Abstract

The purpose of this project is to map the risk areas for two underground power cable systems extending from Nesjavellir geothermal power plant in Iceland. Previous research has shown that thermal dissipation is reduced in a dried-out soil causing high temperatures at the cable jacket. Our objective was to model and map the risk areas for underground cables based on the thermal conductivity of the surrounding soil. Various factors need to be considered when selecting the location of an underground power cable system. These factors include soil type, land cover, elevation, and most importantly, soil type. We ranked each soil type based on its moisture content, the higher the moisture content, the lower the risk of cable failure. Over the past few decades, world-wide usage of underground power cables, as opposed to landlines, has increased. This is because thermal conductivity is reduced in dried-out soil causing high temperatures at the cable jacket. Therefore it is important that the soil moisture, the heavier.

Introduction

Over the past few decades, world-wide usage of underground power cables, as opposed to landlines, has increased. Nonetheless, research on the different factors which impact underground cables is limited. Recent research has shown that there are several important factors to consider in the design and installation of underground cables. Thermal conductivity of the surrounding material will affect for thermal dissipation from the cables. Thermal dissipation can be reduced in dry soil causing high temperatures at the cable jacket which will result in an increased risk of thermal breakdown of the underground cables and can reduce their lifespan considerably (Orradottir and Kristmundsson, 2004). Research has shown that thermal dissipation will be reduced in thermal conductivity by (Kristmundsson, 2004). Therefore it is important to map the thermal conductivity of the surrounding soil has sufficient water-holding properties that so the soil water content will not affect the thermal conductivity. A knowledge of the various physical factors in Iceland which impact underground cables as distinct from surface electric cables is also necessary.

Figure 3: Cross section of underground cables showing the different types of soil in the area of interest. Ranking provided by (Arnalds, 2008), Table 4.1.

Figure 4: Concept map showing what affects thermal conductivity in soil.

Figure 5: Elevation in the area of interest broken into four categories based on natural breaks. The higher elevation, the higher the risk.

Figure 6: Location of area of interest in relation to Iceland. Rivers & Lakes

Figure 7: Rivers & Lakes

Figure 8: The different types of soil ranked based on their moisture content. Ranking provided by (Arnalds, 2008), Table 4.1.

Figure 9: The different types of land cover ranked based on their moisture content. Ranking provided by (Arnalds, 2008), Table 4.1.

Figure 10: The final risk map showing the correlation between the different variables and their risk levels.

Figure 11: The different types of soil ranked based on their moisture content. Ranking provided by (Arnalds, 2008), Table 4.1.

Figure 12: The different types of soil ranked based on their moisture content. Ranking provided by (Arnalds, 2008), Table 4.1.

Results

Figure 1: Concept map showing what affects thermal conductivity in soil.

Figure 2: Concept map showing what affects thermal conductivity in soil.

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Methodology

Hand calculations were performed to determine the area of interest based on the thermal conductivity of the surrounding soil. Then, we ranked each of our individual data sets based on its risk level. We then combined all the ranked data sets using a divergent color scheme in which green represented low risk areas and red represented higher risk areas. Furthermore, we produced a map showing water bodies in area of interest, that is between Nesjavellir power station and the capital Reykjavik.

Data Processing/Analysis:

Rationale:

The purpose of this map is to show the areas which are highly or low risk. We did not include this in our layered risk map.

Over the past few decades, world-wide usage of underground power cables, as opposed to landlines, has increased. This is because thermal conductivity is reduced in dried-out soil causing high temperatures at the cable jacket. Inefficient thermal dissipation is caused by reduced thermal conductivity in a dried-out soil. As seen in (Figure 2), several different factors need to be kept in mind when deciding where to place underground cables. It is important that the surrounding soil has sufficient water-holding properties so that the soil water content will not affect the thermal conductivity. A knowledge of the various physical factors in Iceland which impact underground cables as distinct from surface electric cables is also necessary.

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