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# Black-boxing the Evidence: Planning Regulation and Major Renewable Energy Infrastructure Projects in England and Wales

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## ABSTRACT

How does a regulatory regime cope with the demands of being evidence based? Given the contestation and uncertainties associated with knowledge claims, what are the processes at work? This paper addresses these questions in the context of a relatively new planning regime concerned with consenting major infrastructure projects, focussing on renewable energy. The paper adopts a Science and Technology Studies perspective, showing how black-boxing plays a key role in establishing knowledge-claims that can support regulatory decision-making. However, it also shows how black boxes do not stay closed and, hence, there is a need for other means of closing down debate.

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## Introduction

Planning systems frequently state that they aim to be evidence-based (Davoudi, 2006; Marston & Watts, 2003), but we still lack sufficient understanding of how contested knowledge-claims are handled within planning processes and how they come to stand as sufficient evidence for planning decisions to be taken. Here we focus on a relatively new planning regime, the Nationally Significant Infrastructure Projects (NSIPs) regime initiated in 2008 to handle the development consent process for major infrastructure projects in England and Wales. There are a number of reasons for considering this new planning regime. First, it is currently dealing with substantial infrastructure projects likely to change the socio-economic and physical landscape of the country. Second, among these infrastructure proposals are a range of renewable energy projects, which will play a key role in enabling the UK to meet its commitments under the Climate Change Act 2008 to reduce carbon emissions by 57% on 1990 levels by 2030 and 80% by 2050. Third, this regime may prove to be more widely significant. It is possible for residential development ancillary to an infrastructure project to be considered within the regime, and developers can also apply to central government for a direction that major business and commercial projects be dealt with by the NSIPs regime. Fourth, there could be more general lessons for evidence-based planning and regulation, particularly as fast-track approaches are being implemented in a growing number of countries.

The paper examines how the NSIPs regime operates and, specifically, how it transforms knowledge-claims into evidence as a basis for deliberations, recommendations and ultimately regulatory

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decisions. It concentrates on major renewable energy (RE) projects, which take a variety of forms. Wind farms – particularly offshore – feature prominently, but there are also biomass plants, energy-from-waste centres and innovative technology such as tidal energy. These RE projects are large in scale and complex, and they are likely to generate considerable impacts in three broad categories. First, the socio-economic effects on local economic sectors (typically agriculture, fisheries and tourism), and on the local economy and population more generally. Second, the visual and heritage impacts of the infrastructure judged in the context of existing landscapes and seascapes. Third, the ecological impacts of such infrastructure and associated works, including *inter alia*: terrestrial flora and fauna; for wind projects, the impact on birds in flight; and for sea-based projects, concerns about marine populations.

There remain considerable uncertainties as to the extent and significance of these impacts (Masden et al., 2015), and yet the regulatory regime is called upon to consider whether the impacts are sufficient to justify refusal of development consent, given that national policy has emphasised the need for such projects to be prioritised (DECC, 2011a). Evidence concerning the assessment of these impacts and how they might effectively be mitigated is a key focal point within the operation of the regime. The analysis here takes a Science and Technology Studies (STS) perspective agreeing with Jolivet and Heiskanen that STS is particularly suited to studying “how public decisions are made in an uncertain world” (2010, p. 6748). The discussion, therefore, emphasises contested processes of constructing, warranting and closing down knowledge-claims in response to this uncertainty, and it pays particular attention to how knowledge of potential impacts, including mitigation measures, is constructed as evidence within the NSIPs regime.

The paper begins by outlining the specific institutional arrangements of the NSIPs regime. It then sets out the STS framing of the research and how this influenced the methodologies deployed. The empirical analysis draws on research into 12 major RE projects that have been through the regime. The paper then looks at the ways that evidence is framed and considers how disputes over evidence arise and are then closed down. Such ‘closing down’ is necessary to make the world ‘judgement-compatible’ (van Oorschot & Schinkel, 2015) for the regulators. The final conclusion pulls together the analysis and considers the implications for evidence-based planning and for the treatment of knowledge-claims put forward by local actors.

## Regulating Major Infrastructure Projects: The NSIPs Regime

The Planning Act 2008 introduced the NSIPs regime for regulating development consent orders (DCOs) on certain major infrastructure projects. There are thresholds for determining when a project counts as ‘major’; for energy generating stations this was set at 50 Mw onshore and 100 Mw offshore. The Act provided for an Examining Authority (ExA, comprising an individual or a Panel) from the Planning Inspectorate (a government agency) to examine these cases. The ExA then makes a recommendation to the relevant Secretary of State, who takes the final decision. This regime thus takes these cases out of the remit of the local planning system (although all onshore wind farms in England were returned to local planning control in 2016.<sup>1</sup>)

The NSIPs system was established in response to criticism of the planning system from some quarters for its lack of speed and openness. The new system “is intended to provide a more efficient and transparent decision-making framework which will facilitate the construction of the kinds of new energy infrastructure which we need” (DECC, 2011b, p. 11; but see Marshall & Cowell, 2016 for a critical analysis). It consists of a number of strictly time-limited stages: acceptance of the application (28 days);

examination (6 months); report writing including recommendations (3 months); and final decision (3 months); any legal challenge must be brought within 6 weeks.

The examination is the key stage at which evidence about potential impacts is presented to the ExA and debated. This process comprises a mix of document exchange, public hearings and site visits (accompanied and unaccompanied). The ExA is in charge of how the examination proceeds and may ask rounds of questions to various parties, as well as establish a programme of hearings of different types. The examination is recorded in the ExA report, which is extensive and sets out the reasoning by which the ExA came to their conclusions and recommendations. ExAs are guided in their deliberations by National Policy Statements (NPSs).

The NSIPs process is supposed to be evidence-based (DCLG, 2014). This evidence can take a variety of forms, for example, the developer is under an obligation to conduct an Environmental Assessment (EA) and submit an Environmental Statement (ES), and local authorities may also submit a Local Impact Report (LIR). Other evidence is submitted during the examination, in response to questions from the ExA or offered by Interested Parties as the discussions develop. The ExA's discretion on assessing the evidence is emphasised throughout policy and guidance, and the aspiration is that the ExA will adopt an inquisitorial approach, rather than permitting too adversarial an engagement between parties.

