Facilities Study
For

Clean Line Energy Partners
Guymon, Oklahoma

November 5, 2014

Transmission Planning South
Xcel Energy Services

Executive Summary

Clean Line Energy Partners, LLC ("Interconnection Customer") in 2013 requested the interconnection of Plains and Eastern Clean Line LLC, a Delaware limited liability company, and Plains and Eastern Clean Line Oklahoma LLC, an Oklahoma limited liability company (such parties together, "Clean Line") to the Southwestern Public Service Company ("SPS"), transmission network located in Texas County, Oklahoma. SPS is a New Mexico Corporation and wholly owned subsidiary of Xcel Energy Inc. The conceptual design of the Clean Line high voltage direct current ("HVDC") transmission project as proposed by Clean Line is to provide a bipole system to bring wind energy from the plains of western Kansas, Texas, and Oklahoma to the Tennessee Valley Authority ("TVA") service territory and to the Entergy system in northern Arkansas. The Clean Line HVDC line is planned to be a multi-terminal HVDC facility. SPS will construct a new substation named, Optima. The Optima Switching Station will be located approximately 5.5 miles northeast of the SPS Hitchland Interchange and approximately 12 miles southeast of Guymon, Oklahoma. This project will be completed consisting of an 800 mile bipole HVDC line. The bipole will have a voltage of ±600 kV DC rated at 3500-4000 MW with a metallic return. Each pole will be capable of transmitting 1750 MW, minimum. The Interconnection Customer's expected commercial operation date is 4th quarter of 2018.

The Interconnection Customer is responsible for the total cost of the SPS Network Upgrades and Interconnection Facilities; including all construction required for the 345 kV transmission lines into Optima Switching Station. The Interconnection Customer is also responsible for obtaining any permits and/or Certificate of Convenience and Necessity ("CCN") for building their 345kV transmission lines from the Public Utility Commission of Oklahoma.

Studies for interconnection have been completed at transfer levels of up to 3,500 MW. Any proposed operation above 3,500 MW may require additional studies and may require additional interconnection facilities for which Clean Line will be responsible.

SPS requires that all construction for this request be in compliance with the latest revision of the Xcel Energy Interconnection Guidelines for Transmission to Transmission Interconnections. That document may be found at:

http://www.xcelenergy.com/Energy_Partners/Generation_Owners/Interconnection_Guidelines/Interconnections_for_Transmission.

SPS will also require that the Interconnection Customer be in compliance with all applicable criteria, guidelines, standards, requirements, regulations, and procedures issued by the North American Electric Reliability Corporation (NERC), Southwest Power Pool (SPP), and the Federal Energy Regulatory Commission (FERC) or their successor organizations

It is anticipated that the entire process of building a new 345 kV Optima Switching Station designed as breaker and half with 12 breakers and 8 terminals for the acceptance from Clean Line's HVDC facility output will require approximately 36 months to complete after an Interconnection Agreement is signed and an authorization to proceed is received.

The cost of these upgrades, inclusive of the Interconnection Customer's cost for the interconnection of their HVDC, is shown below in Table 1, with the detailed description of the cost shown in Table 3.

Table 1, Cost Summary, Optima Switching Station

SPS Network Upgrades paid by Customer:	**$ 29,009,113**
Interconnection Facilities [1]:	**$ 614,750**
Total:	**$29,623,863**

[1] This is a direct assigned cost to the Interconnection Customer.

General Description of SPS Facilities [2]

1. **Construction of New 345 kV Switching Station:** See Appendix A, Figure A-1, for general vicinity location map.

   1.1. **Location:** SPS will build a new 345 kV breaker and half scheme with 12-breakers and 8-terminals at Optima Switching Station. Appendix A, Figure A-2 shows the one-line diagram of the 345 kV Optima Switching Station, while Appendix A, Figure 3 shows a typical elevation view of the Point of Interconnection ("POI").

   1.2. **Bus Design:** The new 345 kV breaker and half at Optima Switching Station will accommodate the output from Clean Line (2-345 kV circuits), tapping the Hitchland to Finney 345 kV line, tapping both 345 kV circuits from Hitchland to Woodward. The one-line diagram is shown in Appendix A, Figure A-2.

   1.3. **Line Terminals:** The 345 kV lines and static wire terminals will be designed to accommodate 18,000 pounds per conductor (36,000 per bundle) per phase at maximum tension, with a maximum 15° pull-off angle from normal.

