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Title

Opening up the participation laboratory: the co-creation of publics and futures in upstream participation.

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Abstract

How to embed reflexivity in public participation in techno-science, and to open it up to the agency of publics, are key concerns in current debates. There is a risk of engagements being limited to ‘laboratory experiments’, highly controlled and foreclosed by participation experts, particularly in upstream techno-sciences. In this paper we propose a way to open up the ‘participation laboratory’ by engaging localized, self-assembling publics in ways that respect and mobilize their ecologies of participation. Our innovative reflexive methodology introduced participatory methods to public engagement with upstream techno-science, with the public contributing to both the content and format of the project. This experience drew our attention to the largely overlooked issue of temporalities of participation, and the co-production of futures and publics in participation methodologies. We argue that many public participation methodologies are underpinned by the open futures model which imagines the future as a space of unrestrained creativity. We contrast it with the lived futures model typical of localized publics, which respects latency of materials and processes, but imposes limits on creativity. We argue that to continue being societally relevant and scientifically important, public participation methods should reconcile the open future of research with lived futures of localized publics.

Keywords

Upstream public engagement; invited participation; public participation; futures; energy futures.

Introduction

The “opening up” of techno-sciences through an involvement of publics continues to be a key element of debates about the democratization of science-society relations. Such public involvement is seen as particularly important in the “upstream” of the simplified laboratory-to-market course of innovation, which is prior to and during the processes of techno-scientific development (Wilsdon, Wynne, and Stilgoe 2005, Macnaghten, Kearnes, and Wynne 2005). Upstream techno-sciences do not typically catalyze publics into existence through controversies (Braun, Whatmore, and Stengers 2010, Marres 2007). As a result, involving citizens in the upstream techno-sciences has to call on invited forms of participation (Wynne 2007), organized by participation experts. The resulting dominance of participation experts’ framings on both the content and format of participation projects risks participation becoming a closed and controlled laboratory experiment (Bogner 2012), separated from the spatial, normative, and political concerns which form the ecology of “actual” publics (Gehrke 2014).

There is thus a tension at the heart of public participation in upstream techno-science: having to rely on invited forms of participation, upstream participation methodologies risk stifling the very processes they identify as desirable. In the light of concerns about the unilateral power of participation experts, increasingly attention has turned to the “opening up” of the methods of public participation themselves (Chilvers 2013, Stirling 2008). Scholars have been calling for greater reflexivity around the performative effects of public participation, with a particular focus on the co-constitution of participation events and their “publics” (Chilvers and Kearnes 2016b, Felt and Fochler 2010, Bogner 2012, Michael 2009). This paper contributes to these debates in two crucial ways.

Firstly, we respond to the calls to for an “opening up” of the methods of public participation (e.g. Stirling 2008; Chilvers and Kearns 2016b) through an experiment in embedding reflexivity in public participation in upstream techno-science. This was achieved through a co-production between participation experts and the participating public of both content and format of an upstream public

participation process. We suggest that engaging localized, self-assembling publics in ways that respect and indeed mobilize their ecologies of participation (Gehrke 2014; Chilvers and Kearns 2016b, 272) and that simultaneously recognize and take responsibility for their own performative effects (Chilvers and Kearns 2016b) may be a productive way of addressing the challenge of invited public participation in ways that do not reduce it to a “participation laboratory.”

Secondly, we attend to the way futures and publics are co-created in public participation processes. We thus address the largely overlooked issue of temporalities of participation, specifically the ways that certain expectations about futures are expressed through and embedded in participation processes (although see Selin and Sadowski 2016, Felt 2016). We argue that reflexivity around participation needs to be extended to taking seriously the relationships between the variously configured publics and futures performed in participation experiments. Engaging with the work of Adams and Groves (2007), we argue that if the aim of public participation is extending democratic influence over the shaping of the future, the question of *whose futures are constructed and examined in participation matters*. In the quest to democratize participation, we must attend to this challenge and create forms of engagement that simultaneously address futures as lived, and futures as open. This means taking responsibility for the performative effects of our methodologies, and dealing with the reality of politics and power in participation processes.

