95001 inside the TSS 95 Chestnut interconnection substation fence line.

4. SCOPE OF PROJECT DEVELOPER INTERCONNECTION FACILITIES

Project Developer will design, build, own, operate and maintain the Project Developer Interconnection Facilities on Project Developer's side of the Point of Change in Ownership (PCO). This includes, but is not limited to:

- One (1) 3-Phase Main Power Transformers (MPT)- 62/83/102 OA/FOA/FOA, 345kV Y-grounded, 34.5kV Y-grounded with a 13.8kV Delta tertiary. The Z% = 9.0% on a 100 MVA base with X/R=32 (High side to low side).
- One (1) 345kV circuit breaker
- One (1) 3-pole 345kV disconnect switch
- One (1) 345kV generator lead line, 345kV L.95001, from the Generating Facility to the Point of Change in Ownership.
- Install three (3) 3000:1 CCVTs on 345kV side of power transformers to be used for System 1 and System 2 relay protection.
- For generator lead line 345kV L.95001, Project Developer to Install standard ComEd 138kV GIC interface relaying for the remote end station consisting of a dual SEL-411L-1 current differential scheme per GDD1940.
- Relaying at Project Developer facility to send a Transfer Trip to TSS 95 Chestnut for TR 345kV CB Breaker Failure and Transmission Line Fault. Ability to isolate 87L and DTT functions is required. Example scheme/settings can be provided by ComEd.
- Project Developer to provide transformer test reports for 345-kV-34.5kV step up transformers. Test reports must include %Z impedance, X/R and load loss, including type of inverters used for ComEd short circuit modeling.
- In general, Project Developer relaying, etc. to follow per section 6.1 (Design F) of latest version of EED interconnection guidelines (for Generator Greater than 10MW) Rev 2: Effective 12/16/21, with the following project specific notes:
    - New 345kV gas circuit breakers to auto trip and isolate for critical gas level.
    - New 345kV Tie Line terminal relay types to be the same as ComEd terminal relays. This includes firmware versions.
    - Project Developer to ensure proper current contributions from the new Transformer high side breaker CTs to the 345kV line relaying. New 345kV Tie Line relays to account for tripping the new transformer high side breaker.
    - ComEd Protection and Control Engineering must review all customer relay protection design drawings and relay settings.
    - Generating Facility equipment impedance and/or test data must be provided to ComEd Protection and Control Engineering for all lines, transformers (include percent impedance and load loss), wind turbines, and solar inverters in order to model in a short circuit program.
    - Project Developer to include Over/Under frequency and voltage protection at solar farm collector bus. Suggested settings to be provided by ComEd. Under-frequency settings are to comply with MAIN Guide 1B.

- Dual bus protection for 34.5kV bus
- Dual TRFM protection and site protection must be compliant with NERC & PJM requirements
- Metering is required to be installed per ComEd & PJM standards
- SCADA interface to ComEd will be required
- Witness testing by ComEd or a DA will be required and must be pre-scheduled at least 90 days in advance

- New gas circuit breaker control for loss of SF6 gas condition should be as follows (See Engineering Practice EP-5206E and relay specifications):
  - For an open circuit breaker, when SF6 gas drops to the critical level, the close circuit of breaker shall be opened and line and both CB motor operated disconnects shall be opened.
  - For a closed SF6 gas circuit breaker, when SF6 gas drops to the critical level, the circuit breaker shall be opened, and both CB motor operated disconnects shall be opened.
- For any new equipment connected to the BES (Bulk Electric System rated at 100kV or above) the associated primary/System 1 and secondary/System 2 protective schemes to have a minimum redundant:
  - Connected CTs (where available)
  - PT secondary (where available)
  - DC control circuits
  - Auxiliary trip relays
  - Circuit breaker trip coils (where available)
  - Communication circuitry
- Relay and protective equipment, telecommunications equipment, and Supervisory Control and Data Acquisition (SCADA) to comply with the ComEd's Applicable Technical Requirements and Standards. 345KV L.95001 will require two Single Mode Fiber paths from TSS 95 Chestnut to the developer substation control building approximately 0.75 miles. One fiber path will be dedicated for System 1 Relay/schemes, and the other will be dedicated for System 2 Relays/schemes. These Fiber paths will need to be physically diverse from each other, and each should contain a minimum of 48 Single Mode Fibers. Both of these Fiber cables will be owned and maintained by the customer, and the demarcation of ownership will be in an FDP within the TSS 95 Chestnut control building.
- All changes to topology, including generation, must be modeled during the Phase 1 study for PRC-027 compliance. A protection system coordination study is required for new BES buses or when there is a 15% (or greater) change in fault current for an existing BES bus. Setting changes may be required per the outcome of this coordination study.
  - Three 345kV lines leaving TSS95: L9503, L9515 and L93301, including their remote ends at Latham (Ameren), TSS178 Blue Mound, and TSS933 Radford's Run Wind Farm (customer) respectively.

