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Spaces for sustainable innovation: Solar photovoltaic electricity in the UK

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ABSTRACT

This paper engages with recent research concerning the roles of niche spaces in the strategic management of sustainable innovations. Whilst a growing body of empirical investigation looks to developments within these spaces, it is surprising how little pauses to consider how the spaces themselves develop over time, what constitutes these spaces, and how their characteristics influence sustainable innovation. We explore such questions through a case study into the history of solar photovoltaic electricity generation over the last 40 years in the UK. Whilst we see evidence consistent with recent ideas about niche spaces shielding, nurturing, and empowering sustainable innovation, the main thrust of our analysis concludes that this arises in contested and compromised ways. Moreover, our analysis identifies niche space developing through the political ability of technology advocates recursively interpreting, representing, and negotiating between the content and contexts of innovation.

1. Introduction

After decades of fitful support and development, the generation of electricity from daylight using solar photovoltaic systems (PV) recently underwent a boom in the UK. Installed PV capacity grew from 26.5MWp in 2009 to 594MWp in 2011 [1]. Growth was underpinned by an above-market price guarantee for solar electricity, regulated through a Feed-in-Tariff (FIT) policy introduced by the Labour government in April 2010.

Rapid uptake under the FIT 'subsidy' alarmed the newly-elected (May 2010) Conservative-Liberal Democrat government. Influential sections of the mass media were becoming critical about 'green taxes' on rising energy bills during a time of economic difficulty. Concern reached such a pitch that Secretary of State for Energy Chris Huhne announced early, unscheduled tariff reductions and a general review of the FIT system. In response, a coalition of PV firms, installers, politicians, and PV investors (including households, community groups, and businesses) mounted a campaign to resist the proposals. All parties agreed PV costs were falling — thanks to cheaper components, learning and scale economies, and competition amongst installers. But projected trends were contested. Debate centred on what depth, timing, and character of FIT reform was reasonable, based upon different assumptions about the prospects of PV development in electricity systems and markets whose future structure was also uncertain.

Government cuts went ahead, but less sharply than originally envisaged. In the interim however this controversy cast uncertainty over PV development. Despite media-reported cost concerns, PV remains a popular technology in public surveys[1] and as evidenced by the take up of the FIT. In response, the Department of Energy and Climate Change (DECC) "appears to be bowing to general pressure from industry and NGOs" [2]; and in May 2012 government announced their updated Renewable Energy Roadmap will include solar PV, and that up

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[1] A survey of 2121 representative households by the Department of Energy and Climate Change in March 2012 found 83% support for solar (DECC, 2012).

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to 22GW by 2020 is an 'achievable ambition' (DECC 2012, Press Notice 12/066). This is in stark contrast to positions prior to the FIT controversy, which made no specific provision for PV.

This episode reminds us that political debate about the roles and performance of technology are important for their future development [3]. In this paper we analyse how shifting debates over more than four decades about PV technological prospects helped open up (or close down) the 'spaces' available for PV innovation in the UK, and how the characteristics of those spaces influenced the developments that arose (and whose consequences were drawn upon in subsequent debates).

In analysing PV in this way, the paper engages with salient ideas about 'niches' and 'protective spaces' in the research literature on innovations for sustainable development, i.e. innovation with the potential to contribute towards more sustainable systems of production and consumption (section two). We suggest an approach that subsequent comparative research can use to address more general theoretical issues about the social construction of 'protection' in the research literature on 'strategic niche management' for sustainable innovation [4][2].

Our paper consequently addresses the following questions:

1. How did PV develop in the UK over the last four decades?
2. What implications can be drawn from this study for better understanding the dynamics of spaces for PV innovation?

Section two elaborates the background theory regarding niches for sustainable innovation, and elaborates our analytical interest in protection and PV development. Section three explains the methodology we used in studying PV. Section four presents our results in the form of an historical account of the development of PV in the UK. This is followed by analysis in section five about protective niche spaces and PV innovation, including a discussion on generalizability. Conclusions are drawn in section six.

2. Theoretical background: spaces for sustainable innovation

The innovation systems literature attributes innovative success to an ability of firms, policy-makers and others to link systematically knowledge, capabilities, resources, and markets [11]. Any successful innovation milieu – whether national, regional, sectoral, or technological – is explained by the forming of systems [12–16]. But what happens when neither policy nor commercial interest exists in building effective innovation systems? What strategies are available to aspiring technology developers who are weak, not well connected, and who fail to dislodge vested interests? How do innovations that are promising from the perspective of societal goals, such as sustainable development, develop in situations where those expectations are neither widely shared nor institutionalised amongst investors, policy-makers, and markets? Such was the situation for PV in the UK for decades. The short answer to these questions is that the innovation will fail because a system cannot develop — as diagnosed for PV in the Netherlands [17,18].

But perhaps this answer is too hasty? Even successful innovations suffer difficult periods; whilst 'hopeful monstrosities' can struggle for decades [19]. A second literature in sustainable innovation – strategic niche management – draws attention to the construction of 'protective spaces' where sustainable innovation can be initiated in the absence of fully-developed systems [20]. However, analytical attention tends towards technology development *within* niche protective spaces, and under-investigates *the provision of protection itself* [7]. Our approach to studying PV in the UK here is to address this neglected provision of protective space.

2.1. Spaces for sustainable innovation

Strategic niche management notes repeatedly show technologies that are promising on the grounds of environmental (and social) sustainability, can nevertheless be at a distinct disadvantage in the context of incumbent technologies and their associated institutions (including markets) and infrastructures. The development of the latter arose without sustainability finding full expression in more powerful economic and other criteria. In evolutionary terms, incumbent systems, such as large-scale, centralised, fossil-fuel electricity generation, constitute more structured and structuring 'socio-technical regimes' that present unfavourable selection environments for sustainability novelties like PV. As such, strategic niche management argues sustainable innovations need 'niches' in which to develop initially. Niches are defined in the literature as 'protective spaces' where real world experimentation and development of sustainable technologies can take place and supportive constituencies can be built [6]. Niche protective spaces shield the innovation against premature rejection by incumbent regime selection pressures, until the innovation is proven to be sufficiently robust to compete and prosper in unprotected market settings [5,6].

Market niches have long been recognised as providing limited yet commercially viable opportunities for technologies to find customers willing to pay (typically higher) prices for the new technology (and whose performance is usually poor compared against customary criteria of incumbent technologies). Here, we might think of green electricity consumers willing to pay higher prices for solar photovoltaic electricity, compared to the lower prices of conventional power stations. However, strategic niche management argues that in the case of sustainability, 'technology niches' need to precede or augment market niches. Technology niches are deliberately created protective spaces that seek to improve a cleaner technology through processes of social learning, expectation development and networking, so that its chances of diffusing (via market niches) into wide-spread, application are enhanced [6]. In addition to the support that users and suppliers give to niche technologies, public policy measures such as product subsidies, investment grants and preferential treatment in legal frameworks are mentioned as ways to intentionally shape technological niches.

[2] This paper is part of an ongoing ESRC-NWO research project in which solar PV is compared with off-shore wind energy and carbon capture and sequestration in the UK and the Netherlands. Hence, PV in the UK is the first case study in a series of six. Pointing to the construction of protective niche spaces in this way extends the policy considerations of 'strategic niche management' to include the conditions for its own implementation (though this is beyond the scope of the paper here).