Customer Substation Guidelines
Solar Supplement

1. General Site

a. At least one access driveway is required to the switching station area with room to maneuver a vehicle within or around the outside of the switching station. Additional gates may be added to facilitate transmission line work.
b. The solar developer should provide site drawings in DWG format (2013) to assist in development of the easement/property exhibits.
c. Reference SCDOT Access and Roadside Management (ARMS) standards.
d. The solar developer should provide Dominion Energy South Carolina (DESC) with any available site soil borings or geotechnical study results to minimize duplication of efforts.

2. Transmission Right-of-Way Considerations

a. ROW Encroachment Permitting Process
DESC will need to be consulted early in the planning of any contemplated right-of-way (ROW) crossing. Additionally, DESC must review and approve all plans for construction proposed on DESC rights-of-way. To begin the permitting process, you must submit the following:
- Site Plan
- Road Plan and Road Profiles
- Grading and Drainage Plans
- Utility Plan (if applicable)

b. General Guidelines
The following are guidelines for right-of-way encroachment:
i. Roads that meet the following requirements:
1. National Electric Safety Code (NESC) vertical clearances maintained for conductors;
2. Must cross the right-of-way at, or near, 90 degrees;
3. Must be no closer than 50 feet from structures, guy wires, or anchors at the crossing location not to interfere with present or future structure placement;
4. Parallel roads are not allowed in the right-of-way;

ii. Fences that meet the following requirements:
1. Shall be no taller than 15 feet above ground within the right-of-way;
2. Shall be designed to allow at least a 16-foot opening:
a. Gates are permissible as long as they allow for at least a 16-foot opening;
b. If gates are to be locked, DESC must be allowed to install its own locks on the gates;
c. Locks will be installed in such a manner as to allow the landowners and DESC unimpeded access to the property;
3. Shall cross the right-of-way at, or near, 90 degrees;
4. Shall be properly grounded in accordance with applicable industry standards.

iii. Underground cabling that meet the following requirements:
1. Must be no closer than 50 feet from structures, guy wires, or anchors at the crossing location not to interfere with present or future structure placement;
2. Must cross the right-of-way at, or near, 90 degrees;
3. Must have a minimum burial depth such that DESC and various contractor equipment will not damage the subsurface utility or cables. A general guideline is that a fully loaded bucket truck weighs 95,000 pounds;

iv. Work within DESC easements:
   1. Contractor must maintain a minimum of a 20' Operating Clearance to any energized transmission conductor to excavators, cranes, derricks, etc.
   2. If the contractor has to penetrate the 20' Operating Clearance, they will need to give DESC a minimum of 3 weeks advance notice such that DESC can coordinate with System Control to de-energize and ground the line so the contractor can safely proceed with work inside the 20' operating clearance.

3. Switching Station Dimensions

a. Switching station dimensions will vary based on the orientation of the access easement.
   i. Tapped Interconnections (1 breaker)
      1. 115kV switching stations typically require an area of approximately 175'x155'.
      2. 230kV switching stations typically require an area of approximately 130'x220'.
   ii. Fold-In Interconnections (3+ breakers)
      1. 115kV 3+ breaker switching stations require an area approximately 382'x317'.
      2. 230kV 3+ breaker switching stations require an area approximately 420'x370'.

4. Grounding

a. DESC will conduct a ground resistivity study. The resistivity readings and DESC's resultant grounding evaluation and design will be shared with the solar customer.
b. DESC's switching station ground grid will be designed to be self-sufficient, even when the switching station and solar substation ground grids will be tied together.
c. If DESC and solar substation ground grids need be tied together, DESC will provide two grid-sized bare copper wires as tie points between ground grids.

5. Switching Station Fencing

a. DESC's switching station can share a fence line with the solar substation.
   i. DESC installs non-conductive fencing along the shared section.
b. Non-shared fence lines need to be at least 10' apart
   i. DESC installs chain link all the way around their switching station.

6. Metering Data

a. The solar farm may poll DESC's RTU for metering data. These communications will be run via the DNP3 protocol over multi-mode fiber. The fiber connections will be made in WMO boxes with ST connectors.

7. Relaying

a. DESC employs a "single-shot re-closing" scheme for the switching station breaker. If the transmission line trips, recloses, and holds, then the DESC switching station breaker will automatically re-close on the solar farm after 1 minute. Generation may resume after 5 minutes.
b. Relay and inverter protection settings must be submitted to DESC at least one month prior to energization. Protection settings must conform to applicable standards (i.e. IEEE 1547 and PRC 024), where possible, and should be coordinated such that equipment is tripped in the following progression: inverters first, customer substation breakers second, DESC breaker(s) last.
c. Requirements for test power

d. There is no dedicated inter-tie relaying for 46kV interconnections if the customer's substation has a high side breaker.
e. There are two relaying options for 115kV & 230kV Tapped and Fold-In Interconnections:
    i. Bus Differential Scheme with dual SEL 587Z relays
        1. One set of relays housed in DESC's switch house with hard wired CT and control cable connections to the customer's high side breaker and relays.
        2. Control cables and fiber optics will tie in an Interface Junction Box mounted on the back of DESC's switch house.
        3. DESC's relays must be able to directly trip the customer's high side breaker.
        4. The customer's high side breaker will require two 2000/5, C800 accuracy class, multi-ratio bushing CTs per phase on the transformer side of the breaker.
        5. DESC and Customer's ground grids must be tied together.
        6. Common when customer's substation is very close to DESC's switching station.
    ii. Current Differential Scheme with SEL 411L/311L relays at both ends of the tie line
        1. Relay sets installed in both the switching station and the customer substation.
        2. Relays at either substation communicate via single mode fiber.
        3. Fiber cables from the customer can run all the way into the DESC switch house.
        4. DESC and Customer's ground grids may not have to be tied together.
        5. Required when substations are spaced more than 50 ft apart.

8. Phase Rotation

a. DESC uses a counter-clockwise "1-3-2" phase rotation. Refer to the switching station Single Line Diagram for the phase positions and vector diagram.

9. Connectors at the Point of Ownership Change

a. The solar customer will be expected to string conductors and any static wires to the DESC deadend structure. Please let DESC know what size conductors and static wires will be used.
b. DESC may order the connectors for the Point of Ownership Change (POC), as a courtesy, if the solar customer elects to use one of DESC's standard cable sizes at the POC. A drawing is available that details exactly which connectors need to be sourced.
    i. Standard Phase Conductor Sizes: 336 ACSR (26/7), 477 ACSR, 795 ASCR (26/7), 795 ACSR (45/7), 1272 ACSR (45/7)
    ii. Standard Static Conductor Sizes: 5/16", 3/8", 10M, 7#7 Alumoweld

10. Station Service Power

a. The DESC switching station will include a station service transformer to get power from the Transmission line. For tapped interconnections, DESC would like access to any Distribution source of station service power for a backup, if one is available to the customer. Max load is 100A at 240VAC.