   1.4. **Control House:** The new control house will be utilized to accommodate the new metering, protective relaying and control devices, terminal cabinets, and any fiber-optic cable terminations, etc. for the 345 kV line breaker terminals.

   1.5. **Security Fence:** The new security fence will have a 7-foot chain-link fence with steel posts set in concrete with 1-foot of barbed wire on the top in a "V" configuration. The enclosed area will be approximately 660' by 660' with a rock yard surface.

   1.6. **Ground Grid**: A complete ground grid shall be installed per ANSI/IEEE STD 80-1986, with our standard 4/0 copper ground mesh on 40-foot centers with ground rods and 20-foot centers in corners and loop outside of fence.

   1.7. **Site Grading:** Company contractor, per company specifications, will perform any site grading and erosion control of the new switching station. Soil compaction shall be not less than 95% of laboratory density as determined by ASTM-D-698.

   1.8. **Station Power:** Station power will be provided through either or both a 199 kV/120-240 volt transformer tapped off of the 345 kV bus or will be taken from local distribution if it is available. A generator may be installed if no backup distribution service is available. A flip-flop to automatically transfer the station power will be installed. Service for both transmission and distribution sources will be through the local retail provider.

   1.9. **Relay and Protection Scheme:** The new Optima Switching Station will be a 345 kV breaker and half bus with 12-breakers and 8 line terminals. The primary and secondary bus protection relays to the 345 kV bus will be SEL 487B and GE B90, respectively. No automatic re-closing scheme will be used on the Clean Line 345 kV circuits, but the SEL 411L will be wired for future re-closing. The line terminal protection will be a SEL-411L and SEL-311C-1. Fiber is available on the Hitchland to Woodward lines. In the future, fiber will need to be added on the Hitchland to Optima to Finney line. Line Reactors will use SEL-487V for the primary relay with overcurrent protection and a SEL-351S will be used for secondary relay overcurrent protection. A SEL 351S will be used for breaker failure. Modifications at SPS' Hitchland & Finney and Oklahoma Gas & Electric's Beaver substations may be required.

[2] All modifications to SPS facilities will be owned, maintained and operated by SPS.

AN SEL 411L will display the bus voltage, GCB amps, MW, MVAr, and fault location. An SEL 2032 will be installed for relay communications and other functions as required.

1.10. **Revenue Metering:** The new SPS Optima Switching Station is connected to the 345 kV lines from Hitchland to Finney, Hitchland to Woodward (2-circuits) and Clean Line's 2-345 kV circuits. On the two 345 kV line terminals to the Interconnection Customer's Substation, an individual billing meter that is bi-directional will be installed on both circuits along with a meter per ANSI C12.1 accuracy class 0.2 (3-PT's IEEE C57.13 accuracy class 0.3 and 3 CT's IEEE C57.13 accuracy class 0.15) for full 3-phase 4-wire metering on both circuits. Pulses out of the billing meter will be sent via SCADA to the SPS' Control Center in Amarillo, Texas.

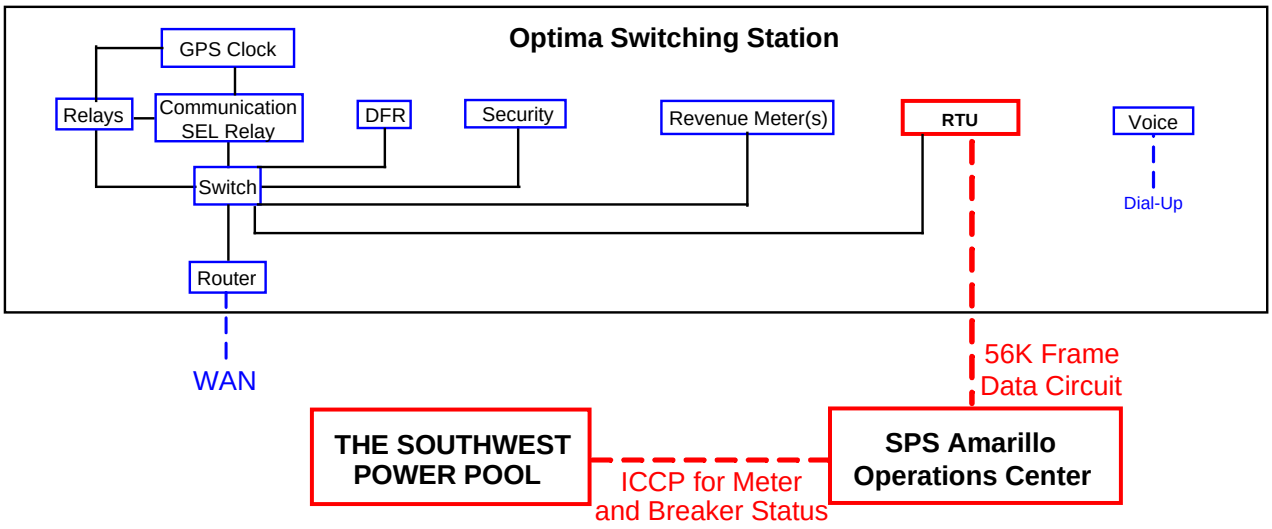
1.11. **Disturbance Monitoring Device:** A Disturbance-Fault Recorder ("DFR"), capable of recording faults, swings, and long term trending, will be installed to monitor and record conditions in the substation and on the transmission lines. The disturbance equipment shall also be equipped with a GPS time synch clock. This equipment will have communication capability with a dedicated communication circuit. The disturbance equipment will have its own dedicated dial-up communications telephone circuit.

