

**DOMINION ESTIMATED TRANSMISSION COSTS
OVERHEAD VS. UNDERGROUND COST COMPARISON
5 MILE, 230kV SINGLE CIRCUIT LINE EXAMPLE
1035 MVA CAPACITY
INITIAL COST ANALYSIS**

1. UNDERGROUND 230kV PIPE TYPE CABLE SYSTEM: \$40,577,000

- 2 – 4 foot wide trenches on 24 foot right of way
- 4 – 8 inch diameter steel pipes
- 12 – 2500 kcmil copper cables
- 5 mile length

<u>Large Cost Items</u>	<u>Quantity</u>	<u>Material Cost</u>	<u>Installation Cost</u>
Steel Pipe	105,700 ft.	\$ 1,902,000	\$15,840,000
Power Cable	317,400 ft.	\$11,109,000	\$ 952,000
Manholes	26	\$ 390,000	\$ 370,000
Cable Splices	44	\$ 1,144,000	\$ 2,948,000
Terminations	24	\$ 840,000	\$ 144,000
Pumping Plant	2	\$ 750,000	\$ 106,000
Dielectric Fluid	158,000 gal.	\$ 792,000	\$ 158,000
Other Misc. Items		\$ 2,550,000	
Total Material & Labor		\$39,995,000	
Right of Way		\$ 582,000	
Grand Total		\$40,577,000	

2. UNDERGROUND 230kV XLPE CABLE SYSTEM: \$32,123,000

- 2 – 2 foot wide trenches on 20 foot right of way
- 8 – 6 inch diameter PVC conduits
- 8 – 3000 kcmil copper cables
- 5 mile length

<u>Large Cost Items</u>	<u>Quantity</u>	<u>Material Cost</u>	<u>Installation Cost</u>
PVC Conduit	211,200 ft.	\$ 634,000	\$11,880,000
Power Cable	212,500 ft.	\$12,328,000	\$ 638,000
Manholes	24	\$ 360,000	\$ 360,000
Cable Splices	96	\$ 1,104,000	\$ 2,112,000
Terminations	16	\$ 288,000	\$ 96,000
Other Misc. Items		\$ 1,838,000	
Total Material & Labor		\$31,638,000	
Right of Way		\$ 485,000	
Grand Total		\$32,123,000	

3. OVERHEAD 230kV CIRCUIT: \$5,282,000

- Self-supporting steel poles on 100 foot right of way
- Concrete foundations
- 6 - 636 kcmil ACSR conductors & 1 - 3#6 Alumoweld shield wire
- 5 mile length

<u>Large Cost Items</u>	<u>Quantity</u>	<u>Material Cost</u>	<u>Installation Cost</u>
Poles with Insulators	40	\$ 797,000	\$ 334,000
Conductor	159,000 ft.	\$ 149,000	\$ 225,000
Shield Wire	27,000 ft.	\$ 9,000	\$ 25,000
Foundations		\$ 563,000	
Other Misc Items		\$ 756,000	
Total Material & Labor		\$ 2,858,000	
Right of Way		\$ 2,424,000	
Grand Total		\$ 5,282,000	

Notes:

Cost estimates are for a hypothetical 5 mile single circuit transmission line in network configuration (meaning another transmission source is available to maintain service during an outage of the line) and are based on average expenses from actual projects across the Commonwealth of Virginia.

Factors that may increase the cost of an underground system over and above the estimates shown:

- Rock Excavation
- Installation in Pavement (Streets or Sidewalks)
- Requirements to Bore Underneath Street Crossings
- Right of Way Acquisition Costs
- Reactive Compensation Requirements at Substations
Underground cable is capacitive in nature and the longer the length of circuit, the more likely the need for compensation.
- Radial Configuration of the Line
Absence of another transmission source to maintain service during an outage of the line may require installation of additional underground cable redundancy.

**DOMINION ESTIMATED TRANSMISSION COSTS
OVERHEAD VS. UNDERGROUND COST COMPARISON
5 MILE, 230kV SINGLE CIRCUIT LINE EXAMPLE
1035 MVA CAPACITY
LIFE CYCLE COST ANALYSIS FOR 70 YEAR LIFE**

1. UNDERGROUND 230kV PIPE TYPE CABLE SYSTEM: NPV \$40,827,000

- 2 – 4 foot wide trenches on 24 foot right of way
- 4 – 8 inch diameter steel pipes
- 12 – 2500 kcmil copper cables
- 5 mile length

<u>Large Cost Items</u>	<u>Quantity</u>	<u>Material Cost</u>	<u>Installation Cost</u>
Steel Pipe	105,700 ft.	\$ 1,902,000	\$15,840,000
Power Cable	317,400 ft.	\$11,109,000	\$ 952,000
Manholes	26	\$ 390,000	\$ 370,000
Cable Splices	44	\$ 1,144,000	\$ 2,948,000
Terminations	24	\$ 840,000	\$ 144,000
Pumping Plant	2	\$ 750,000	\$ 106,000
Dielectric Fluid	158,000 gal.	\$ 792,000	\$ 158,000
Other Misc. Items		\$ 2,550,000	
Total Material & Labor		\$39,995,000	
Right of Way		\$ 582,000	
Maintenance (Net Present Value)		\$ 250,000	
NPV Grand Total		\$40,827,000	

2. UNDERGROUND 230kV XLPE CABLE SYSTEM: NPV \$34,408,000

2 – 2 foot wide trenches on 20 foot right of way
8 – 6 inch diameter PVC conduits
8 – 3000 kcmil copper cables
5 mile length