The examination is thus a key point at which knowledge-claims are constructed and warranted as relevant evidence. A variety of actors and artefacts come together in processes of knowledge validation, and these processes are captured in the ExA's report. The ExA's report becomes the legitimized account of what is valid knowledge and what is not; what counts as evidence and what does not; which evidence is deemed sufficient to influence decision-making and which fails. Hence these reports have featured prominently in our methodology and associated conceptual framing of the research.

## An STS Perspective on Constructing Knowledge and Evidence

STS is centrally concerned with the nature of knowledge and the socio-material processes by which such knowledge is constructed. Framing the 'problem' of knowledge in this way challenges the idea of science holding a mirror up to nature and reflecting the objective reality of the world (Latour, 1999). STS sees such knowledge as created through specific institutions which have their distinctive ways of bringing together social actors and material elements. This has produced fascinating studies of laboratory life (Latour & Woolgar, 1998), socio-scientific innovations (Latour, 1988) and environmental change (Callon, Lascoumes, & Barthe, 2001; Wynne, 1996). But this perspective has also produced insights for considering knowledge in the context of planning systems. Studies have, for instance, examined knowledge in environmental policy (Collins, Cowell, & Flynn, 2009; Cowell & Lennon, 2014; Dunlop, 2014), spatial planning (van Broekhoven et al., 2015), and energy infrastructure decisions (Aitken, 2009; Kerr et al., 2014). In these politicised contexts, the focus is on occasions of conflict and contestation, because knowledge in planning contexts is rarely unitary or certain (Alexander, 2008; Rydin, 2007). Where regulatory decisions have to be taken, this can be problematic.

The specific demands put on scientific knowledge by regulatory systems have been explored by Jasanoff (2015), who argues that regulation requires 'serviceable truth' which satisfies the scientific community and supports reasoned decision-making, but does not demand impossible standards of scientific certainty. In related work, Hunt and Shackley (1999) coin the term 'fiducial science' to describe knowledge-claims produced as a service to others (such as regulators), where there is an emphasis on trust in the knowledge and on creating closure in uncertain and contested arenas. The contested mix of knowledge-claims arising from uncertainty has to be reduced so that it can provide the basis for

the regulatory decision; in the context of judicial decision-making, van Oorschot and Schinkel (2015) refer to this as rendering the world 'judgement-compatible'.

When considering how knowledge can be made appropriate for these demands of the regulatory system, it is helpful to distinguish between the construction of knowledge-claims and the dynamics by which they are warranted and confirmed as legitimate, or rejected and discounted (Rydin, 2007). This process of selective warranting in regulatory contexts involves attention to how debates about knowledge-claims and evidence are closed down. STS uses the concept of 'black-boxing' to suggest one way that debate on knowledge-generation processes is ended, by locking the details of the contestable process of construction inside the box, dispensing with debate about this process and instead focussing on the outputs. The Latourian use of this term (Latour, 1987, 1999) sought to represent the success of science in establishing a consensus, and the focus is thus, in the context of scientific institutions, on black boxes being not just closed but sealed.

However, here the focus is on a regulatory context and the way that agreements on aspects of knowledge are sought within that context. Black-boxing is not always readily achieved; evidential claims can be contested both by the ExA and other actors. The ExA can, and probably will, exercise their inquisitorial aspirations through questioning. In addition, there are likely to be conflicts with other actors (NGOs, statutory bodies, individuals and local groups) who may disagree with specific knowledge-claims or have wider concerns about the development proposal that they are expressing (perhaps tactically) through disputes over knowledge-claims. Numerous attempts may be necessary for contested knowledge to become fixed within the regulatory regime, involving a variety of strategies.

STS approaches also draw attention to the role that certain artefacts play in constructing, circulating and attempting to black-box knowledge-claims. Such artefacts can take many forms, but the role of paper – files, reports, images, etc. – and virtual online equivalents are particularly important within planning and regulatory regimes. This echoes Latour's study (2002) of law-making in the French context, where he follows such artefacts around the Conseil d'État; similarly Hull's study (2012) of bureaucratic decision-making in Pakistan shows how the circulation of chits constitutes regulatory practice in that context. From this perspective, planning regulation can be conceived of as the 'circulation of artefacts'. These artefacts may take the form of representations from interested parties, as well as standardised/required documents such as the ES or LIR. They may be the draft DCO, an associated Section 106 agreement (between the developer and the local authority ensuring off-site mitigation measures), or a Statement of Common Ground, emphasised below. Knowledge-claims are presented within artefacts such as the ES and also its numerous constituent elements (modelling exercises, visualisations, survey results, forecasts, etc.).

Thus the STS-framing of the research emphasises the constructed and multiple nature of knowledge-claims, the contestation involved in selectively warranting them for the purposes of regulatory decision-making, and the central role of black-boxing involving key artefacts in seeking to close down disputes.

## Methodology

The research presented focussed on analysis of 12 RE cases that had been through the NSIPs regime (see Table 1). As of September 2015, there were 15 major RE cases that had done so; three offshore wind farms were excluded to produce a manageable sample size, on the basis that they replicated issues within the sample. For brevity, each case is referred to by its location. Non-wind cases were included

**Table 1.** Renewable energy infrastructure case studies.

Cases	Applicant	Scale
Kentish Flats Extension to Offshore Wind Farm	Vattenfall Wind Power Ltd	10–17 turbines; 90–141 MW
Galloper Offshore Wind Farm	Galloper Wind Farm Ltd (joint venture between RWE Innogy UK and SSE Renewables)	Max 140 turbines; 504 MW
Burbo Bank Extension to Offshore Wind Farm	DONG Energy Burbo Extension (UK) Ltd	Max 69 turbines; 259 MW
Rampion Offshore Wind Farm	E.ON Climate and Renewables UK Rampion Offshore Wind Ltd	Max 175 turbines; 700 MW
Walney Extension to Offshore Wind Farm	DONG Energy Burbo Extension (UK) Ltd	207 turbines; 750 MW
Triton Knoll Offshore Wind Farm	Triton Knoll Offshore Wind Ltd	288 turbines; 1200 MW
Navitus Bay Offshore Wind Farm	Navitus Bay Development Ltd (joint Venture between Eneco Wind UK Ltd and EDF Energy)	Max 194 turbines; 970 MW (plus Turbine Area Mitigation Option)
Brechfa Forest West Wind Farm	RWE Npower Renewables Ltd	Max 28 turbines; 84 MW
Clocaenog Forest Wind Farm	RWE Innogy UK Ltd	Max 32 turbines; 96 MW
Swansea Bay Tidal Lagoon	Tidal Lagoon (Swansea Bay), Tidal Lagoon Power Ltd	240 MW
North Blyth Energy-from-Biomass Plant	North Blyth Energy Ltd	99.9 MW
Rookery Energy-from-Waste Plant	Covanta Rookery South Ltd	65 MW

to test the specificity of this technology; however, the patterns found extended across the different technologies covered in our research.