The case study

The paper discusses an unusual project in upstream participation in techno-science in which we, the authors, were involved as academic researchers (experts in their fields) and as participation experts (project organizers). The Solar Energy in Future Societies (SEFS) project experimented with an “opening up” of the upstream participation laboratory through a 2-year engagement between a group of academics (authors of this paper) and a self-assembled and localized public composed of residents of Stocksbridge (North England). The academic team consisted of colleagues from physics and material sciences who specialized in photovoltaic research (principal investigator, post-doctoral

research associate, and doctoral researcher), geography (co-investigator, co-investigator, post-doctoral research associate), and architecture (co-investigator and contracted researchers). Forty local residents of Stocksbridge were involved in the project over the two-year period, with a core group of fifteen participants having a continuous involvement with the project.

The upstream technology in question was organic photovoltaics: carbon-based electro-optical materials, which can be used, amongst other things, to convert sunlight into electricity. While experimental OPV technologies are available for purchase, overall the technology is considered upstream as it has as yet not become embedded in any set of devices or practices. The ongoing research on OPV, and particularly its promissory narratives, is situated within the wider landscape of renewable energy and energy systems research, and the futures of OPV technologies are intimately linked to the futures of energy supply, demand, and distribution. The overall motivational statements articulated in the field of OPV at the time of the project centered on the promises of lower cost (including lower embedded energy cost), higher performance, and greater flexibility in form and functionality when compared with established crystalline semiconductor materials, such as silicon.¹ As Van Lente notes, such promissory statements should not be treated as factual descriptions of pre-determined future states, but as tools for the attainment of those states through the mobilization of attention and resources (2000, 43). They express certain expectations and visions of the future, and play a powerful role in shaping the direction of techno-sciences (see for example Brown, Rappert, and Webster 2000).

The SEFS project aimed at opening up these techno-scientific future imaginaries by putting them in dialogue with visions of energy futures generated by a localized and self-assembling public, whose concerns about and ambitions for the future were rooted in a concrete place. Our motivation was simultaneously normative, in bringing “actual” publics into the fold of techno-science, as well as substantive, in seeking to make OPV better by revisiting the motivations for OPV research from a broader perspective (Fiorino 1990).

The paper presents a roughly chronological and self-reflexive narrative of a reconfiguration of project methodology in response to ongoing reflection about the relationship between publics and futures in the project. In the context of the current calls to embed reflexivity in public participation (Chilvers and Kearns 2016b), we take an opportunity to illustrate the complexities of structuring participatory methodologies around reflexivity. This approach adds to previous efforts to build participation upon reflexivity (Tsouvalis and Waterton 2012), and to challenge expert framings of issues through methods such as competency groups (Landström et al. 2011) and deliberative mapping (Bellamy, Chilvers, and Vaughan 2016). Unlike previous work, this project adopted a co-production format in the context of an upstream, non-controversial techno-science; we elaborate on the significance of working with localized publics in relation to non-controversial upstream techno-science below. In addition, both the content and the process of the project were co-produced between the participants and the organizers (the “participation experts”); indeed, this focus on co-production of the project process was in itself an outcome of the reflection embedded in the project.

To illustrate the reflexive character of the project, we intersperse the empirical story with more explicit engagement with literature, narrating in parallel the ongoing theoretical reflection and the resulting gradual re-configuring of the project methodology. We draw here on qualitative data collected throughout the duration of the SEFS project (2012-2014), which included transcripts and participatory observation notes from 12 project workshops and two exhibitions, feedback interviews with the academic team, and with the core group of participants, focus groups organized to facilitate participant shaping of project process and products, as well as formal and informal project meetings.

Our initial interest in developing alternative ways to engage publics with upstream technologies developed in relation to the critical techno-science participation literature, which we review in the following section. We then describe the initial methodology of the project, and illustrate participant “misbehavior” (Michael 2012) in relation to the framing it imposed. In the context of our project, this

misbehavior led to reflection around the assumptions about publics and futures embedded in the project methodology, and a consequent re-design of the approach to engage with locally relevant ways of relating to and acting on the future. This local way of relating to the future as *lived*, however, created a tension with the relationship with the future as *open*, which, we argue, underpins academic research. The tension could not be resolved, and for the remainder of the project the two ways of relating to the future were pursued in parallel.²