- Project Developer to provide final lead length of 345kV L.95001, electrical characteristics, construction configuration, size of conductors, and impedance characteristics.
- Project Developer to provide limiting Transmission Facility ratings for their portion of 345kV L.95001, in accordance with NERC FAC-008, FERC Order 881 and PJM Operational requirements for normal and emergency ratings from -55F to 130F in 5F increments.
- Project Developer shall provide shunt reactive compensation as required by the PJM Interconnection studies.
- Power output from the customer site shall be in accordance with the power quality standards contained in the IEEE Standard 519. The generating units and all associated equipment at the customer site shall not introduce any distortion of ComEd's waveform or telephone or carrier interference that is inconsistent or conflicts with such standard.

B. Transmission Owner Facilities Study Results

The following is a description of the planned Transmission Owner facilities for the physical interconnection of the proposed AH1-541 project to ComEd transmission system. These facilities shall be designed according to ComEd Applicable Technical Requirements and Standards. Once built, ComEd will own, operate, and maintain these Facilities.

1. TRANSMISSION OWNER INTERCONNECTION FACILITIES:

- A 345kV dead-end structure and foundation within the fence of the Interconnection Substation, to terminate the Project Developer’s generator lead line.
- Line conductor from the dead-end structure to the bus position in the switchyard of the interconnection substation.
- One (1) Motor Operated Disconnect (MOD) switch. Disconnect switch to be installed should be rated 4000A continuous, ACCC D06.
- Three (3) metering CTs, three metering PTs, or a combination unit, meters, and associated equipment to meter L.95001.
- Install equipment necessary to provide bi-directional revenue metering (kWH, kVARH) and real time data (kW, kVAR, and circuit breaker status and 345kV voltage) for 345kV L.95001, on the ComEd side of the POI per ComEd applicable standards.
- Three (3) surge arrestors
- Foundations and structures

2. STAND ALONE NETWORK UPGRADES

This section is not applicable.

3. NETWORK UPGRADES

TSS 95 Chestnut Upgrade AHI-541

The existing substation, TSS 95 Chestnut 345kV, will be upgraded to interconnect the project with the ComEd transmission system.

- Expand TSS 95 Chestnut **60'** south to accommodate the added static poles.
- For 345kV L.95001 install ComEd GIC interface relaying consisting of a System 1 87L-1/SEL-411L-1 (with standard 1300nm 87L port) current differential scheme and a System 2 87L-2/SEL-411L-1 current differential scheme. Use full tap 3000:5 CT ratio for both systems of line relaying.
- Customer to install, own, and maintain two Single Mode Fiber paths that are physically diverse from each other, and to connect to the TSS95 Chestnut Distribution Panel (FDP). One path will be for System 1 Relays and the other path will be for System 2 Relays, and there should be a minimum of 48 fibers in each cable. IPP fiber demarcation will be FDP within the TSS95 control building. The customer will own and maintain both Fiber cables from ComEd's TSS95 FDP all of the way to their Sunbridge Solar facility. Additional circuits for SCADA, Metering, telephony, etc. may be placed on the unused Fiber strands in either cable. Fiber installation requirements will be specified by the P&CE Communication Engineering. Refer to GDD 1940 modified for direct fiber connection. In addition, install load rejection logic such that transfer trip is initiated on both Primary and Secondary relaying to GIC site if BT1-5 and BT3-5 CBs at TSS95 are opened (refer to GDD 4003 for load rejection design).
- Install a new 345kV circuit breaker for Bus-Tie 3-5 and two (2) motor operated disconnect switches (one switch on each side of the circuit breaker). The circuit breaker nameplate shall be rated 4000A continuous. The circuit breaker will have an interrupting capability of 63kA at -40F.
- The two (2) Motor Operated Disconnect Switch shall be rated 4000A continuous, ACCC D06.
- Install three (3) 3000:1 CCVT's with two winding outputs to be used for System 1 and System 2 relay protection on Bus 5.
- Install 50BF/79 SEL-451-5 relay and LOR per GDD 1930 on new line 345kV CB. New CBs must have sync check through the relay for Manual close, SCADA close, and automatic reclosing.
- New CB's will have a SEL-2411 installed for CB Monitoring per GDD2411.
- New CB's will have two sets of 3000:5 CTs on each side, C800 accuracy class, and at least a 1.5 times rating factor. Tap all CTs at full ratio.
- CB will have MODs on each side that will be tripped/opened on critical gas.
- For existing 345kV L.9503, modify existing System 1 SEL-411L and System 2 SEL-311C relays to remove CT contribution and tripping connections to/from existing 345kV BT1-3 (new BT1-5) and add CT/tripping contributions to/from new BT3-5 breaker.
- Upgrade existing SEL-3530 RTAC to SEL-3350.
- Connect new realys and SEL-2411 CB Monitoring to existing dual IP architecture.
- Connect ComEd-owned revenue meter to new IP switch architecture.
- Install one pair of serial fiber connections for each Customer RTU data exchange to be coordinated with ComEd SCADA Engineering:
    - Breaker statuses
    - Line analog values
- Battery System to be evaluated during detailed design.

