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"I think we need to get a better generator": Household resilience to disruption to power supply during storm events

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HIGHLIGHTS

- The resilience of UK householders to power cuts due to storms was explored.
- Resilience is achieved through modifying everyday electricity-related practices.
- DNO's should explore how to use community networks to communicate with households.

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ABSTRACT

Electricity is becoming ever more central to the everyday practices of households. As the energy system decarbonises, it is likely that electricity will supply even more services, thereby increasing the dependence of communities on reliable electricity supply. In this situation, the risk of power outages during extreme weather events poses a serious challenge to the safety and wellbeing of communities. However, little is known of the capacity of households to manage normal day-to-day life in such circumstances. This paper focuses on the UK winter storms that occurred in February 2014, the result of which 80,000 homes were left without power and communities not reconnected for several days. We outline the impacts these power outages had on households, describing the challenges faced and the strategies adopted to alleviate impacts. This provides insight into everyday household-level resilience achieved through social and material elements that constitute everyday life.

1. Introduction

The stormiest winter for two decades[1] saw a series of storms hit the UK between December 2013 and February 2014, causing coastal and inland flooding and high winds which damaged electricity networks, both directly and from flying debris. In December, more than 2 million customers lost electricity; 1 million lost power for more than 3 minutes and 16,000 were without electricity for 48 hours (Office for Gas and Electricity Market (Ofgem), 2014). In February 2014, 100,000 homes and businesses lost power following storms on the 12th of the month. Although UK weather is highly variable, the intensity and frequency of these storms was exceptional and storm tracks fell in lower latitudes causing severe gales in the South and West of the country.[2] Whilst such a period of extreme weather cannot be directly attributed to climate change, its impacts are recognised as presenting a risk to the future resilience of electricity infrastructure (McColl et al., 2012).

UK electricity networks are very reliable on a day to day basis; for example the reliability of the transmission network was 99.99987% in 2014/15 (National Grid, 2015) although, as the winters of 2013/2014 and January 2015 showed, they are vulnerable to the weather. Widespread disruptions have occurred as a consequence of wind storms in 1987, 1990, 1997, 2002, 2013, 2014 (Energy Networks Association (ENA), 2011) and 2015; wind also

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[1] http://www.metoffice.gov.uk/climate/uk/interesting/ 2014-janwind accessed 20th May 2014.

[2] The Recent Storms and Floods in the UK; February 2014; The Met Office.

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caused transient faults or the tripping of circuits during storms or due to blowing debris on a daily basis (National Grid, 2014). Whilst technical assessments often follow a power outage, there has been little research to understand the consequences of power cuts for those affected. This paper aims to fill this gap by exploring how householders who lost power during winter storms in February 2014 coped with the power outages. The paper briefly reviews existing research in this area, before moving on to consider the context of everyday electricity consumption. In Section 2, we present the methodology; the results in Section 3, followed by a discussion. The paper concludes by considering the significance of the results from an energy policy perspective.

1.1. Power outage research

Blackouts are prevalent across the globe, from China and the United States, to developing countries in Asia, Africa and South America, according to Byrd and Matthewman (2014) who conducted a review of power outage events reported in the media. Focusing more on a European context, research with households who have experienced power outages has been conducted in Finland (Silvast, 2008) and Sweden (Palm, 2009), where the outages were caused by storms, and in the Netherlands, where households were left without power for 3 days in winter due to a military accident affecting power lines (Helsloot and Bareens, 2009). These papers describe how most householders had alternative means of lighting and, to a lesser extent, cooking and heating in their homes; although this helped them to cope with the power outage, equipment was not kept specifically as a precaution against such events. For those living in rural areas, where every winter storm caused power outages, these were regarded as manageable and people had developed coping strategies (Silvast, 2008; Palm, 2009). Personal skills and mutual aid, for example providing food, were important, although Palm (2009) highlights the informal nature of this aid, suggesting that officials could make more use of such networks for communication and support. In particular, Palm (2009) identifies a communication mismatch, with electricity companies posting information on the Internet but local people seeking information via the media or phone. Knowing how long an outage may last, and enabling people to plan for the situation (Helsloot and Bareens, 2009), is particularly important. On a positive note Silvast (2008) highlights that many people enjoy the atmosphere of a power cut, particularly lighting candles, a finding echoed in other research (Devine-Wright and Devine-Wright, 2009; Yuill, 2004). For example, Yuill (2004) described the extensive black-out in New York in 2003, where his "reflective and reflexive" account and impressions were grouped into four distinct areas: a heightened sense of being, an absence of panic, a sense of 'keeping things ticking over' and the presence of mutual aid. Although he attempted to triangulate his personal experience of the power cut with data from other sources, his remains an individual account and hence it is not possible to tell the extent to which others shared his experiences.