The first stage of empirical investigation involved the detailed reading and coding of documentation held on the Planning Inspectorate's website for NSIPs. The NSIPs website provides a wealth of documentary material. Particularly important are the ExAs' reports, key artefacts moving between different institutional locations and carrying the knowledge-claims that are warranted as significant 'evidence' within them. The reports have to bridge the organisational world of the Planning Inspectorate, the examinations involving many stakeholders (during which they are partially drafted), the political world of the relevant government department and the legal world, since the decision may be challenged in the courts.

Thus the way these reports construct and warrant knowledge-claims has wide significance. For these reasons, ExA reports had particular prominence within our methodology. They were the main focus of data collection and analysis in the first stage of the project, together with supplementary reading of LIRs and ESs. The ExA reports for our 12 cases were coded using some 119 codes under the five headings of actors, impacts, evidence, deliberative processes and mitigation. The desk-work was conducted in NVivo and tested through blind re-coding of randomly sampled text extracts by two coders; the coding proved robust and replicable. Code runs were then iteratively undertaken to build up the analysis: the initial runs selected extracts for close reading, which then suggested possible patterns and lines of analysis; this led to further code runs, and so on. Such coding was exclusively of textual material; the ExA reports refer to quantitative and visual artefacts, but do not reproduce them, focussing instead on the rationalisation of conclusions.

Later stages of the research comprised a series of focus groups with local participants for eight of the cases (plus a 'control case' in London); again transcripts were coded in NVivo. Supplementary research was conducted: an online survey with local participants in the 12 cases, and the 'control': interviews and workshops with developers, ExAs, community facilitators and national NGOs, interviews with key actors in the Navitus Bay case where consent was declined; and attendance at two hearings, a public exhibition, and a site visit on three 'live' cases. This material was used to check and support the analysis.

It should be acknowledged that this is ‘small-n’ research, looking at a sufficient number of case studies to understand the patterns involved in such regulatory practice. Such ‘small-n’ research does not provide rich stories of individual cases nor summary descriptive statistics; but it does allow for greater generalisation than one or two cases offer, at the same time as providing more insight into the intra-case dynamics than summary quantitative data (Blatter & Haverland, 2012). Our coding-based analysis (thematic not discourse analysis) allowed emerging patterns across cases to be iteratively explored through repeated codes runs, initially exploratory in nature and then becoming more focussed on common issues and themes across the cases. Throughout we were very much aware of the nature of the ExA reports as rhetorical devices, which exist in order to justify the recommendations made for the regulatory decision; indeed we were interested precisely in this justification and how it related to knowledge-claims. In the following analysis, we identify common patterns from across the 12 cases; and then illustrate this through discussing specific aspects of contestation in individual cases using quotes from ExA reports (unless other sources are indicated).

### Evidence as Technical Expertise: Framing

A first important feature to note is the preference for warranted evidence to be framed in terms of accredited technical expertise. This applies across all types of evidence – ecological, landscape or heritage, socio-economic – but it is particularly apparent where the potential impacts of a wind farm on bird, fish, and other marine populations are discussed. Here modelling is relied on to assess bird collision mortality and dispersion of marine populations due to offshore construction activities. This is combined with population modelling for different species and, further, the cumulative impact of one RE project is then projected alongside other projects. A typical example of the way knowledge-claims are then framed can be found in the Kentish Flats case:

Estimation of the cumulative impact for the existing, under-construction and planned wind farms within the [designated bird protection area] is problematic. Based on the ‘worst case’ in-combination interaction value of 25.4% or 1585 birds (including the effects of Kentish Flats and the [extension] project), a mortality range of 30–60% could mean additional ‘worst case’ annual mortality of between 476 and 951 of the citation population of 6466. The red-throated diver is a long-lived bird with a relatively slow rate of breeding. For this reason the population would be unlikely to be maintained in a favourable condition if that rate of displacement-related mortality was sustained over a period of years. (S. 6.4)

Here an ornithological knowledge claim about a specific bird species is combined with quantitative figures for “interaction value” and “mortality range”. An assumption is made about the period over which “displacement-related mortality” will be sustained and modelling outputs are given to the nearest unit. Finally, a conclusion is drawn about the scale of the impact to feed into decision-making.

But evidence on other kinds of impact is also presented as technical expertise despite its arguably more subjective nature. Landscape and seascape assessment proceeds through a complicated set of procedures undertaken by designated consultants, identifying Zones of Theoretical Visibility (or similar nomenclature), viewpoints and receptors and then considering, often using computer-generated visuals, the impact of the yet-to-be-built project. While socio-economic impacts typically receive less detailed consideration and are based on less substantial evidence-bases (Rydin, Natarajan, Lee, & Lock et al., *in press*), nevertheless the evidence is presented as technical in the form of data from surveys and/or demographic and economic statistics, extrapolated in various ways to suggest impact.

Such evidence is presented as accredited and justified by reference to guidance documentation. Methodologies for formulating the technical or expert knowledge are rendered explicit in the ways described by Nonaka (1994), suggesting methods and approaches alongside benchmarks and

standards. More or less 'official' approval of particular approaches lends weight to those approaches, which are given authority and legitimacy by the (presumed) authority and legitimacy of the body providing the guidance. This is perhaps most obvious in respect of guidance endorsed by central government through the NPSs. For example, NPS EN-3 gives a strong steer on using the Energy Technology Support Unit's 'ETSU-R-97' conditions for assessing noise and vibration in relation to wind farms and this is frequently cited in ExA reports. But there is a wealth of other guidance produced by a variety of national and international agencies and professional bodies that is relied on to validate the methods for producing knowledge-claims of different kinds, from the assessment of civil and aviation defence impacts (Rampion) to the planning of piling during the herring spawning season (Walney). Sometime references to multiple guidance documents emphasise support for evidence.

As Jasanoff (2015) and Hunt and Shackley (1999) emphasise, the purpose of such technical evidence does not lie in the generation of knowledge for its own sake but rather to enable regulatory decision-making. So, these knowledge-claims undergo a transformation, reduced to sets of classifications about the scale of significance of the impacts. This is part of the rendering of the world 'judgement-compatible' (van Oorschot & Schinkel, 2015), as in most cases only very significant impacts will outweigh the presumed need for the projects. This transformation of complex knowledge-claims into black-boxed categories of significance is necessary to enable the move from the context in which modelling is undertaken and debated, to the deliberations of the NSIPs process over significance, and then to decision-making within a central government department.