- Modify all mimic boards as required.
- New SB-95001and CD-95001 will be created for the new line.
- Comm Summary:

System 138kV L95001	Function	TSS95 Chestnut	Sunbridge Solar (IPP)
1 – Direct Fiber	SEL 411L (87L-1, LTT, BFTT)	T R	T R
2 – Direct Fiber	SEL 411L (87L-2, LTT, BFTT)	T R	T R

4. OTHER SCOPE OF WORK

This section is not applicable.

5. MILESTONE SCHEDULE FOR COMPLETION OF COMED WORK

Facilities outlined in this report are estimated to take 60 months to construct, from the time the Generation Interconnection Agreement is fully executed. This schedule may be impacted by the timeline for procurement and installation of long lead items, the ability to obtain outages to construct and test the proposed facilities.

Description	Start month	Finish month
Detailed Design	1	22
Permitting	16	46
Construction	47	60

6. ASSUMPTIONS IN DEVELOPING SCOPE/COST/SCHEDULE

- Assumes existing TSS 905 Chestnut can be expanded to the South.
- Assumes there are sufficient DC circuits and AC circuits for additional equipment.
- Assumes building can accommodate the additional relay panels.
- Assumes ComEd can obtain the land required for the expansion of TSS 905 Chestnut.

- ComEd estimate does not include costs of design and construction of AH1-541 Sunbridge Solar substation, and transmission as described in Project Devolper scope of work. ComEd estimated schedule is based on GIA contract being executed by all parties.
- This cost estimates assume that work will be performed during normal weekdays and with no overtime. Transmission line outages for construction have not been identified, but generally are available from September to May. These outages are controlled by PJM.
- Costs are based on 2026 rates and do not reflect a potential increase in Labor or Material costs after 2026.
- Foundation design assumes typical soil conditions at locations and will be subject to change after soil boring tests.
- The Project Developer will be responsible to request and bear the cost for relocation of existing transmission or distribution lines (including structures and other facilities) that may be required for transmission line crossings, the transport of any large equipment, such as turbines, rotors, turbine structures, cranes, etc. Formal submittal of this request to ComEd's TSO for ultimate review by PJM can be made 7 months prior to back feed request date.
- All upgrades to facilities included in this document will be required to meet latest ComEd standards.
- ComEd cost estimate is valid for six (6) months after Facilities Study release by PJM.
- Upgrades are subject to change based on detailed design development.
- ComEd will complete pre-design and post construction survey for the transmission and substation upgrades, as required. This includes, but is not limited to, the LIDAR survey and video imaging for transmission lines. Costs associated with this are at the expense of the Project Developer. Pre-design survey must be completed prior to detailed engineering.
- ComEd will complete geotechnical soil borings, resistivity study, and analysis for substation and transmission upgrades. Costs associated with this are at the expense of the Project Developer.
- This Facilities Study is time dependent. If the project is not into construction within one year of the issuance, the study will be void and the project re-studied, requiring the completion of a new Facility Study.
- All real property conveyed in fee to ComEd must be remediated to and all real property to which real property rights are transferred to ComEd (as determined in ComEd's discretion) must be remediated to IEPA's Tiered Approach to Corrective Action.

7. REVENUE METERING REQUIREMENTS

All revenue metering needed for this interconnection project must meet the metering requirements stated in Appendix 2, section 8 of the AH1-541 GIA, and in PJM Manuals M01 and M14D. The details of applicable revenue metering requirements are given in the 'ComEd Interconnection Guidelines' posted on PJM website.

The revenue metering will be installed on the ComEd side of the Point of Change in Ownership will be installed, owned and maintained by ComEd.