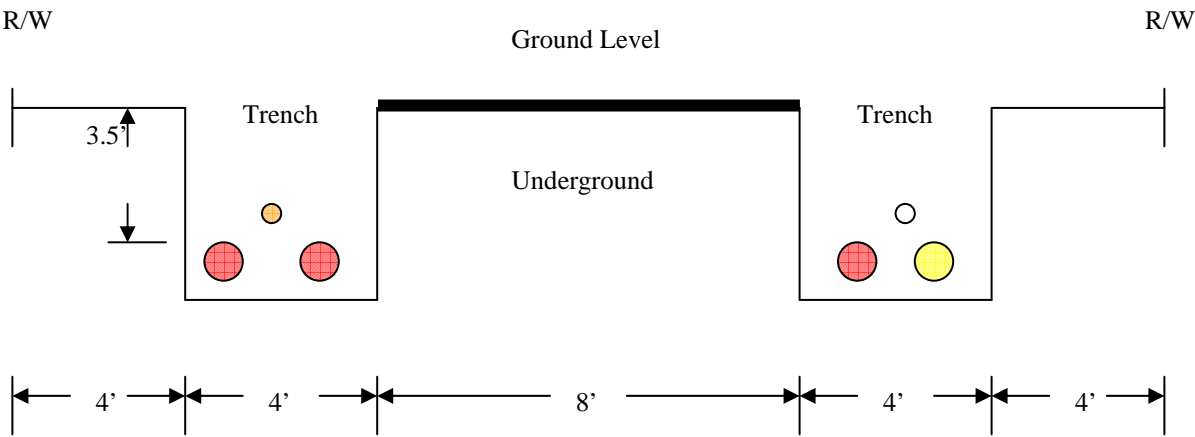
<u>Large Cost Items</u>	<u>Quantity</u>	<u>Material Cost</u>	<u>Installation Cost</u>
PVC Conduit	211,200 ft.	\$ 634,000	\$11,880,000
Power Cable	212,500 ft.	\$12,328,000	\$ 638,000
Manholes	24	\$ 360,000	\$ 360,000
Cable Splices	96	\$ 1,104,000	\$ 2,112,000
Terminations	16	\$ 288,000	\$ 96,000
Other Misc. Items		\$ 1,838,000	
Total Material & Labor		\$31,638,000	
Right of Way		\$ 485,000	
Maintenance (Net Present Value)		\$ 315,000	
40 Year Cable Replacement (NPV)		\$ 1,970,000	
NPV Grand Total		\$34,408,000	

3. OVERHEAD 230kV CIRCUIT:**NPV \$5,420,000**

Self-supporting steel poles on 100 foot right of way
Concrete foundations
6 - 636 kcmil ACSR conductors & 1 - 3#6 Alumoweld shield wire
5 mile length

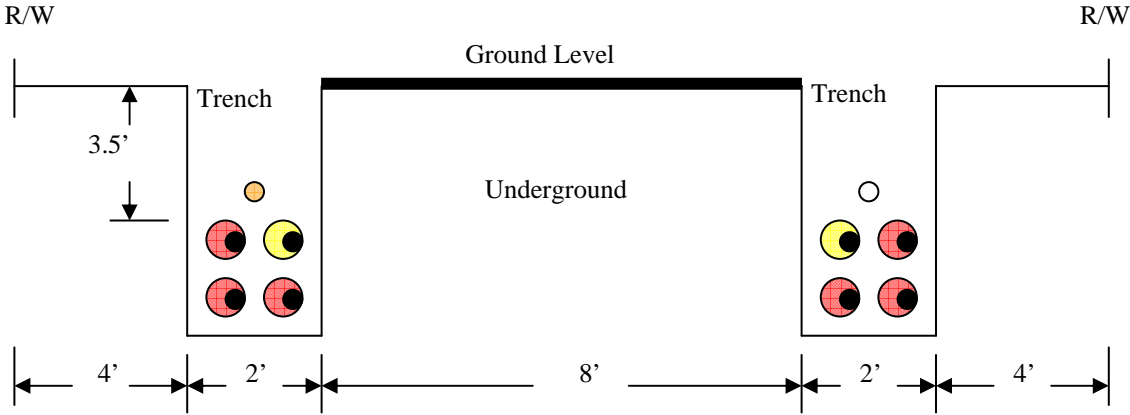
<u>Large Cost Items</u>	<u>Quantity</u>	<u>Material Cost</u>	<u>Installation Cost</u>
Poles with Insulators	40	\$ 797,000	\$ 334,000
Conductor	159,000 ft.	\$ 149,000	\$ 225,000
Shield Wire	27,000 ft.	\$ 9,000	\$ 25,000
Foundations		\$ 563,000	
Other Misc Items		\$ 756,000	
Total Material & Labor		\$ 2,858,000	
Right of Way		\$ 2,424,000	
Maintenance (Net Present Value)		\$ 138,000	
NPV Grand Total		\$ 5,420,000	





Underground Transmission Line
230kV Pipe-Type Cable System
Typical Configuration
1035 MVA Capacity w/ Spare Cable



- Fiber Optic Cable for Protective Relaying
- Spare 3" PVC Conduit
- Energized 230kV Cable (~890 Amps) - ACTIVE
- Energized 230kV Cable - SPARE

Underground Transmission Line
 230kV XLPE System
 Typical Configuration
 1035 MVA Capacity w/Spare Cable



-  Fiber Optic Cable for Protective Relaying
-  Spare 3" PVC Conduit
-  Energized 230kV Cable (~1300 Amps) - ACTIVE
-  Energized 230kV Cable - SPARE

Overhead Transmission Line
230kV Steel Pole
Typical Configuration
1035 MVA Capacity