Addressing the foreclosure of invited publics in upstream participation

The substantial societal and knowledge/innovation benefits expected of the participation of publics in techno-sciences depend on the publics being able to envisage and articulate different futures to those put forward by techno-scientific imaginaries. However, whether such alternative futures can in fact emerge in the processes of organized (or “invited,” Wynne 2007) participation has been increasingly called into question. The nub of the critique has been the shaping of the publics involved, and concerns have been growing around what kinds of “publics” participation events actually engage with. For instance, Gehrke argued that a great deal of “engagement” has depended on aggregated groups of individuals, placed in artificial surroundings and directed toward prescribed modes of deliberation (2014, 85). The phrase “participation laboratory” in this paper’s title comes from Bogner (2012), who contended that the dominant modes of engaging publics in science and technology can be seen as laboratory experiments, that is, events “organized by professional participation specialists and carried out under controlled conditions, rarely (...) linked to public controversies, to the pursuit of political participation, or to the experiences of people directly affected” (2012, 507). Not only are participants within “participation laboratories” typically prevented from influencing the methodological, conceptual, and institutional frames of the participation exercises (Michael 2012), but by having their role limited to “doing the public” (Michael 2009) they are prevented from influencing the shaping and the impact of the resulting outputs. A focus on representativeness and impartiality of the involved citizens can also result in the excluding

of alternative points of view (Lezaun and Soneryd 2007), self-censorship of participating citizens (Bogner 2012), and a dominance of hegemonic problem framings, such as “sound science” (Bora and Hausendorf 2006). Rigid framings can limit the participants’ potential for questioning what counts as salient knowledge (Wynne 2007), and thus can undermine attempts at generating alternative ways of imagining socio-technical futures (Bogner 2012; Stirling 2008).

The critiques have thus focused on the participation processes failing to achieve their ambitions of democratizing techno-science due to their configuration of publics as if they were consumer panels: in these critiques, demographic representativeness is seen as no substitute for political positionality. “Laboratory” participation methods and their invited publics tend to be contrasted negatively with un-invited or protest participation, and with “publics in the wild” (Callon and Rabearisoa 2003), which, as Wynne (2007) notes, always challenge dominant techno-scientific narratives. Such publics have been seen to be catalyzed by issues (Marres 2007), deriving their identity from shared matters of concern (Latour 2004). However, in the case of upstream techno-sciences, catalytic matters of concern around which publics can self-assemble are less likely to have emerged due to limited social awareness and interest, and to the indeterminate nature of possible techno-scientific outcomes; as Bogner comments, “[t]here is no fighting in the streets over questions of nanotechnology or neuroscience” (2012, 509). Furthermore, as Wynne argues, in line with Chilvers and Kearns (2016b), trying to “understand” publics necessarily implies being involved in “bringing publics into being” (2016, 105): all participation is a form of co-production. As a result, if we are to have any engagement with publics in relation to upstream techno-science, participation methods are obliged to rely on participation experts to “encourage a public or publics into being” (Wynne 2016, 106), necessarily introducing some form of framing. At the same time, we must address the highlighted issues of foreclosure and performativity associated with invited forms of participation.

Assembling a local public for upstream participation

Building on the critiques of laboratory participation methods as foreclosing publics, our project sought to open up the participation laboratory by explicitly turning to self-assembling and localized publics in engaging with an upstream techno-science. The aim was to revisit the motivations for OPV research in dialogue with the situated perspectives of a public brought together by an attachment to a place. This move can be seen as combining the object-centered approach to participation, which builds on Dewey's work (1927), with concerns about the situatedness of "external" participation events within existing participation ecologies and systems. As Marres argues, people's involvement in politics is mediated by problems that affect them, and by the attachments that people mobilize and are mobilized by in the performance of politics (2007). Place can be seen as one such powerful attachment, one which forms the very basis of political life, and yet one which has been under-theorized in public participation in techno-science debates (although see Macnaghten and Guivant 2011, Selin and Sadowski 2016). Furthermore, through their everyday assembling of publics, places can be seen as entry points into diverse ecologies of participation, that is, already existing social practices and discourses (Gehrke 2014, see also Chilvers and Kearnes 2016a), thus situating external participation efforts in dialogue within an already rich tradition of techno-science politics.