In this context, claims put forward by local residents and NGOs that rely on less formal knowledge, and do not meet the standards for technical framing of knowledge-claims provided by other actors, may not fare well. In the Brechfa case, a local resident offered a sleeping log in relation to noise impacts, which was noted, but did not count as evidence: "I have no robust evidence as to how often the main adverse impacts reported by the community arise." (S. 4.107). Similarly in the Rookery South project, observations by local people were not seen as important evidence. In some cases, local environmental groups may be able to offer evidence that is considered to be in the appropriate form. In the case of Rampion, the impacts on seahorses, a nationally protected marine species, were debated. According to desk-studies, two species (the short-snouted and the spiny) over-wintered in the area of the proposed wind farm. However, accepted uncertainty led to the applicant working with the Seahorse Trust and "local experts to refine the data on seahorse ecology and to include a more comprehensive evidence based assessment" (S. 4.176). This enabled the conclusion that the spiny seahorse was "no more than an occasional vagrant to the development area" (ibid).

Such local expertise may not always be accepted. In the Navitus Bay case, local NGOs claimed that local experts on ornithology had been insufficiently consulted even though they could offer a baseline bird survey; local residents in interviews reiterated that: "local people have the local knowledge". However, the expert agency, Natural England (NE) and the developer saw engagement with such NGOs as part of wider mandatory community consultation, rather than a way to gather important technically-framed knowledge to inform deliberations.

### **Evidence as Technical Expertise: Persistent Contestation**

The second key feature is the extent of contestation about knowledge-claims within the NSIPs process. This is partly due to the inquisitorial aspirations of the system which emphasise the role of the ExA in testing the evidence in order to determine if it is robust enough. It is also partly due to the politicised nature of NSIP projects, and the uneven distribution of costs and benefits that can give rise to local



opposition. Such opposition is likely to take the form of contesting the evidence put forward in support of the project. Thus in the Navitus Bay case, where local parties were highly organised in opposition, local residents were vocal on the alleged limitations of the ecological modelling; one interviewee said that “we were taking a hell of a risk on something we don’t know anything about”, citing the old adage of ‘garbage in, garbage out’. Challenge Navitus, the umbrella organisation set up to represent local communities, argued that the survey methods in the ES did not meet industry standards and, in interviews, a local resident described the sampling for surveys as “sparse” and related how they had to demand that specific surveys were done (e.g. for bats).

The extent of contestation within the NSIP deliberations and represented within the ExA reports essentially derives in part from the uncertainties associated with many of the knowledge-claims and the resulting tension between the need of the regulatory system for robustness and certainty, and the nature of the evidence often put forward. Thus it is not just local opponents who engage in such challenges; national NGOs and expert agencies, such as the Environment Agency or Natural England (NE) were also involved in debating scientific evidence. The Walney case provides a typical example. The Environment Agency and the applicant disagreed, through two rounds of written questions and an issue-specific hearing, on the impact of underwater noise from piling on salmonid smolt. Both agreed that “distinct evidence is lacking in some areas” (S. 4.100) and the ExA also acknowledged “that there are clearly some areas of uncertainty” (S. 4.104), particularly on the route of migrating salmon and the behavioural response of smolt to underwater noise. The Marine Management Organisation (MMO) consulted the fisheries and aquaculture experts, Cefas, and they advised that the noise would not inhibit migration. In the Navitus Bay case, there was also discussion of the impact of piling on salmon migration. This depends partly on the sensitivity of the hearing of fish, but it was made clear that there is hardly any scientific knowledge on this. NE argued, on the basis that only a small geographical area was affected, that there was unlikely to be an impact at the population scale. They had little idea whether salmon would be affected by noise in this area, but it was a small area relative to the area occupied by the whole salmon population, and so could be disregarded.

Such uncertainty extends to non-ecological evidence also. It is notable that evidence on socio-economic impacts is often sparse (Rydin et al., *in press*), but nevertheless it can be critiqued for its inadequacies. In the Navitus Bay case there was more discussion of such impacts than in many cases; one local resident “suggested that those who had used the surveys as evidence of serious tourism impacts had ignored their methodological limitations and [the resident] provided a detailed critique of the figures produced by Bournemouth BC in their LIR.” (S. 12.2.63). More fundamentally, the ExA here was

mindful of comments made by a number of parties on the difficulty of linking cause and effect for tourism in circumstances such as this, where a large number of different factors can affect the outcome, where the factors and the inter-relationships between them are not well understood and where there is no steady state or repetition. (S. 12.2.99)

But even where there is agreement on some of this technical evidence, the implications for regulatory decision are not necessarily clear. In the case of Kentish Flats, this distinction was made with regard to evidence on habitats:

The extent to which there are important gaps in scientific knowledge and the nature of the uncertainty resulting has been illustrated by the contrast between: (a) the high level of agreement reached during the examination regarding the available scientific information and analysis regarding the nature and extent of likely effects upon habitats and protected species, and (b) outstanding disagreement regarding how this limited information should be interpreted and applied in reaching conclusions regarding the degree of certainty or uncertainty regarding an adverse effect on integrity and in making the relevant decision regarding this application. (S. 4.164)

Reference to guidance does not prevent challenges either. Instead contestation is diverted to debate the relevance of the guidance, whether it was appropriately applied and how up-to-date it is. For example, the Navitus Bay case saw a complex discussion of the noise calculations and whether they had been calculated over the correct distances and, with regard to the preparation of visual representations, there was debate over which version of the guidance to use: the 2006 or the 2014 version of Scottish Natural Heritage (SNH) guidance and the 2010 or the 2011 version of a supporting academic paper. Sometimes attention is drawn to ambiguities and gaps in the guidance documentation (Rookery South concerning heritage assessment; Kentish Flats over EA regulations for NSIPs; and Clocaenog on infrasound impacts).

However, such contestation cannot be allowed to continue indefinitely. The NSIPs regime allows parties to open up the black box, but only if it can then be closed to enable the regulatory process to proceed in a timely manner. Uncertainties and disagreements around evidence create difficulties for the ExA. They are required to reason from evidence towards their conclusions on project impacts, and then on to their recommendations regarding development consent. Where there are limited uncertainties surrounding claims on a particular impact and the relevant evidence is not contested, then the ExA's task is relatively simple. However, contestation and identification of uncertainties renders the process much more open. We now turn to the means of closing down debate that are found within the process.