In the UK context, Devine-Wright and Devine-Wright (2009) conducted discussion groups in contrasting locations of urban Leicester and a small Scottish community, where plans to upgrade power lines to a wind energy site meant that electricity was high on the local consciousness. The issues emerging from the discussions were further explored using a national online survey, which found weather to be the second most commonly identified cause of a blackout (15.4%), the most common being excess demand for electricity (18.5%); terrorism was third (15.2%). Power cuts were deemed to have both negative (bad for the image of the UK) and positive impacts (helping each other out and an absence of light pollution), depending on the length of the outage. Following power outages in London and Birmingham in 2003 that were due to technical faults, Brayley et al. (2005) conducted a survey to explore perceptions of blackouts. Although these prompted extensive media discussions at the time, the survey was conducted 18 months later and memories had faded. Research participants identified possible terrorist activity, a lack of investment, and past and present political decision-making as the potential causes of outages. When presented with blackout scenarios, interviewees were surprised at the possibility of such extensive blackouts and the scale of the resulting problems, and felt that swift reconnection of workplaces was prioritised over homes.

However our knowledge of how households manage their normal day-to-day life when faced with power outages remains limited, particularly in the UK. Understanding these coping mechanisms is important given the extent to which electrical services are pervasive and taken for granted, in some cases becoming invisible. The expectation is that this could leave residents ill prepared in the face of disruptions to power supplies caused by extreme events.

1.2. Electricity and everyday life

Electricity is becoming an ever more essential part of diverse everyday practices and economic activities; living and working without electricity is inconceivable to many. As the energy system is decarbonised, it is likely that electricity will supply more services, including heating and transport (Department of Energy and Climate Change (DECC), 2011), thereby increasing this dependence on a reliable supply of electricity. Electricity demand may rise in the future as an increase in cooling, as well as the electrification of services, places increased pressure on electricity networks.

In this context, power outages caused by network failures or extreme weather events pose a serious challenge to homes, businesses and communities, compromising their ability to function normally. Moreover, climate change impacts and increasing intermittent generation from renewable sources present challenges for maintaining the reliability of electricity services (National Grid, 2011). An increased likelihood of power cuts would result in an added level of vulnerability as societies become more reliant on electricity services, leading to wider disruptions and cascading effects and the failure of other services that rely on electricity (Graham, 2009). Thus, thinking about how society might respond to these challenges is crucial to ensure the safety and wellbeing of households and individuals.

A growing body of research has examined the resilience of power systems under a variety of challenges, for example in the context of disasters, such as the terror attacks of the 11th of September 2001 in New York (Mendonça and Wallace, 2006). Other studies have confirmed the impact of weather conditions on the daily operation of electricity service infrastructures (Yu et al., 2009), indicating the importance of being able to anticipate potential power system failures and identify effective mitigation strategies. Linnenluecke and Griffiths (2010) explored the impacts of extreme weather on businesses and industry sectors, highlighting the need for new approaches to understand and incorporate the impacts of climate change, including the increased impact of weather extremes, on businesses, organizational decision-making and corporate strategy. Also focusing on extreme events, Klinger et al. (2014) reviewed reported impacts on health from loss of electricity services during extreme events, revealing how integral electrical power and its supply are to essential services. This work, and other research mentioned earlier, demonstrate the extent to which the failure of the electricity network as a socio-technical system impacts on social systems which depend on it – homes, villages, towns etc.