In this project, we used an exhibition as a means of entering this local ecology while catalyzing the assembly of a new public of project participants. For two weekends, we held an open exhibition in the Stocksbridge library that used a number of architectural models, posters, technological artifacts, and games to generate debate about potential futures of the local energy systems—and the role of OPV technologies in these systems—amongst the residents. The public that participated in this event thus self-assembled around the interest in the energy future of their town. A model of Stocksbridge populated with energy generating technologies acted as a prompt for thinking about the desirability of various socio-technical solutions to local energy generation and consumption (see Figure 1). The verbal and non-verbal reactions of the exhibition visitors informed how the next step

of the participation process was framed, which at that stage in the project was envisaged as a series of scenario workshops.

[Figure 1]

The first workshop brought the localized future into view as a series of options using a classic scenario methodology. On the basis of the exhibition findings, acting as participation experts we constructed two sets of narrative scenarios that presented a “day in the life of a Stocksbridge resident” in 2050. These scenarios were used as the starting point of a deliberative exercise, the aim of which was to support participants in creating localized visions of a “good life” with future energy systems. Situating the scenarios in the space of the town, and scripting in the continuity of some of the socio-political and infrastructural processes identified through the exhibition engagement (e.g. built environment, values around landscape), we sought to create credible and provocative future visions with which the residents would want to engage.

Scenario workshops are a classic tool of upstream engagement, and they perform a particular relationship between the public and the futures debated. To be legible, scenarios need to express a certain continuity of the future with the present; at the same time, they have to prompt debate about (socio)technical discontinuities and novelties. To accommodate this, scenarios typically utilize a mid-range time horizon of 20-30 years from the time of the engagement—close enough to be imaginable, but far enough to “free participants from the strictures of current norms, constraints and regulations, and allow for the creation of more radical solutions compared with thinking from the present” (Davies, Doyle, and Pape 2012, 55). The goal of the scenario workshop process is for participants to evaluate the visions presented, build on their critique to agree upon a more desirable vision, and articulate a set of action plans to achieve it (Chopyak and Levesque 2002). The public is therefore expected, on the one hand, to assume a role of responsibility for the future debated, and, on the other, engage with this future in a creative manner.

Our public resisted this configuration. While it was relatively easy to elicit opinions, hopes, and fears around existing technologies and their potential future uses in Stocksbridge, it was hard for the participants to imagine what alternative socio-technical arrangements could fulfil their criteria for “a good life” in relation to energy futures. The participants dismissed their own contributions to future planning as irrelevant, as the potential changes would not occur within their lifetimes. They questioned their authority to speak about and their capacity to act on the future, arguing this responsibility belonged to others such as the government or the next generation. In the words of one participant: *“It may be best leaving your children, grandchildren and great grandchildren to be sort of part of the solution as it happens.”* The participants also saw technological progress as both unavoidable and unpredictable, which in turn made any discussion of the future of technology seem futile, stifling creativity. The participants did not see themselves as having any impact on technological trajectories, or any ability to predict future trends, as the following excerpts illustrate:

Mobile [telephones]. When it first came out it was magic, you could walk around with this half a brick. Now it tap-dances, does your washing (...) technology has moved forward in that short time, so what is around the corner?

If it [technological progress] continues the same way as it has done the last 40 years, I mean what is to stop them having mirrors in the sky and sending 24 hour sun down to a big solar panel unit?

...in the next 50 years something revolutionary can happen which just swings the whole thing back to a different scenario.

Maybe not 2050 but 2150 maybe you know we should be alive on Mars.

Rethinking the role of futures in upstream participation

Felt and Fochler's (2010) comment that resistance to the framings proposed by "experts of community" should be seen as a methodological and conceptual resource. They highlight the potential discrepancies between the ways of being a public designed by the participation event, and those that come naturally to the invited participants. Taking these insights seriously, we saw the "misbehavior" (Michael 2012) of our participants as a more or less direct commentary on the remits of salience and non-salience set in both the content and process of the participation exercise, feeding into our ongoing reflection about the project. It was at this moment that our methodology began to open up, starting a gradual shift away from the dominance of participation experts towards more fully co-produced project content and process.