### Seeking Closure: Recourse to Expert Agencies

In the face of contestation about whether a knowledge claim constitutes sufficient evidence for regulatory decision-making, a judgement has to be made. The NPSs provide that in all matters concerning the adequacy of evidence submitted, the professional judgement of the ExA is key. The ExA is expected to be able to determine the adequacy of assessment across a range of impacts, using an inquisitorial approach. This is a convenient fiction. No ExA – even with a Panel of several members – is likely to have this expertise. The ExA can interrogate the evidence offered to try and understand it sufficiently to determine how much weight to give it and they can ask for clarification and additional evidence. But the time-limited nature of the examination precludes too extensive questioning or significant commissioning of new evidence to assist the ExA. This can put the ExA in a difficult position.

The strategy typically adopted is to rely on the views of external expert organisations, particularly statutory bodies, as to the quality of the knowledge claim. Expert agencies are frequently referred to in the ExA reports. In the 12 cases analysed here, coding of the different 'voices' within the discussion found that expert agencies were the second most frequently cited, coming after the applicant; the applicant was coded some 15,000 times and expert agencies about 11,000 times. This compares with roughly 9000 times for local authorities. The next most commonly cited actor was the local NGO at about 300 instances of coding; no other actor was coded more than 200 times. Such expert agencies can have a variety of relevant remits. However, it is clear that the expert agencies dealing with nature, the environment and heritage are particularly relied on; these are NE, the Environment Agency, English Heritage and their Welsh counterparts, as well as the MMO in the case of offshore matters.

In the Burbo Bank case, the ExA sums up the generally adopted approach, emphasising the mix of institutional expertise and presence within the examination that raises such agencies' profile in resolving contestation:

It follows that I find that, by the end of the examination, the statutory nature conservation bodies (SNCBs), the local authorities and the EA [Environment Agency] had accepted that the applicant's data collection and methodology was appropriate. The RSPB (Royal Society for the Protection of Birds) concerns were not expressly resolved. However, without them having participated directly in the examination of evidence and development of common ground between the applicant and the SNCBs which took place through

the hearing process, I place greater weight on the satisfaction of the SNCBs, due to their roles as statutory advisors and due to their participation in hearings at which their evidence could be tested alongside that of the applicant. (S. 4.65)

Three further cases demonstrate how uncertainties around modelling the impact on birds of offshore wind farms were resolved by recourse to NE's expertise.

In the Navitus Bay case, there was considerable discussion about the detail of modelling the impact of individual bird collisions with the turbines on bird populations. NE asked for work to be done on the modelling paths of bird migration, and had concerns over the calculation of Biologically Defined Minimum Population (BDMP) values for various bird species, and also queried aspects of the Collision Risk Modelling (CRM) assessment. The developer made revisions to meet NE concerns, including re-running various models. NE also undertook their own calculations and compared outputs with the developer's. This comparison enabled them to advise that the conclusions of the applicant's modelling were valid, despite concerns about the modelling itself. For the ExA, the key point was that there was sufficient confidence from NE in the outputs to enable the significance of the impacts on birds to be classified.

Considering the Walney wind farm, NE was concerned about a number of issues: the different returns from boat-based and aerial surveys of existing bird populations; the portioning of bird groups to species; the incomplete cumulative and in-combination assessments; the details of the CRM; and the assumptions made for certain birds in the non-breeding season (S. 4.113). This led to discussions between the applicant and NE and further modelling being undertaken. A study of survey precision instigated by NE led to the aerial survey data being preferred as "objectively more precise" (S. 4.115). Once NE accepted the group-to-species portioning, the applicant updated the CRM for three species, redefining the regional populations. This work led to an agreement between the applicant and NE for two species; however, for the kittiwake further discussion was necessary before NE was satisfied that lack of robust site data rendered a particular approach acceptable. In the end, "NE and the Applicant agreed that no further work could be reasonably done to refine this assessment" (S. 4.119) bringing a halt to the debates on this evidence.

Finally, the Rampion case provides an interesting example where there was recourse to the expertise of the statutory agency but the ExA's own reasoning – using a classic black-box emphasis on outcomes rather than generative processes – dominated. The discussion on marine bird populations focussed on cumulative impacts. NE and the RSPB pointed to inadequacies of the data at a biologically meaningful scale and NE argued for a much longer range of wind farms around the coast to be included in the cumulative impact assessment. The applicant provided numbers on the BDMP, the associated baseline mortality and the percentage increase over this baseline with and without Rampion, on different assumptions. None of the percentage increase figures was over 1% and thus the applicant argued that CRM was not needed. The RSPB and Sussex Ornithological Society agreed that the contribution of the Rampion offshore wind farm would be small but not that it would be insignificant. They considered the surveys did not capture data on large pulses of certain migrant birds. NE undertook their own assessment, concluding that an assessment of no adverse impact could not be made; there then followed further modelling work and discussion on specific species of concern. There was continued disagreement between NE and the applicant on which other (proposed) wind farms should be included in the cumulative assessment, with decisive implications on the result. This discussion prompted the ExA to produce their own summary table, comparing the applicant's and NE's figures for four species under different assumptions and approaches. Both NE and the applicant provided commentary on this table, but the difference of view on the 'facts' remained. The ExA then proposed their own approach

to determining cumulative impact; this had a different logic to the applicant's but the outputs – the numbers – were close to those produced by the applicant's method. Thus, there were three logics – ExA, the applicant and NE – and two sets of numeric conclusions and the ExA concluded (based on the similarity between their and the applicant's figures) that concerns about cumulative impacts should not prevent the DCO being made.

### Seeking Closure: Using a Key Artefact

STS approaches emphasise the important role that artefacts can play. Within the NSIPs process, the Statement of Common Ground (SoCG) often plays a central role in binding the expert statutory agencies' views into the decision-making network and then closing down the deliberation for movement towards recommendation and decision. It can be used to demonstrate common ground on the scope of assessment of impacts, on the assessment methods used and the conclusions drawn: this common ground can be agreement or recorded disagreement. In the Navitus Bay case, for example, SoCGs signed with NE and MMO covered a variety of matters: the methods used for assessing onshore ecology; the methods in the EA for assessing sediment dispersion, modelling physical process pathways, effects and receptors; establishing levels of sensitivity; devising the Realistic Worst Case Scenario for impacts; and assessing the cumulative effects of the project. As concerns were raised about ecological impacts, the SoCG with NE was "continuously updated during the examination as the two parties worked together to provide additional clarification or data" (S. 6.2.9), and similarly for the MMO. As a result of such joint working, the question of the existence and severity of the impacts becomes a resolved fact through the agreement made manifest by these artefacts. SoCGs are repeatedly referred to in the ExAs' accounts of how deliberations proceeded. Any interested party can be a signatory to a SoCG, but, where they are signed by the statutory expert agencies, they carry additional weight.

