

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

Thongsavanh Keekhoungning ¹, Wullapa Wongsinlatam ¹, Tawun Kemsungnen ², Ariya Namwong ¹, Sirote Khunkitti ², Bounmy Inthakesone ³, Apirat Siritaratiwat ⁴, Suttichai Premrudeepreechacharn ^{2,*} and Chayada Surawanitkun ^{1,*}

¹ Center of Multidisciplinary Innovation Network Talent (MINT Center), Faculty of Interdisciplinary Studies, Khon Kaen University, Nong Khai Campus, Nong Khai 43000, Thailand; thong.kkg@kku.ac.th (T.K.); wullawon@kku.ac.th (W.W.); rwanun@kku.ac.th (T.R.); ariyana@kku.ac.th (A.N.)

² Department of Electrical Engineering, Faculty of Engineering, Chiang Mai University, Chiang Mai 50200, Thailand; sirote.khunkitti@cmu.ac.th

³ Head of Research Division, Faculty of Economics and Business Management, National University of Laos, Dongdok Campus, Vientiane 7332, Laos; b.inthakesone@nuol.edu.la

⁴ Department of Electrical Engineering, Faculty of Engineering, Khon Kaen University,

Khon Kaen 40002, Thailand; apirat@kku.ac.th

* Correspondence: suttic@eng.cmu.ac.th (S.P.); chayada@kku.ac.th (C.S.); Tel.: +66-96-819-7551 (C.S.)



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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

Challenge Of Supplying Energy

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Meeting the energy challenge Great Britain: Department for Business, Enterprise & Regulatory Reform, 2008-01-10 The May 2007 White Paper Meeting the energy challenge a white paper on energy Cm 7124 ISBN 9780101712422 set out the Government's international and domestic strategy to address the two main challenges tackling climate change by reducing carbon dioxide emissions and ensuring clean and affordable energy as the country becomes increasingly dependent on imported fuel An online consultation on nuclear power and the role of the private sector www.direct.gov.uk *nuclearpower2007* was produced at the same time This White Paper sets out the Government's decision taken in response to the consultation The Government believes it is in the public interest that new nuclear power stations should have a role to play in the country's future energy mix alongside other low carbon sources that energy companies should have the option of investing in them and that the Government should take active steps to open up the way to the construction of new nuclear power stations It will be for the energy companies to fund develop and build the new stations including meeting the full costs of decommissioning and their full share of waste management costs Section 1 summarises the consultation process Section 2 addresses the key issues that arose from the consultation and how they have been taken into account in shaping policy and reaching conclusions Section 3 outlines the facilitative actions the Government will take to reduce the regulatory and planning risks associated with investing in new nuclear power stations Finally there are three annexes alternatives to nuclear power justification and strategic siting assessment processes regulatory and advisory structure for nuclear power

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