Significantly, the participants' unwillingness to engage with the scenario methodology pointed to the importance of futures, and to the problems our construction of a relationship to the future through scenario methods were posing to this public. As Adams and Groves (2007) argue, our ideas of what the future is like, and the reasons for engaging with the future, are always informed by our positionality in the present. Importantly, the ways we engage with the future express our assumptions about agency—about who or what has the power to shape the future, and how. Upstream participation through methods such as scenario workshops mobilizes the future in a particular way, and for particular ends. It operates with what Adams and Groves (2007) call the *open future* model, mobilizing the future as an arena in which different socio-technical trajectories can play out. Scenarios assume different development pathways for particular technologies and illustrate the assumed consequences to society. The participating publics are asked to engage imaginatively with these scenarios and debate the desirability of the potential socio-technical developments. This mode of mobilizing the future is predominantly *evaluative*, in that it configures the publics as assessors of potential futures. It is also idealistic, in that it gives primacy to the power of the mind in shaping potential futures. It downplays the latent agency—or 'obduracy', Selin and

Sadowski 2016)—of places and spaces in which futures actually unfold. Publics are asked to take on a responsibility for the shaping of this de-contextualized, un-placed future by accepting the form of power granted to them through the participation process.

The way that laboratory publics engage with futures is different from how they are engaged with by uninvited or self-assembling publics. In these cases, publics assemble as a result of anxieties about the futures of particular places, things, and peoples. Self-assembling publics always already have a future orientation, which grows from their experiences of localized pasts and presents as well as similarly localized ambitions about future states. These publics engage with the future in a *generative* mode, mobilizing locally situated meanings, concerns, resources and issues to engage with a future that they care about. Their relationship with the future corresponds to what Adam and Groves (2007) call the *lived future* model, in which the future is engaged in a way that respects the latent agency of situated interests and realities, and which helps shape the meaning of present and past action.

The use of the open futures model in upstream participation is consistent with its use in all other areas of scientific research. As Adam and Groves indicate, modern science engages with the future through the notion of progress: the idea that futures arise from actions in the present; that the aim of these actions is the creation of better futures; and that these futures are not pre-determined, but open to colonization and imaginative transformation (2007, 201). In this context, research—including the research of public participation—has the mandate and task to engage with the future imaginatively, in a “what-if” ideological way, without the engagement being overly constrained by the socio-material powers that structure life in the present. These are cherished principles of research as a creative undertaking; herein lies the freedom that scientists try to safeguard from the limiting influence of political and economic “realities” imposed on research from the outside (including, indeed, public participation). This engagement with the future as products of the intellect and imagination, however, is enabled by a particular positionality, and we should not assume that it

is universally seen as the most appropriate way to relate to the future, a point we develop further below.

Understanding local ways of being a public

While disengaging from the framing we proposed, the public that had assembled around our project was actively communicating to us what ways of being a public and engaging with the future made sense for them, in the context of their pre-existing ecologies of participation. The project's public was composed mainly of individuals who were already active in trying to influence the future of Stocksbridge in a variety of ways (e.g. involvement in the Stocksbridge Community Forum, in the Stocksbridge Town Council, and volunteering across a range of local initiatives), or who saw the project as a way to become involved in community life in a way that was not pre-determined by existing ways of channelling community-oriented action. Drawing on their experiences and ambitions, the participants were suggesting an alternative way of engaging with the future, and a way of "being a public" that corresponded to the ways futures were already lived and engaged with in the town through collective action, in line with the local ecologies of participation (Gehrke 2014).

We became aware that a new mode of working was needed through the conversations with the participants during the workshop, and through the ways participants were "overspilling" (Michael 2012) the workshop design. Already prior to the workshop, the potential benefits of the SEFS project's presence in the town were discussed by the participants and other residents at the Stocksbridge Community Forum, where a new Community Energy Group was formed with the intention of generating renewable energy projects for the benefit of the town. During the first workshop, the relevance of renewable energy to a number of local issues was discussed. Following the workshop, the closure of a council-funded local Leisure Center provoked a mass protest and generated a rush of enthusiasm for community action, and we began receiving emails and phone calls asking for help with the Leisure Center issue. Very quickly, the SEFS project became enrolled as an actor in the local politics unfolding in the town.

What became clear to us was that in order to progress with the project we should not try to construct futures for this public; they were already actively engaged in future-oriented action. In order to go ahead, we needed to find a way of bringing together the residents' investment in local lived futures and an engagement with the open futures of OPV as an upstream technology in the context of uncertain energy futures. Concerns about the way present events were shaping the future of the town, we envisaged, could offer us a starting point for a joint imagining of desirable local futures through better energy generation, distribution, and consumption technologies.

