

TRANSMISSION LINES

A comparison: overhead vs. underground



Puget Sound Energy's network of transmission lines safely transport high voltage electricity generated by hydropower, natural gas, coal, wind and solar sources to transmission and distribution substations in local communities throughout PSE's nine-county electric service area. PSE's transmission system primarily consists of overhead high voltage lines supported on wood or steel poles to transport electricity.

When it comes to deciding whether or not to underground electric lines, utilities must weigh the costs and benefits to customers. While underground lines may improve aesthetics, have lower vegetation management costs, and reduce the frequency of outages, overhead lines are less expensive to construct and maintain, are quicker to repair, and are less disruptive to the environment. For these reasons, utilities traditionally favor overhead transmission lines, except where such lines are impractical like instances that require underwater cable to supply electricity from the mainland to islands.

Following is a comparison of overhead and underground transmission lines in the areas of aesthetics, impacts and costs:

Aesthetics

Overhead

- Poles, wires and support anchors are visible
- Some vegetation can remain under or beside the lines

Underground

- No poles, wires or support anchors visible
- Steel termination poles are visible
- Vegetation must be completely removed on and around the route

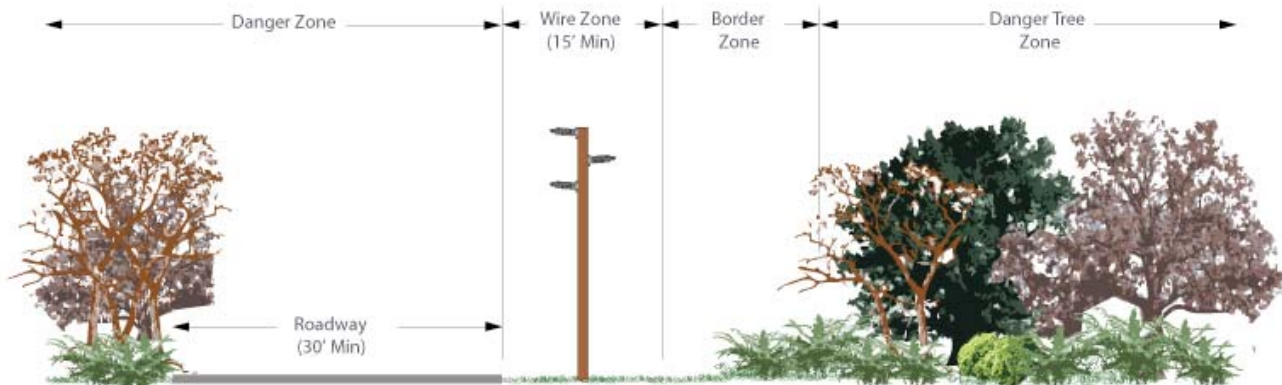
Outage Impacts

Overhead

- Outages are more frequent during normal and severe weather
- Repairs can typically be made within a day

Underground

- Outages are less frequent
- Repairs can take up to six weeks



Typical cross section of overhead 115 kilovolt transmission lines

Construction Impacts

Overhead

- Temporary traffic impacts, if work is in or along street rights-of-way
- Construction entails setting poles and stringing wire
- Construction equipment used includes line trucks, bucket trucks and tree removal equipment
- Environmental impacts include removing trees and removing 120 cubic yards of dirt per mile

Underground

- Temporary traffic impacts, if work is in or along street rights-of-way
- Substantial trenching is required: a 5 ft. (wide) x 4 ft. (deep) trench is required for the line; a 20 ft. (wide) x 10 ft. (deep) trench is required every 1,500-2,000 feet for the utility vaults
- Construction equipment used includes line trucks, bucket trucks, backhoes and tree removal equipment
- Environmental impacts include removing trees and removing 530 cubic yards of dirt per mile

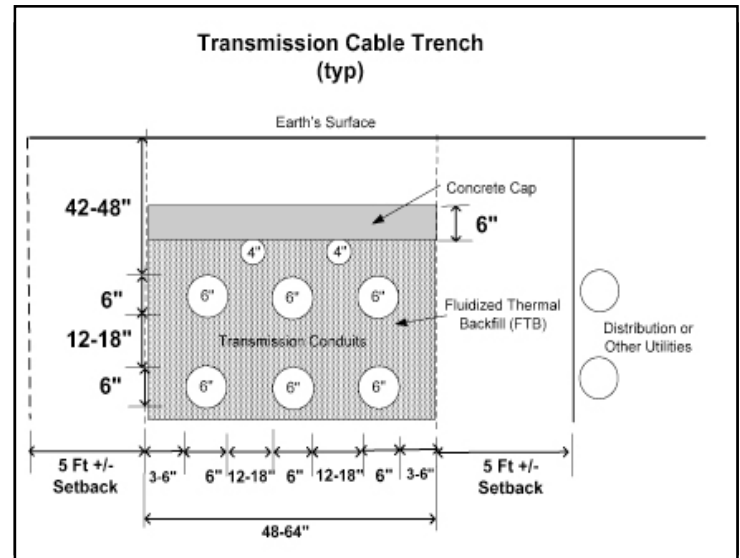
Costs

Overhead

- \$500,000 to \$1 million per mile to construct
- Costs more to maintain vegetation
- Costs less to maintain, repair, upgrade and relocate
- Costs from car-pole accidents, tree trimming, and transmission line losses are higher
- Costs are covered by all ratepayers; no additional area costs to local customers is necessary

Underground

- \$4 million to \$10 million per mile to construct
- Vegetation management costs are negligible, however affected vegetation creates a "wider" utility corridor due to greater impact on surrounding trees' root systems
- Costs more to maintain, repair, upgrade or relocate
- Costs from car-pole accidents, tree trimming, and transmission line losses are lower
- Costs are not covered by all ratepayers; local customers who benefit must pay the cost difference of undergrounding via area rates



Typical cross section of underground 115 kilovolt transmission lines

Underground and overhead transmission lines Estimated cost comparison		
	Construction and relocation	O & M¹
Underground	\$4-10 million per mile	\$300 per mile per year
Overhead	\$500k-\$1 million per mile	\$1,100-1,900 per mile per year

¹ O & M costs include vegetation management, and exclude storms and locating temporary services.