1.12. **Remote Terminal Unit ("RTU"):** A RTU will be installed to accommodate the new 345 kV line terminals at Optima Switching Station. SPS will install RTU cards for metering and telemetry as required by the latest Xcel Energy Interconnection Guidelines. The direct cost will be charged to the Interconnection Customer.

1.13. **Communications:** To meet its communications obligations, the Interconnection Customer shall be responsible for making arrangements with the local phone company to provide telephone circuits as required by SPS. SPS equipment may include, but is not limited to, the following: relay communication equipment, RTU, and disturbance monitoring equipment at Optima Switching Station. Prior to any construction, the Interconnection Customer is required to contact SPS' communication engineering department for all communication details.

The following communications schematic diagram, which includes communication equipment information for the Interconnection Customer, Transmission Provider (Southwest Power Pool) and SPS, is provided to assist the Parties.

A schematic outlining the proposed communications is provided below:



The Interconnection Customer shall be responsible for providing fiber optic communication circuit installed in their overhead transmission line static wire for protective relaying from the Interconnection Customer substation to Optima Switching Station indicated in Section 1.9.

2. **Transmission Work:**

2.1. The Interconnection Customer will construct, own, operate, and maintain the 345 kV transmission line from the Interconnection Customer's HVDC station and AC Switching Station to the Interconnection Point at SPS Optima Switching Station as shown in Appendix A, Figure A-2. ***The SPS transmission design group prior to any construction by the Interconnection Customer or its contractor on any customer 345 kV transmission lines, or doing work in close proximity to any SPS transmission line, will require an engineering review of the customer's design. It is the Interconnection Customer's responsibility to initiate the design review in a timely manner before construction of any transmission line begins. If the review has not been made or the design at any of the aforementioned locations is deemed inadequate, the crossing(s) and or termination into the SPS Optima Switching Station will be delayed until the matters are resolved. SPS will not be held responsible for these delays.***

3. **Right-Of-Way and Permits:**

3.1. **Permitting**: The Oklahoma Corporation Commission will not require a permit for the construction of a new 345 kV switching station line terminals to receive output from the Interconnection Customer's Clean Line Substation and HVDC facility at Optima Switching Station. The Interconnection Customer will be responsible for any permitting and right of way of their substation, switching station, and the 345 kV transmission lines from their Switching Station to the Interconnection Point at Optima Switching Station.

4. **Construction Power and Retail Service:** It is the sole responsibility of the Interconnection Customer to make arrangements for both construction and station power, which may be required for the Interconnection Customer's HVDC facility and switching station. **Additionally, if the Interconnection Customer's substation(s) and/or construction site(s) are located outside of the SPS service area, SPS cannot provide station power (retail service) and the Interconnection Customer needs to make arrangements for retail service from the local retail provider.**

5. **Project and Operating Concerns:**

5.1 Close work between the Transmission group, the Interconnection Customer's personnel and local operating groups will be imperative in order to meet any in-service date that has been established.