Reconfiguring the methodology around local ways of being a public

The project methodology was thus opened up to accommodate and capitalize on the local ways of relating to the future. This involved a collective re-thinking, involving both the participants and us as the participation experts, of both the content and the process of the project going forward. At the 2nd workshop we proposed continuing the project as a year-long collaboration between the academic team and the Stocksbridge residents (early 2013 – early 2014). The uncertain and hypothetical arena of energy futures was to provide the space in relation to which local concerns would be identified, and potential solutions discussed. Seeking to answer the question—“What kind of energy future do we want for Stocksbridge?”—we would develop together with the participating residents the knowledge of the futures already present and unfolding in the town, and on that basis create visions of desirable future states. In terms of the substantive aims of our project (Fiorino 1990), by building on local concerns we hoped to learn what would characterize preferred energy futures in this place, and what place OPV technologies may have within these.

Five research pathways structuring the content of the project were identified by the residents in the second workshop. These pathways used locally relevant issues as a starting point for engaging with questions around the future of renewable energy technologies and their associated socio-technical infrastructures. The five pathways explored: using renewable energy technology to power local

electric vehicles; using renewable energy technology to grow food locally; increasing the energy sustainability of local community buildings; generating renewable energy for the benefit of the wider community; and raising awareness of sustainability issues through the use of renewable energy technologies (for a detailed discussion of the content of the pathways see Krzywoszynska et al. 2016). By proposing to work through the five themes the participants identified, we hoped to incorporate locally relevant ideas of “a good life” into visions of future socio-technical change. Each of the five themes created a broad boundary of interest within which the relationships between desired outcomes, socio-material networks (including OPV), and action pathways were jointly debated in the work of constructing visions of desirable socio-technical futures. Over the following workshops, which took place every four to six weeks, the themes were further elaborated, with researchers and participants gathering relevant information and carrying out research into the questions the themes were presenting between the workshops. The work on the themes progressed through a dialectic of articulating aims and objectives (expressing desirable futures), assessing local conditions (describing the present), and re-articulating aims and objectives. The desirable futures were therefore not fixed, but emerged as the latency of ongoing processes (e.g. political campaigns, developer investments) and materialities (e.g. historical infrastructures, natural resources) was discovered and discussed. Progress on each theme was reported to the whole group in project workbooks, created by us and circulated to all before each workshop.

As the workshops progressed, a second, more diffuse manifestation of participant “misbehavior” was occurring. This was felt as a waning interest in the developing of future visions for certain themes, with a simultaneous growing concern around “viability” of the future visions under discussion. The components that had to come together to make the future vision “viable” for the participants were:

- Power—the goals articulated in the vision were commensurate with the power of the “owners” of the vision to execute it. The “owners” were not necessarily the participants

themselves; the visions remained viable if the participants felt they were in a situation to convince someone else (e.g. a company, a government body) to take it forward.

- Economic feasibility—the cost of achieving the goals was matched with the ability of the “owners” to pay for it. It could be expensive, as long as the “owner” had a way to raise the appropriate amount of capital.
- Technical feasibility—technologies existed or could be easily developed that made the vision deliverable.

The conditions for viability indicated that the participants were configuring their relationship with the future primarily by building on the present. Changing the future was seen as a project of assembling existing human and non-human assets and limiting uncertainty. This relationship with the future clashed directly with the open futures model, which had to be adopted to imagine, discuss, and evaluate the uncertain characteristics of OPV technology as an upstream techno-science. As a result of this overarching methodological mandate to engage with the future as if it were open, the process of building visions on the back of real concerns of today quickly developed into necessarily hypothetical research, a direction that contradicted the viability of projects desired by the participants. We further illustrate how this tension played out by taking a closer look at the dynamics within one of the five project themes.