- REVENUE METERING FOR PJM AND COMED
    - The revenue meter measures the wholesale energy output (Hourly compensated net MWH and Hourly compensated net MVARH) of the Generating Facility.
    - The metering equipment, including revenue meter and CT/PT shall be installed, at Project Developer's expense, at the interconnection substation on ComEd side of the Point of Change in Ownership.
    - ComEd shall own, operate, maintain, inspect, and test all the metering equipment as set forth in 'Testing of Metering Equipment' section of this Interconnection Service Agreement, at the Project Developer's expense.
- REAL-TIME METERING FOR PJM
    - The Project Developer shall install, own, operate, maintain, inspect, and test real-time metering equipment to measure and transmit directly to PJM the real time MW, MVAR, voltage and status of electrical equipment such as circuit breakers and Motor Operated Disconnect switches, in conformance with the requirements listed in PJM Manuals M-01 and M-14D.
- RETAIL METERING FOR COMED
    - The AMI Meter measures the energy consumption by the Project Developer at transmission level and hence shall be designed to measure low MW flow.
    - The metering equipment including AMI Meter and CT/PT shall be installed at the interconnection substation on ComEd side of POI, at the Project Developer's expense.
    - ComEd shall own, operate, maintain, inspect, and test all the metering equipment as set forth in the 'ComEd Interconnection Guidelines'.
- BATTERY TERMINAL AMI METERING FOR COMED
    - FERC Order 841 designates inflow to charge battery storage facility as wholesale power. To separately measure the power inflow to charge the battery and bill it at wholesale rate, the Project Developer needs to install the following equipment.
        - Advanced Metering Infrastructure (AMI) equipment including AMI Meter and Current Transformer/Potential Transformer (CT/PT) at the output terminal of the battery storage facility to measure power flow from transmission system to charge the battery storage facility.
        - Fiber cable to provide communication link to transmit AMI meter data to the ComEd SCADA system.

8. LAND REQUIREMENTS FOR INTERCONNECTION SUBSTATION

ComEd will acquire additional land at the Project Developer's expense to accommodate expansion of Chestnut 345kV Station. The total land dimension needed is 60' x 804' (estimated), totaling 48,240 square feet (approximately 1.11 acres), spanning across 1 land parcel. The average cost is currently valued at $15,000 per acre, plus associated closing costs.

9. APPLICABLE TECHNICAL REQUIREMENTS AND STANDARDS

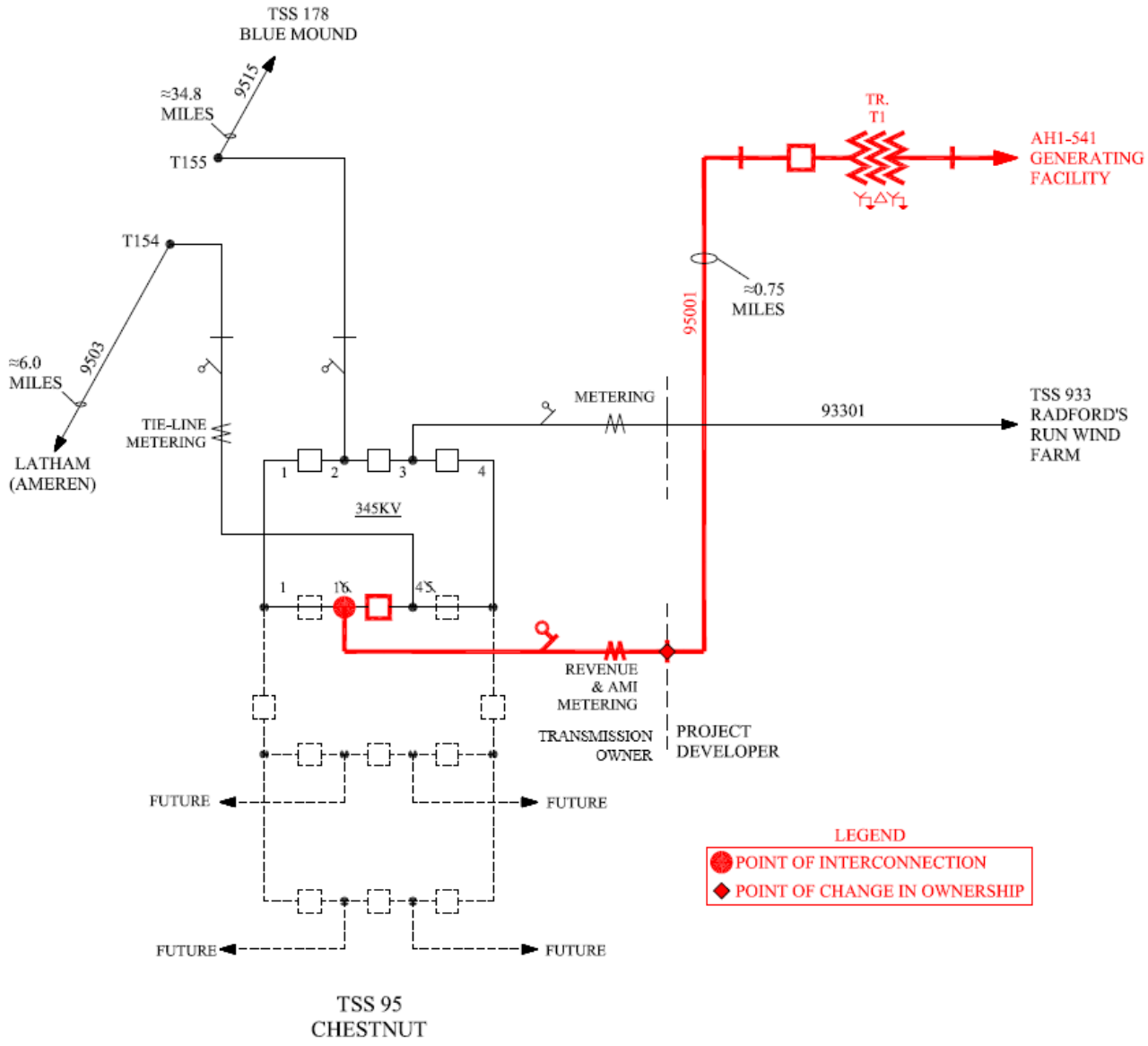
- ComEd Interconnection Guidelines (For Generators at Transmission Level), Rev. 2, Dated 12/16/2021
- ComEd Guidelines on Land Requirements for Interconnection Substations, Rev. 2, Dated January 2026