5.2 Clean Line should manage their power factor such that they do not push more than 75 MVAR into the SPS system nor consume more than 75 MVAR from the SPS system to minimize inputs on SPS's static and dynamic reactive resources.

6. **Fault Current Study:** The available fault current at the interconnection location using the MDWG 2015S with MMWG 2015S and without any contribution from the HVDC converter facilities, is shown in Table 2 below. The values below are for the final 345 kV configuration based on studies to date.

Table 2, - Available fault current at Point of Interconnection Location

Short Circuit Current Availability at Optima Switching Station without contribution from Clean Line				
	Fault Current (Amps)		Impedance (Ω)	
Fault Location	Line-to-Ground	3–Phase	Z^+	Z^0
345 kV Bus	8,960	9,019	1.84+j22.007	2.93+j22.361

Estimated Construction Costs

The projects required for the interconnection of this 3500 MW HVDC interconnection at SPS' Optima Switching Station. The cost for this project is summarized in the table below.

Table 3, Required Interconnection Projects[3]

Project	Description	Estimate
	SPS Network Upgrades (at Interconnection Customer's expense)	
1	Disturbance Monitoring Device (DFR) and Remote Terminal Unit (RTU) and Communication Equipment.	$ 368,176
2	Right-of-Way for Optima Switching Station.	$ 304,130
3	Transmission Line Work J-7 (In and Out); Hitchland to Finney 345 kV line.	$ 3,868,624
4	Transmission Line Work J-12 and J-13 (In and Out); (Hitchland to Woodward 345 kV Double Circuit).	$ 5,219,834
5*	Build new 345 kV 12-Breaker and Half with eight terminals.	$ 19,248,349
	Subtotal:	**$29,009,113**
	Interconnection Facilities (at the Interconnection Customer's expense)	
6	Communications [4]	*$ See footnote*
7	Revenue metering (2 sets)	$ 560,000
8	345 kV Line arrestors	$ 54,750
	Subtotal:	**$ 614,750**
	Total Cost:	**$29,623,863**

*No 345 kV shunt reactors are shown in the estimate. An Electro-magnetic Transient Program ("EMTP") Study will be required to finalize any 345 kV or higher voltage shunt reactor sizes, cost and delivery, if they are needed. The EMTP Study will be done after the authorization to proceed has been received as required in the Milestone Schedule of the Interconnection Agreement.

[3] The cost estimates are 2014 dollars with an accuracy level of ±20% except it does not include AFUDC.

[4] It is the Requester's responsibility to provide both the data circuit and both dial-up telephone circuits, see Section 1.13.

Engineering and Construction:

An engineering and construction schedule for the installation of the 345 kV Optima Switching Station and line terminals is estimated at approximately 36 months. Other factors associated with clearances, equipment delays and work schedules could cause additional delays. The schedule is applicable after all required agreements are signed, and internal approvals are granted.

All additional cost for work not identified in this study is the sole responsibility of the Interconnection Customer unless other arrangements are made.

Additional Studies Required

The cost estimates provided are for the operation of the Clean Line facility at 3,500 MW based on studies conducted under Section 3.5 of the SPP Criteria. Should Clean Line choose to operate at a higher transfer level, those studies must be redone to address any upgrades required to operate at the higher transfer level.

Additional studies are also required once the final HVDC vendor has been chosen and the equipment design completed. These studies are performance verification studies and may or may not produce any additional construction requirements for transmission interconnection facilities or need for supplemental protection schemes for reliable operation.

