



Hawaiian
Electric

UNDERGROUNDING

Understanding the facts



Hawaiian Electric owns and operates more than 9,800 miles of transmission and distribution lines across the five islands we serve. Underground powerlines are commonly deployed in Hawai'i. Approximately 43% of these lines are already underground, demonstrating a significant investment in underground infrastructure to ensure reliability and minimize visual impacts.

Hawai'i utilities – including electricity, phone, and state or city-owned streetlights – jointly own about 120,000 poles. Hawaiian Electric has sole ownership of about 50,000 poles.

ADVANTAGES OF UNDERGROUNDING:

- ◆ **Reliability** – Underground power lines are more reliable than overhead lines and helps lower wildfire risk – particularly during hurricanes and severe weather, when trees and vegetation and wind-blown debris can cause outages to overhead lines.
- ◆ **Aesthetics** – Improve neighborhood by eliminating visible overhead infrastructure contributing to a visually appealing environment.

DISADVANTAGES OF UNDERGROUNDING:

- ◆ **Reliability and resilience** – Underground powerlines are less impacted by high winds but can be more susceptible to flooding compared with overhead powerlines.
- ◆ **Restoration time** – When an underground powerline has a short circuit or “fault”, locating the point of failure is more time consuming and requires the use of specialized equipment and specialized contractors from the mainland. This often results in longer times (from multiple hours to multiple days or months) to make repairs and place an underground powerline back into service.
- ◆ **Environmental impacts** – Underground powerlines usually require the digging of a continuous trench for the entire circuit. The trenching and other underground construction requires more extensive permitting and can have a greater archeological impact to the lands in which the powerline is installed.
- ◆ **Geographic obstruction** – Underground powerlines cannot be installed in remote locations or in rocky or in steep inclines. Power equipment and wheeled vehicle access is required to dig trenches, pour concrete, and pull cables. So remote overhead lines cannot be replaced with underground powerlines in the same location and route. Alternative routes, within or alongside roads will be needed.
- ◆ **Timing of installation** – Permitting and construction of underground powerlines often takes 4-6 years, compared with overhead powerlines which typically takes 2-3 years to permit and construct.
- ◆ **Cost considerations** – Underground powerlines cost approximately 5-10 times more to install compared with an equivalent overhead powerline.

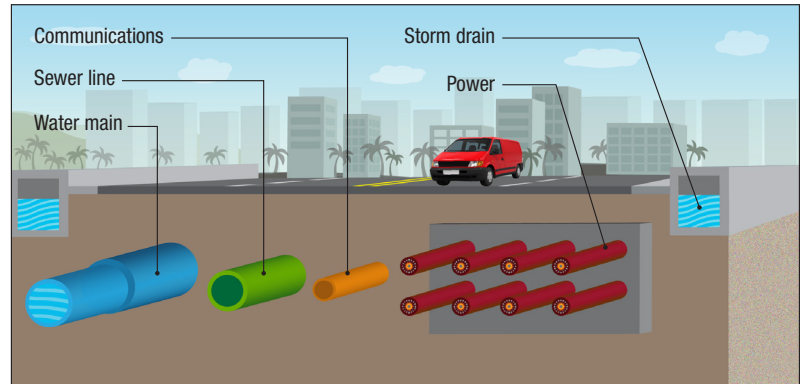


What's underground?

FOOTPRINT AND CONSTRUCTION

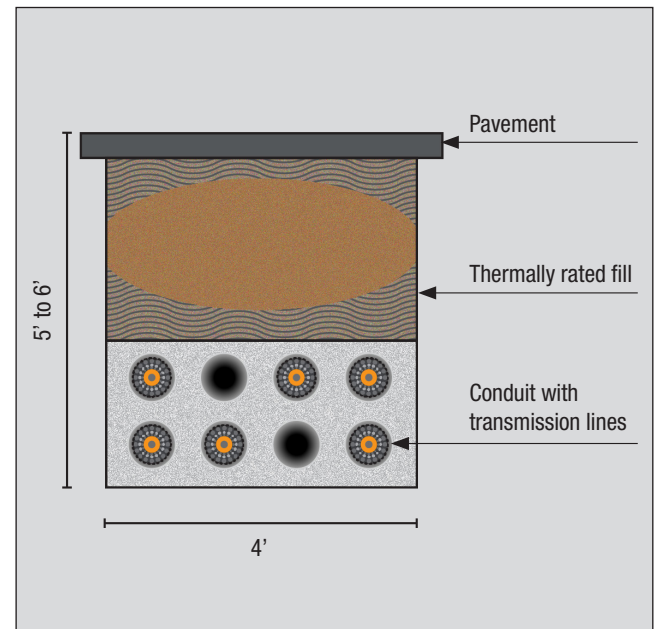
Undergrounding of transmission lines are less common due to the large size of underground ducts and the specialized construction, maintenance, and repair skills and equipment needed for transmission cables. Depending on the situation, undergrounding can require a lot of horizontal real estate:

- ◆ Underground powerlines need to avoid other underground utilities (i.e., sewer, water, communications) and requires clearances between utilities for safety and maintenance purposes.
- ◆ Overhead line provide flexibility to avoid the other infrastructure obstructions.
- ◆ Each sub transmission and transmission underground circuit requires its own underground systems (e.g., manholes and ducts) to maintain reliability and safety, and circuits running in parallel require horizontal spacing to maintain electrical ratings.



Building underground powerlines in existing communities will take more time and will be much more costly. Reasons for higher costs include:

- ◆ Underground powerlines are commonly installed under roadways and sidewalks. Roads and other rights of way may not have sufficient space to place new underground powerlines.
- ◆ Installation of underground powerlines will require long closures of lanes or entire roads to allow for trenching and construction of underground powerlines, impacting traffic in the area.
- ◆ Once construction is completed, roads, sidewalks, walls, etc. need to be rebuilt.
- ◆ Underground powerlines require easements on private property to place utility equipment, such as padmount transformers and switchgear. Negotiating easements within established communities is a lengthy process.
- ◆ To fully underground a powerline, electrical lines to every home and business needs to be converted from overhead to underground. Driveways, parking lots, and yards need to be dug up for the conversion of overhead services lines to underground to serve each customer. In such cases, customers will have to relocate or modify their electrical service and meter panel to receive power from an underground line instead of an overhead line.
- ◆ Disposal of excavated spoils is an environmental concern.
- ◆ Backfill materials must be imported.



REGULATORY CONSIDERATIONS AND COST SHARING

Hawaiian Electric participates in regulatory proceedings to review undergrounding regulations, ensuring alignment with state and local requirements. Cost-sharing agreements may be established under specific circumstances, facilitating collaborative efforts to enhance infrastructure resilience.

CONCLUSION

Hawaiian Electric believes undergrounding of powerlines is an important component of our strategy to reduce public safety risk. Specifically, we believe there are specific instances where the undergrounding of a powerline makes sense, even

with the higher cost of undergrounding. One example is the consideration of undergrounding lines along key evacuation routes, particularly where there is only one road serving a community.

As Hawaiian Electric continues to prioritize reliability and resilience in serving our customer, undergrounding utility lines remains a strategic consideration. By understanding the benefits, challenges, and regulatory aspects of undergrounding, we aim to make informed decisions that best serve the needs of our communities.