Thus SoCGs are a key way that sufficient and conclusive evidence is constituted. Objections are successively removed as rounds of SoCGs are signed off. This can lead to changes to the DCO and the details of mitigation measures. Indeed, in the absence of agreed changes set out in SoCGs, the ExA themselves have to take a view on how to amend the DCO and it is clear from the reports that they would prefer to rely on agreements between parties. While this may streamline the emergence of the development consent, there are also implications for the wider deliberation on the project (see also Clifford & Morphet, 2017). The extensive use of SoCGs can close down public discussion. The ExA may even decide that hearings are no longer needed, as in the case of the Kentish Flats project (S. 1.13). Issues in SoCGs can be re-opened but the pressures of the regime tend to prevent this.

The way that SoCGs control the escalation of disagreement within the NSIP process can be usefully contrasted with Jolivet and Heiskanen's analysis (2010) of a wind power case in France, where they used the STS concept of 'overflowing' to analyse how an alternative vision for the project and the locality emerged to challenge the original proposal. Within the NSIPs regime, the use of SoCGs prevents this happening by breaking down the agreements and disagreements into smaller sets of specifics which actors are asked to negotiate and decide on as the examination proceeds. SoCGs are reducing uncertainties, resolving disputation between certain parties and rendering the world 'judgement-compatible'. But they are also effectively removing the opportunity for further disputation in public and embedding agreements that strengthen certain specific ties within the NSIP examination. Actors have to be present within the network of the SoCG to be part of the agency of these artefacts; a local NGO in one of focus groups told us that SoCGs needed "to be a more inclusive process".

## Seeking Closure: The Embodied Experience of the Regulator

Where ecological impacts are concerned, we have seen the reliance on modelling, accredited expertise and black-boxing. Difficulties also arose in the case of impacts concerning landscapes and seascapes (Lee, 2017). However, these were different in nature and resolved in a different way. Evidence that is constructed around seascape and landscape visual impact assessment (SLVIA) envisions the appearance of the projects from different vantage points and assesses affected sightlines in qualitative terms. Visual artefacts such as photos feature prominently as part of the assessment of landscape and seascape impacts (Jolivet & Heiskanen, 2010) and competing visualisations can be prepared for the ExA.

In the Navitus Bay case, the ExA report noted that the SLVIA conclusions “attracted substantial criticism and debate across a wide range of statutory, non-statutory bodies, local authorities and individuals” (S. 7.2.1); one interviewee in this case said: “I felt the wool was being pulled over our eyes”. The NE view was that there was no fundamental disagreement about the appropriateness of the methodology deployed; it was industry standard. However, as the Secretary of State noted in his decision letter (S. 17), SLVIA “is a matter which is especially susceptible to subjective analysis”. Furthermore, the ExA recognised that visualisations – however good they are – cannot be “an accurate representation of the true impact, partly ... because of the limitations of static representation of a dynamic facility” (S. 7.2.4). The ExA cited prevailing guidance to state that “even SNH 2014 confirms that images can never be 100% accurate” (S. 7.2.64). This means that there is more scope for the ExA to exercise discretion, relying on site visits. During such visits, the embodied experience of the ExA is used to triangulate the visual imagery included in the formal visual impacts assessments. It is common practice to go to each viewpoint for which photographic images are provided and assess the image and the direct experience *in situ*. In Navitus Bay “The Panel duly noted that a photographic image does not fully represent exactly what the eye will observe on site” (S. 7.2.64); thus, the “conclusions that the Panel has reached on impacts are based on our experiences of the area and inspections at identified viewpoint locations assisted by the images on site” (*ibid.*).

There was less reliance on agreement and negotiation between other actors than with ecological evidence. Thus when the applicant sought to argue that anything beyond 20 km was ‘remote’ in terms of SLVIs, the Navitus Bay ExA dismissed this: they just did not agree. However, the site visits do become a means for the ExA to understand the concerns of local actors. In the Rampion case, the ExA said that site visits enabled them to understand local actors’ concerns, while in Triton Knoll the ExA undertook site visits “to ensure that it had a clear understanding of the issues raised in representations in their broader landscape and seascape context” (S. 5.518). The experiential knowledge of local actors generally cannot compete with the accredited knowledge on ecological matters provided by NE and scientific consultants, but here it becomes something that the ExA can appreciate through their own traverse of the local environment. In effect, the ExA’s role has the potential to legitimate local knowledge, which could turn it from something with no weight to something that could carry weight, although rarely sufficiently to affect the final decision. This gives the ExA the power to do more than appreciate local knowledge-claims; it is a form of warranting.

## Conclusions

The analysis of these cases of major RE projects suggests that the validation of knowledge-claims as evidence involves a number of processes. The knowledge-claims themselves are framed as technical in nature, with a strong emphasis on generating the claims through recommended methodologies. Knowledge-claims are contestable, including by reference to the adequacy of supporting

methodologies. This can create difficulties within the regulatory regime that needs to classify impacts into categories of significance for the purpose of decision-making. This leads to an emphasis on 'black-boxing', so that in some contentious cases examination of the methodologies is replaced by attention to the outputs. However, the research has also shown that black boxes don't always stay closed and that contestation persists. This threatens the ability of the NSIPs regimes to render the world 'judgement-compatible'; rather it remains a highly contested world of uncertain knowledge-claims. In response, the analysis of ExA reports emphasises that a number of strategies are deployed: the reliance on the explicit knowledge of an expert agency; the use of the artefact of the Statement of Common Ground to embed agreement and record an end to contestation on that matter; and, on some issues, reference to the embodied experience of the ExA. These processes enable the regulatory process to function. This research raises two issues of more general relevance; the tensions within evidence-based planning; and the implications for public engagement in such regulation.