Appendix A

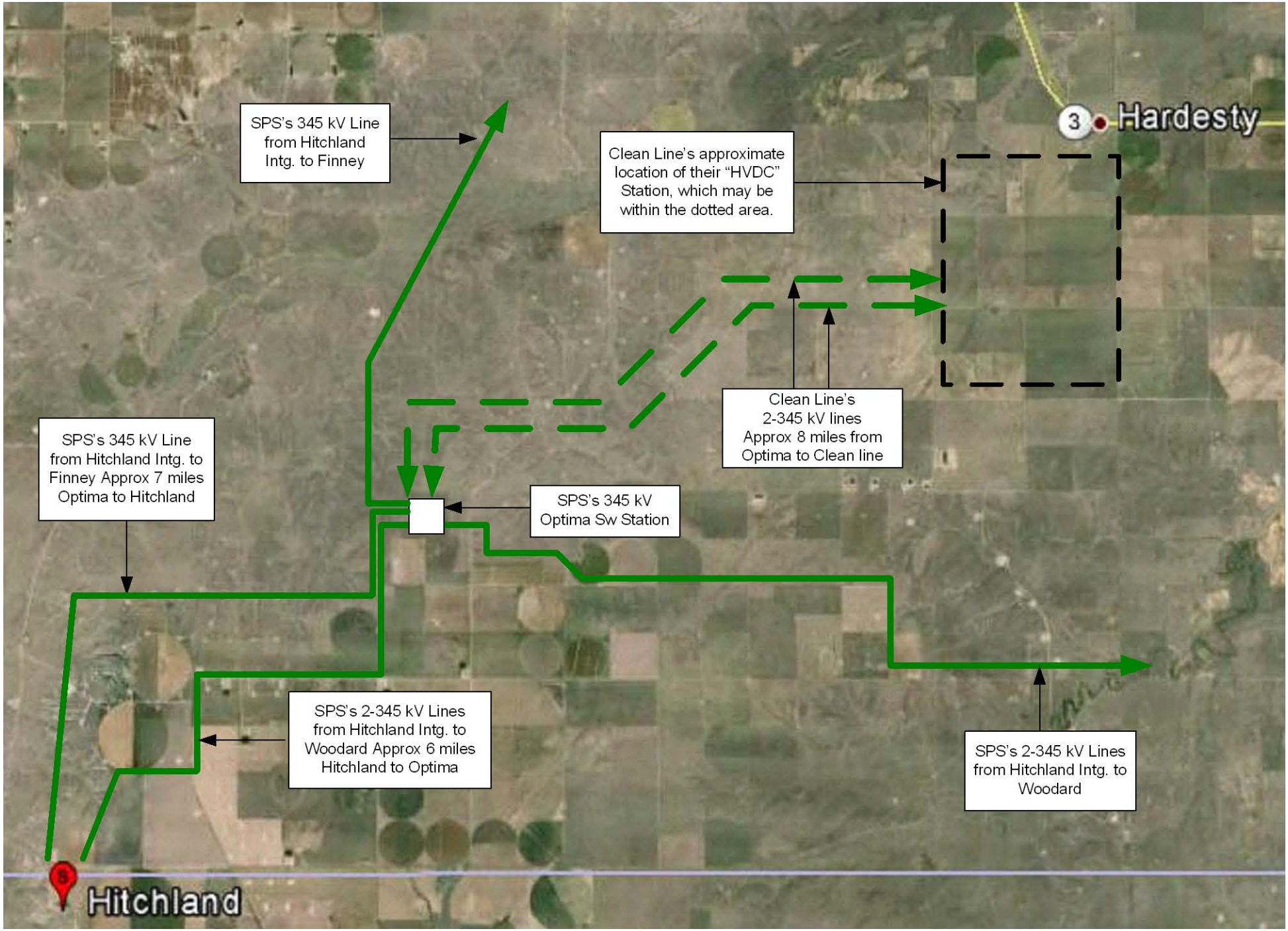


Figure A- 1 Approximate location of proposed Clean Line Facility

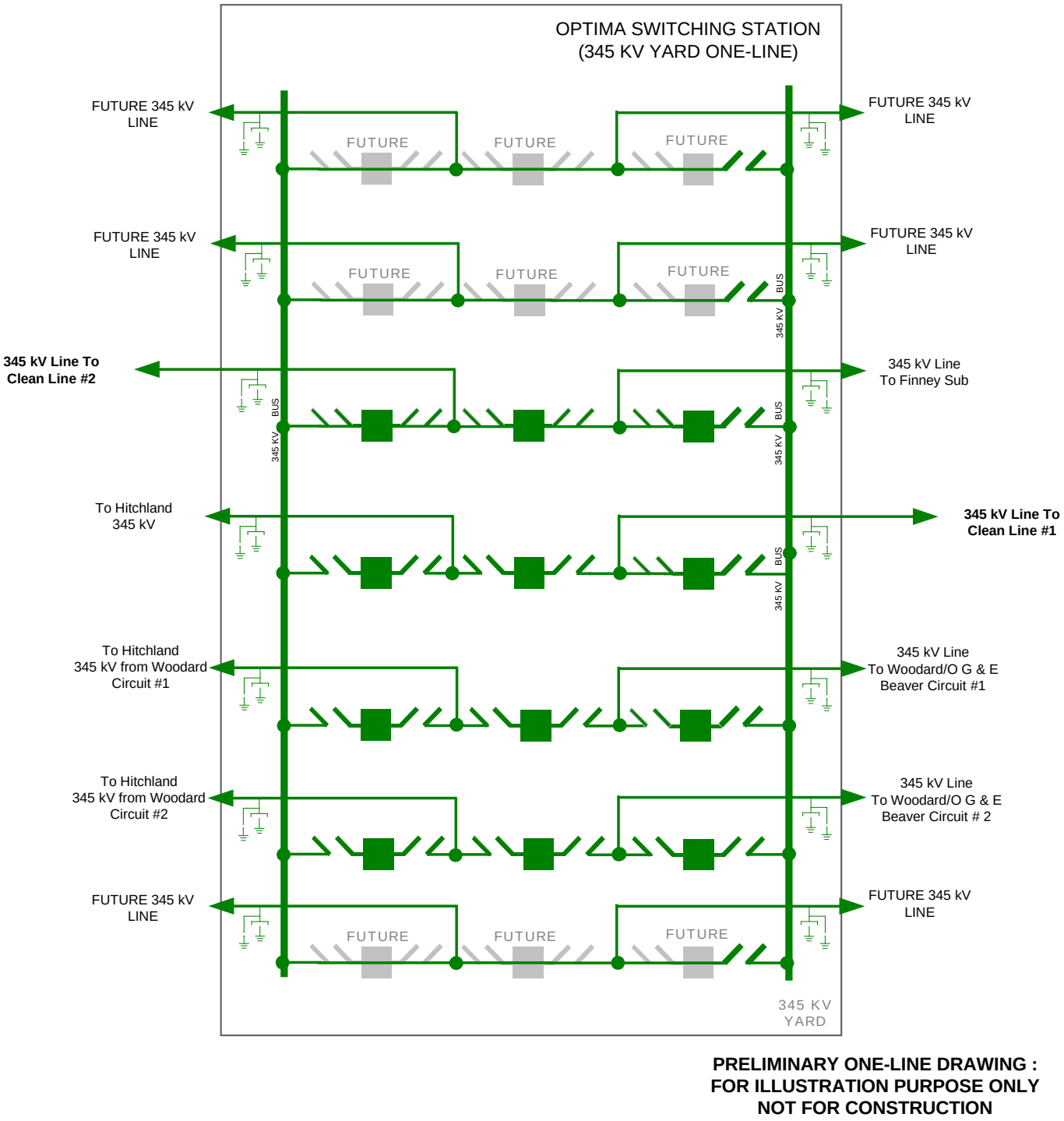
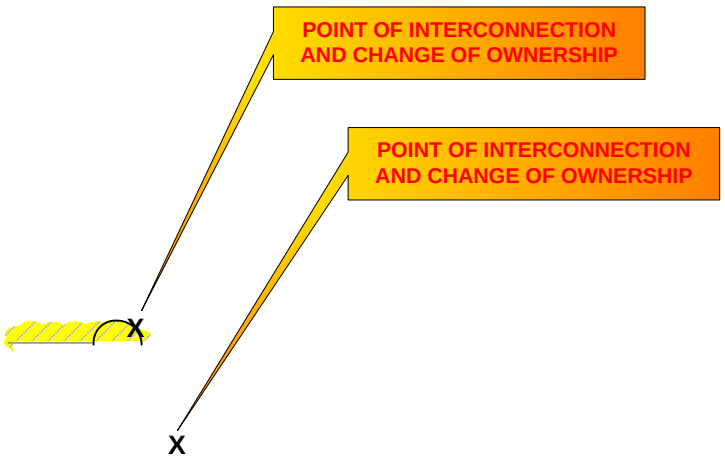


Figure A- 2 One-line Diagram of Optima Switching Station



NOTE: CUSTOMER SHALL PROVIDE ALL MATERIAL FOR DEAD ENDING PHASES AND STATIC TO 345 kV DEAD END TOWER.

THIS DRAWING ILLUSTRATES ONLY THE POINT OF INTERCONNECTION AND THE BOUNDARIES OF CUSTOMERS RESPONSIBILITY. IT MAY NOT BE USED FOR CONSTRUCTION

Customer's Responsibility

Figure A- 3 Point of Interconnection & Change of Ownership (Typical)

– END OF REPORT –