

Article

Challenge of Supplying Power with Renewable Energy Due to the Impact of COVID-19 on Power Demands in the Lao PDR: Analysis Using Metaheuristic Optimization

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Abstract: Human activities have been limited by coronavirus disease 2019 (COVID-19), and the normal conditions of our lifestyles have changed, particularly in terms of electricity usage. The aim of this study was to investigate the impact of COVID-19 on the power sector in the Lao PDR in 2020, as well as the challenge of using solar energy to supply power to the network using an optimal approach. The returns on investment of network extension and the purchase of solar energy were also evaluated. Furthermore, load conditions caused by the country's lockdown policy were analyzed. We analyzed the optimal sizing and location of solar energy using a particle swarm optimization method based on the main objective functions, with the system's power loss decreasing and its reliability improved. The results demonstrated that the suddenly reduced load from industry and commercial business did not have a large impact on its operations; however, revenue was reduced. The optimal method for connecting solar energy to a network can reduce power loss and improve system reliability. In addition, we discovered that the location and capacity of solar generation can reduce the investment costs of extensions for new lines, with the surplus power being exported.

Keywords: renewable energy; energy management; power energy; energy resources; optimization; economy

1. Introduction

Coronavirus disease 2019 (COVID-19) widely impacted many sectors around the world [1]. Limitations on human activities were employed worldwide, also known as lockdowns [2]. The power sector had to endure new environmental conditions in terms of operations and planning [3]. Demand progressively decreased because the main loads were suddenly stopped as people were prohibited from leaving their houses [4], with schools and universities operating online [5]. The COVID-19 pandemic slowed the global economic system because the main consumer industries, such as commerce and tourism, were not allowed to operate, with the overall demand for electricity also decreasing [6].

For the power sector in the Lao PDR, power demand and generation were impacted by COVID-19 from early 2020 to 2021 because of the country's lockdown policies. The main activities of people were limited, and industry and commerce grinded to a halt [5,6]. The remaining electricity demand comprised households, which had a small capacity [7]. In

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web f 1 earth s surface is not a single piece of rock instead it is made up of many plates 2 there are many tectonic plates on earth but only about 7 to 12 huge plates the largest include the african plate antarctic plate eurasian plate indo australian plate north american plate pacific plate south american plate 3