Davoudi (2006, 2012, 2015) has reviewed the growing importance of evidence-based planning, and she has suggested that this framing of planning, with the emphasis on objective fact-finding and assumption of clear cause-effect relationships is limiting (see also Saltelli & Giampietro, 2017). It privileges, as we have found, scientific expertise and the deployment of scientifically-accredited methods. Instead, Davoudi calls for an interpretive planning stance which emphasises shared notions of place and common understandings of space through deliberative methods and engagement with multiple sources of knowledge. She emphasises "understanding what the social world means for the people who live in it" (2015, p. 318) as part of planning practice.

Davoudi's proposal is based in the context of plan-making within a locality. Here it becomes possible to consider iterative rounds of such plan-formulation and to rely on the experience of 'seasoned' planners developed over time. Moreover, "Central to planning as practice of knowing are the dynamics relations between individual planners, their communities and their conceptions of planning activity" (2015, p. 327). Thus the history of planning practice within a locality is core to the development of an alternative vision to positivist evidence-based planning. This raises interesting questions about regulatory activity, especially where a regulator from outside the locality is deployed (as with ExAs in the case of NSIPs). We can turn to Latour's work for an insight here.

Latour identifies a fundamental tension between regulatory institutions (such as the ExA) and expert knowledge production. In *The Making of Law* (2010, pp. 202–243), Latour draws attention to the tensions between scientific discourse and legal discourse. He characterises the construction of scientific expertise in terms of multiple distinct specialisms, rooted in specific places and continuous career pathways. Scientists are allowed, even expected, to demonstrate passion in arguing for their knowledge and scientific texts are "please-go-on's" in that there is always doubt, to be resolved by future work. Scientists are not neutral but argue for their knowledge-claims. These claims arise from a very large number of transformations or links, starting from the material reality they seek to represent and gaps in the chain of representation can be tolerated by the scientific community: "Scientists speak inarticulately about precise objects" (2010, p. 237). By contrast, Latour's legal actors – who play a different role from the ExAs, but are sufficiently similar for current purposes – are generic experts, who have no rooted, located existence but are able to operate in different places. They are circulating in and out of the legal context, before and after other occupations. They are expected to adopt a neutral, disinterested position: "a whole *hexis* of disinterest" (2010, p. 211). The legal reasoning becomes an "arrêt" – literally a 'stop', but a decision where conclusions are drawn. Doubt is maintained up to a certain point and then closure is sought (p. 204), a process that is reinforced by the pressure of time. The emphasis is on the

quality of reasoning: “We are evaluated on the quality of our reasoning, but not on our solutions” (p. 213); Latour concludes that “lawyers speak in precise terms about vague objects” (p. 237).

There are significant differences between the institution that Latour studies and the NSIPs process, where the major emphasis is on deciding on the particularities of the case about this particular development consent. Nevertheless, even within regulatory regimes such as NSIPs, there is an encounter between the two discourses of science and law. Rendering the world judgement-compatible results in a focus on generating agreement on knowledge-claims, even if only at the level of likely impact rather than the processes by which analysis of that impact proceeds; different models and approaches may be followed through and the outputs compared and/or different model runs with different inputs/assumptions may be made. In either case, the issue is whether the outputs of the processes are sufficiently close to constitute a *de facto* agreement. This is a deeply pragmatic approach to evidence and planning within a regulatory context.

Our research also addresses the role of public involvement in NSIPs regulation. The analysis has shown how the knowledge-claims put forward by local actors can struggle. If they wish to provide evidence of impacts, they have to do so on equivalent terms to the developer, their consultants and the expert agencies. But the knowledge of local actors may not take the form of models, techniques and assessments that are recognised as warrantable knowledge. Local people may wish to offer narratives of local experience of their area, for example, but these generally only become validated if and when the ExA does a site visit and lends their professional weight to it. They also may be unable to invest financially and temporally in ‘appropriate’ presentation of knowledge-claims. In addition, the proposer of the evidence needs to be available to answer challenges and questions about their knowledge-claims. Evidence from local actors has to be sufficient, validated and defended by presence within the regulatory process. Without this, the ‘local’ evidence is likely to be downplayed. Again this is a resource-intensive exercise, which local actors are often unable to afford.

To resist ‘expertise’ would be to push against a set of relationships that has become embedded in particular heterogeneous networks of material artefacts and social actors. In her research on the public local inquiry system in Scotland for regulating wind power, Aitken argued that local opponents of the wind project, when they emphasised the accredited qualities of their evidence, were in a sense complicit in the prioritisation of expert knowledge (2009, p. 62); this might seem a bit harsh, given that they were responding to the rules of the game established elsewhere. Tironi (2015) suggests a rather different perspective. He argues against the separating out of lay and expert knowledge, not just as categories of knowledge-claims but as social categories. Criticising radical planning for seeing lay communities as essentially ‘other’ to epistemic communities, he instead draws on his research in Santiago, Chile to point up how civil society groups can use strategies that are commensurate with those used by the ‘experts’. He sees citizen groups as retrieving their political strength “by reproducing and utilising experts’ arguments, techniques and grammars” (2015, p. 71). He sees citizen involvement in formal participation mechanisms as a political act, rather than complicity. Conceptually, this dissolves the categories of ‘expert’ and ‘lay’; strategically, it sees value in enabling ‘technification’ – the ability of communities to act as technical entities by engaging with scientific evidence on equal terms to accredited expert organisations.

The question then becomes how to achieve this. How can community groups be involved in opening up black-boxes effectively and involved in the processes by which debate is then closed? It is clear that we need to find ways by which community representatives are not intimidated by formal settings, perhaps not (just) by changing the setting, but by offering training and opportunities to ‘try them out’. They need to be given access to information and baseline data on an equal footing to expert

organisations, both those operating in the public and the private sectors. There could be a case for considering funding for assistance to community groups in engaging with the technical aspects of evidence. It is clear that there is a need to draw to community groups' attention to the importance of artefacts such as the SoCGs and the incremental process by which agreements on impacts and mitigation measures are reached; perhaps there should be a log, recording agreements made during the examination. Finally, it seems that more emphasis should be given to enabling occasions when the key regulatory actors can engage with community groups' experience outside the formal settings of hearing, as occurs potentially on site visits. Such institutional reforms may help rebalance the operation of the regulatory regime and the implications of how knowledge is black-boxed as evidence within it.