10. ENVIRONMENTAL AND PERMITING

- ComEd will be responsible to obtain all environmental approvals and permitting required for the expansion of TSS 905. This includes any endangered species studies and monitoring, as required. Costs associated with this permitting are at the expense of the Project Developer.
- The Project Developer will be responsible for site restoration required for substation and transmission upgrades. This includes, but is not limited to road restoration/improvements, wetland restoration, and farm field restoration/crop damage. Costs associated with this are at the expense of the Project Developer.
- The Project Developer will be responsible for the cost to purchase real estate or obtain the necessary right-of-way easement for all upgrades associated with this project. These associated upgrades are not included in the costs listed in this study.
- The Project Developer will be responsible for remediation costs for locations found to have environmental contaminations and remediation. This may require contaminated soil disposal as well as lead paint removal for existing structure work.
- It is assumed that all necessary permits will be obtained in a timely manner to allow engineering and construction to proceed according to the Milestone Schedule.
- It is assumed that conveyance of property and rights will be obtained to support the PJM Transmission Outage Schedule.
- It is assumed that the required Environmental Study will yield no impediments to the development of the site.
- ComEd will complete geotechnical soil borings, resistivity study, and analysis for substation and transmission upgrades. Costs associated with this are at the expense of the Project Developer.
- If detailed engineering and design and/or construction activities identify the need for an environmental study and/or permit requirements, the developer is fully responsible for the costs related to any environmental study, any actions to address the identified environmental impacts and the permits. Also, the schedule will be adjusted accordingly to account for the necessary time to perform the environmental study, address the identified environmental impacts and to obtain the permits, if applicable. All environmental studies, actions to address environmental impacts and permit actions shall comply with all ComEd requirements as detailed in "ComEd Environmental Requirements for Third Party Developers", and with all local, city, county, state, and federal requirements.

C. APPENDICES

Attachment #1: Single line Diagram for the Physical Interconnection


TSS 178
BLUE MOUND
≈34.8
MILES
9515
T155
T154
≈6.0
MILES
9503
LATHAM
(AMEREN)
TIE-LINE
METERING
1
2
3
4
345KV
1
3
4
TR.
T1
AH1-541
GENERATING
FACILITY
95001
≈0.75
MILES
METERING
93301
TSS 933
RADFORD'S
RUN WIND
FARM
REVENUE
& AMI
METERING
TRANSMISSION
OWNER
PROJECT
DEVELOPER
FUTURE
FUTURE
FUTURE
FUTURE
LEGEND
POINT OF INTERCONNECTION
POINT OF CHANGE IN OWNERSHIP
TSS 95
CHESTNUT