Identifying key influences for planning acceptance of onshore wind turbines

Michael Harper, Ben Anderson, Patrick James, AbuBakr Bahaj

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Abstract

There is a global drive to develop renewable energy power generation to reduce environmental impacts and enhance energy security especially through indigenous resources. Wind energy conversion both on and offshore is one of the most effective technologies to provide sustainable power. In the deployments of such technologies, geographical information systems are extensively used to identify suitable sites for the installation of wind turbines. However, there are concerns that such approaches fail to model site suitability accurately, and in particular fail to account for the difficulties faced in gaining planning permission. This study has explored whether the planning success of proposed wind turbine projects can be predicted using a range of geospatial parameters based on Great Britain as a case study. Logistic regression is used to assess the relationship between appropriate variables and planning outcome. The results indicate that the size of the project, percentage of the local population with high levels of qualifications, the average age, and local political composition emerge as key influences affecting planning approval. To the authors' knowledge, this is the first study which has quantitatively linked regional social and political data to the planning outcome of wind turbines. These findings can help reduce the level of planning issues encountered for proposed wind turbine, improving the accuracy of GIS modelling of wind turbines.

Keywords

Onshore Wind, Logistic Regression, Planning, Demographics, Great Britain, GIS

1 Introduction

Increased environmental concern and issues surrounding security of supply have led to a global drive to develop renewable energy systems. In the European Union, over $40 billion is invested annually in renewable energy technologies (mostly wind and solar) and it is expected to increase by a further 50% by 2020 (UNEP 2016).

Onshore wind power generation is now competitive with fossil energy in many countries and is one of the most mature renewable energy technologies available. However, there are major technical challenges in identifying suitable sites for wind turbine farms. Projects often face strong local opposition, as can be seen from the low acceptance rates of wind turbines in Great Britain, with over 50% of onshore projects rejected (DECC 2016).

A large number of geospatial models have been produced to determine site suitability for wind farms (Atici et al. 2015, Aydin, Kentel, and Duzgun (2010), Baban and Parry (2001), Gass et al. (2013), Van Haaren and Fthenakis (2011), Hansen (2005), Janke (2010), Lee, Chen, and Kang (2009), Miller and Li (2014), Neufville (2013), Noorollahi, Yousefi, and Mohammadi (2015), Sliz-Szkliniarz and Vogt (2011), SQW Energy (2010), Voivontas et al. (1998), Q. Wang, M'Ikiugu, and Kinoshita (2014), Watson and Hudson (2015), Yue and Wang (2006)), but such models are highly sensitive to the underlying modelling assumptions, and there has been limited validation of these models against actual developments patterns. A few studies have aimed to rigorously quantify key influences on historical planning outcomes (Haggett and Toke 2006, Horst and Toke (2010), Rensburg, Kelley, and Jeserich (2015), Toke, Breukers, and Wolsink (2008)), but such analysis has yet to be integrated within a full geospatial model.