However, in making such points – which echo much other research looking at the imbalances between local community groups and other actors (notably developers) within planning – one also needs to have regard to a potential disjuncture between the balance of evidence on likely project impacts and the desire of local communities to prevent the development. Projects such as NSIPs have a broader rationale – including mitigation of climate change as well as economic development – which goes beyond the net impacts on local groups. Leaving to one side the difficulty of ensuring adequately inclusive processes for that 'higher' level of decision-making, this suggests that perhaps less emphasis should be given to whether the regulatory consent is granted or not, and more to the ways in which knowledge-claims support measures that might mitigate local impacts. Such mitigation may be seen as another pragmatic way to resolve disputes about conflicting knowledge-claims. In some cases, it may be easier to offer mitigation than to seek to make the evidence on impacts more certain and consensual. Rather than rendering the world more 'judgement-compatible', this could be considered rendering the development more 'judgement-amenable', another important function for planning regulatory processes.

## Note

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- Aitken, M. (2009). Wind power planning controversies and the construction of 'Expert' and 'Lay' knowledges. *Science as Culture*, 18(1), 47–64.
- Alexander, E. R. (2008). The role of knowledge in planning. *Planning Theory*, 7(2), 207–210.
- Blatter, J., & Haverland, M. (2012). *Designing case studies*. London: Palgrave Macmillan.
- van Broekhoven, S., Boons, F., Van Buuren, A., & Teisman, G. (2015). Boundaries in action: a framework to analyse boundary actions in multifunctional land-use developments. *Environment and Planning C: Government and Policy*, 33(5), 1005–1023.
- Callon, M., Lascoumes, P., & Barthe, Y. (2001). Hybrid Forums. *Acting in an uncertain world: An essay on technical democracy* (pp. 13–36). London: MIT press.
- Clifford, B., & Morphet, J. (2017) *Infrastructure delivery: The DCO process in context*. NIPA Insights Programme 2016 Research Report.
- Collins, A., Cowell, R., & Flynn, A. (2009). Evaluation and environmental governance: The institutionalisation of ecological footprinting. *Environment and Planning A*, 41(7), 1707–1725.
- Cowell, R., & Lennon, M. (2014). The utilisation of environmental knowledge in land-use planning: Drawing lessons for an ecosystem services approach. *Environment and Planning C: Government and Policy*, 32(2), 263–282.
- Davoudi, S. (2006). Evidence-based planning. *disP – The Planning Review*, 42(165), 14–24.
- Davoudi, S. (2012). The legacy of positivism and the emergence of interpretive tradition in spatial planning. *Regional Studies*, 46(4), 429–441.
- Davoudi, S. (2015). Planning as practice of knowing. *Planning Theory*, 14(3), 316–331.
- DCLG. (2014). *Government response to the consultation on the review of the Nationally Significant Infrastructure Planning Regime*. London: HMSO.
- DECC. (2011a). *National Policy Statement for renewable energy infrastructure (EN-3)*. London: HMSO.
- DECC. (2011b). *Overarching National Policy Statement for energy (EN-1)*. London: HMSO.
- Dunlop, C. A. (2014). The possible experts: How epistemic communities negotiate barriers to knowledge use in ecosystems services policy. *Environment and Planning C: Government and Policy*, 32(2), 208–228.
- Hull, M. S. (2012). *Government of paper*. London: University of California Press.
- Hunt, J., & Shackley, S. (1999). Reconceiving science and policy: Academic, fiducial and bureaucratic knowledge. *Minerva*, 37, 141–164.
- Jasanoff, S. (2015). Serviceable truths: Science for action in law and policy. *Texas Law Review*, 93, 1723–1750.
- Jolivet, E., & Heiskanen, E. (2010). Blowing against the wind—an exploratory application of actor network theory to the analysis of local controversies and participation processes in wind energy. *Energy Policy*, 38(11), 6746–6754.
- Kerr, S., Watts, L., Colton, J., Conway, F., Hull, A., Johnson, K., & Jude, S. (2014). Establishing an agenda for social studies research in marine renewable energy. *Energy Policy*, 67, 694–702.
- Latour, B. (1987). *Science in action*. Cambridge, MA: Harvard University Press.
- Latour, B. (1988). *The pasteurization of France*. Cambridge, MA: Harvard University Press.
- Latour, B. (1999). *Pandora's hope: Essays on the reality of science studies*. Cambridge, MA: Harvard University Press.
- Latour, B. (2002). *The making of law an ethnography of the Conseil d'État (2009 translation)*. Cambridge: Polity Press.
- Latour, B. (2010). *The making of law: an ethnography of the Conseil D'État*. Cambridge: Polity Press.
- Latour, B., & Woolgar, S. (1998). *Laboratory life: The construction of scientific facts* (2nd ed.). Princeton, NJ: Princeton University Press.
- Lee, M. (2017). Knowledge and landscape in wind energy planning. *Legal Studies*, 37(01), 3–24.
- Marshall, T., & Cowell, R. (2016). Infrastructure, planning and the command of time. *Environment and Planning C: Government and Policy*, 34(8), 1843–1866.
- Marston, G., & Watts, R. (2003). 'Just the facts Ma'am': A critical appraisal of evidence-based policy. *Just Policy*, 30, 32–46.
- Masden, E., McCluskie, A., Owen, E., & Langton, R. (2015). Renewable energy developments in an uncertain world: the case of offshore wind and birds in the UK. *Marine Policy*, 51, 169–172.
- Nonaka, I. (1994). A dynamic theory of organizational knowledge creation. *Organization Science*, 5(1), 14–37.

- van Oorschot, I., & Schinkel, W. (2015). The legal case file as border object: On self-reference and other-reference in criminal law. *Journal of Law and Society*, 42(4), 499–527.
- Rydin, Y. (2007). Re-examining the role of knowledge within planning theory. *Planning Theory*, 6, 52–68.
- Rydin, Y., Natarajan, L., Lee, M., & Lock, S. (in press). Do local economic interests matter when regulating Nationally Significant Infrastructure? The case of renewable energy infrastructure projects. *Local Economy*.
- Saltelli, A., & Giampietro, M. (2017). What is wrong with evidence based policy, and how can it be improved? *Futures*, 91, 62–71.
- Tironi, M. (2015). Modes of technification: Expertise, urban controversies and the radicalness of radical planning. *Planning Theory*, 14(1), 70–89.
- Wynne, B. (1996). May the sheep safely graze?: A reflexive view of the expert-lay knowledge divide. In S. Lash, B. Szerszynski, & B. Wynne (Eds.), *Risk, environment and modernity: Towards a new ecology* (pp. 44–83). London: Sage.