Understanding New Landscapes: Support for Renewable Energy Planning

Ian D. Bishop, Department of Infrastructure Engineering, University of Melbourne, Melbourne, VIC, Australia
Sophie Atkinson, Department of Engineering, Centre for Sustainable Development, University of Cambridge, Cambridge, UK

ABSTRACT

The pace of transition to new energy sources, and away from fossil fuels, is as hard to predict as any other impact of climate change. However, it appears inevitable that a transition will be made eventually. In some countries, notably Germany and Denmark, the process is already well underway. In others it is just beginning. This article uses the situation of the state of Victoria in southern Australia to explore the possible extent of landscape change under a move to renewable energy sources, and to explore the key variables and tools for analysis and communication which will identify the consequences and support planning. A scenario for a future level of wind power generation in Victoria is proposed, potential sites identified and then the visual impact of these analyzed, not simply on a case-by-case basis but as a system of facilities across the landscape. People travelling by road, or train, will be particularly aware of the extent to which the change is pervasive and new parameters and representations are proposed for documentation of these dynamic visual landscape outcomes.

Keywords: Energy Landscapes, Green Energy, Renewable Energy, Visual Impact, Wind Farms

INTRODUCTION

A Renewable Energy Future

The possibility of a world in which all our energy needs are met by renewable sources, and specifically Wind, Water and Sunlight (WWS) has been recently proposed, and supported with appropriate analysis, by Jacobson and Delucchi (2011). They argue that all new energy needs could be met by WWS by 2030, while existing energy sources could be converted by 2050. Not all analysts agree and the article and its companion (Delucchi & Jacobson, 2011) were the subject of a critique by Trainer (2011) and a response by Delucchi and Jacobson (2012).

Nevertheless the original analysis suggests that a WWS energy world is possible. Even if we do not go all the way, we will surely need to expand further the use of WWS and the consequences for the landscape should be considered.

In their scenario for the future, Jacobson and Delucchi (2011) propose that wind and solar (specifically roof photovoltaic [RPV], plant photovoltaic [PPV], and concentrated solar [CSP]) energy together would account for 90% of future supply. The scope for new hydroelectricity is fairly low, but used with geothermal can fill some supply gaps. Tide and wave energy systems remain largely experimental. They calculate a requirement for 4 million wind turbines each of 5 MW and about 90,000 PPV or CSP power plants each of 300 MW. This sounds like it would take a

DOI: 10.4018/ijepr.2012100101
lot of space. However, Jacobson and Delucchi calculate that:

If 50% of the wind energy were over the ocean... and if we consider that 70% of hydroelectric power is already in place and that rooftop solar does not require new land, the additional footprint and spacing areas required for all WWS power for all purposes worldwide would be only ~0.41% and ~0.59%, respectively, of all land worldwide (or 1% of all land for footprint plus spacing). (p. 1161)

While this is small, relative to agricultural areas which occupy close to 40% of land worldwide (Ramankutty, Evans, Monfreda, & Foley, 2008), the potential impact is exacerbated by the high visibility of the infrastructure, by the power generators needing to be reasonably close to population centres, and by these places (in which we live) also commonly being our areas of culturally and environmentally important landscapes. Consequently we need to assess the effects in more sophisticated terms than simply footprints.

Objectives

In this article we explore ways to assess the landscape implications of moving to a WWS future. Some environmental effects, such as air and water pollution, would surely be reduced but others including wildlife impacts, noise and aesthetic impacts would likely increase. Here we focus on the visual impacts on the landscape without asserting that these are the only or even necessarily the major concern. A major increase in wind and solar energy infrastructure will both affect more people in their residential situations (albeit at impact levels similar to those experienced by some people already) and also affect people a lot more because of great exposure while travelling around. Bishop (2011) reviewed the considerable research into the visual impacts of wind energy infrastructure. The prior work has however been focused primarily on individual wind turbines and wind farm through model calibration studies using either visual preference or willingness-to-pay studies (Ladenburg & Dubgaard, 2007; Ladenburg, 2010). Apart from the work of Rodrigues, Montañés, and Fueyo (2010) there has been little attempt to develop processes for understanding the aesthetic implications across a wide area or analysis of the experience of someone moving through a WWS landscapes. This requires new thinking and new metrics for assessment of landscape impacts.

The specific objectives of this article are therefore to:

1. Review the existing processes for assessment of visual impact of major infrastructure, such as wind farms, and the assumptions which underlie this analysis;
2. Use a case study to generate impact metrics which can be applied across a whole region, to compare impacts between sub-regions and to evaluate the experience of travel through such regions;
3. Propose policies which might be applied regionally, rather than by individual wind farm proposal, to moderate the visual impacts; and
4. Suggest techniques for better public communication of impacts to support policy implementation.

Outline

In the next section we review briefly the development of visual analysis techniques, especially quantitative computer based technique, we look to prior research for guidance on key analysis parameters and discuss the issues involved in moving from site level analysis of a particular wind farm proposal to consider the broader implications of transition to a landscape in which energy infrastructure is much denser on the ground. We review the many assumptions involved in this process, and make the case for further perception studies to calibrate the models used. After that we propose a specific scenario for a WWS future in Victoria, Australia that includes a 100% transition to electric vehicles and also extensive use of vehicle-to-grid
14 more pages are available in the full version of this
document, which may be purchased using the "Add to Cart"
button on the product's webpage:
www.igi-global.com/article/understanding-new-landscapes/74820?camid=4v1

www.igi-global.com/e-resources/library-recommendation/?id=2

Related Content

Improving Urban Planning Information, Transparency and Participation in Public Administrations
www.igi-global.com/article/improving-urban-planning-information-transparency-and-participation-in-public-administrations/186792?camid=4v1a

Digital Community Planning: The Open Source Way to the Top of Arnstein’s Ladder
www.igi-global.com/article/digital-community-planning/151462?camid=4v1a

From Intelligent to Smart Cities: CoPs as organizations for developing integrated models of eGovernment Services
Mark Deakin (2012). City Competitiveness and Improving Urban Subsystems: Technologies and Applications (pp. 84-106).
www.igi-global.com/chapter/intelligent-smart-cities/60104?camid=4v1a
The E-Citizen in Planning: U.S. Municipalities’ Views of Who Participates Online

www.igi-global.com/chapter/citizen-planning-municipalities-views-participates/43187?camid=4v1a