Tensions in keeping open and lived futures together: the food theme

One of the five themes focused on local food production, which was seen by the participating public as a way to improve the future of the town by creating local jobs and education, and improving food sustainability. The participants and academics involved in the developing of this theme explored how renewable energy technologies such as OPV could support local food production by powering hydroponic pumps, generating electricity for lighting, and powering ground source heat pumps. This early explicit focus on the OPV technology was quickly lost, however, as another energy source was uncovered that responded more directly to the conditions for project viability discussed above. One

of the participants, a manager at the local steel manufacturing company, suggested the company's waste heat could be used to maintain a constant temperature in greenhouses. At that time the company had both empty land and existing infrastructure that would make constructing a number of heated greenhouses technically straightforward. The potential of this resource was enthusiastically embraced by members of the food theme. By the second workshop, then, renewable energy had already slipped from its role as a primary source of energy to a support function. At this stage, OPV remained "in the conversation" as the possibilities for incorporating energy-generating glass into the greenhouses were discussed. This idea was further researched by some of us, the SEFS academics, between the workshops, and a number of options for incorporating OPV panels into greenhouses were presented in the third workshop workbook. However, by the third workshop it was becoming apparent that the condition that future-oriented technology should remain "part of the conversation" was starting to get in the way of what the participants saw as the most direct way of translating the project from idea to reality. Specifically, experimenting with uncertain technologies was starting to be seen as an unnecessary financial and technical complication, as illustrated by this excerpt from the workshop transcript (P indicates participants and SEFS researchers):

Alan (P): I think the solar is confusing this because if you wanted energy from solar just put it on them roofs up there, why, I guess, why have a compromise on a greenhouse?

Alistair (SEFS): [People assume] that integrating building integrated solar energy is a sensible idea. So I think you are exploring that to a certain extent. (...)

Mark (P): [O]kay the other way around is that if you have already got planning permission (...) for your greenhouses, you have got the structure (...) you have only got to buy the PV solar panels that go on, you have got a very cheap solution for generating electricity through PV, so it would be a very good business proposition for somebody who already owned a load of greenhouses.

Alan (P): Yes, but if you wanted to do a commercial PV and you have got a few empty fields, all you need is a simple framework of 45 degrees and you just fill it full of panels, it's not..

Mark (P): No, I agree. This application I keep sort of thinking, I keep going back to how can we use the PV, because the heat is the main thing.

This excerpt illustrates the tension between the open futures framing on which the project methodology was based, and the lived futures framing with which the participants operated. In the conversation, potential future renewable energy technology is struggling to be meaningful within the framework of participants' perspectives on "viability" presented above. While the academic, Alistair, argues that exploring integrated technology (such as OPV) is valid as it identifies an entry point for further joint inquiry (is integrating organic photovoltaics into buildings a sensible idea? under what conditions?), the participant Alan questions the economic and technical conditions of the idea's "viability" (if you want to generate electricity why not just put panels on other buildings, or on a framework?). The participant Mark, in turn, struggles to reconcile the two approaches. He is mindful of the conditions for the collaboration we had set out at the beginning ("we have to keep OPV as part of the conversation"), and is explicitly trying to find a way to "fit" this technology into the plan for local food production explored in the food theme. The desirability and appropriateness of discussing the future as if it were an open arena of possibility, which the academic Alistair is operating with, clashes directly with an approach to the future as situated and already unfolding, which the participant Alan is using. An inquiry into building-integrated OPV technology, which Alistair sees as a valid research direction, may lead to benefits further down the line, and may in turn result in locally relevant improvements; however, that pathway is fraught with uncertainty. In contrast, the availability of the heat resource (technical feasibility), combined with the interest from the biggest employer in the valley (power, economic feasibility) promises immediate improvements to the life in the town.

From the perspective of the project's methodology, with its framing of an open, hypothetical future, the unfolding tension was not necessarily problematic. The various dissonances between what was *desired* from the OPV and its wider energy system, and what was *available* for participants through the current framings of energy technologies (political, economic, material, infrastructural, knowledge) offered points for further learning about how OPVs and broader energy systems could be made more socially robust. However, continuing the conversation required willing participation of the public, and it was becoming increasingly clear that the participants did not consider engagement with the hypothetical open futures of possible techno-scientific developments an appropriate way of addressing the issues presented by the localized "now." The public felt increasingly disengaged from the open futures model; in a feedback interview in February 2015, one of the participants, Gill, recalled that *"...when it [the projects] became more academic and less practical then I felt a little disappointed."* Another participant, Andy, who became less engaged with the project as time went on, commented that in the early days of the project there were a lot of *"off the wall, utopian, idealistic [ideas], yeah we would all like to see solar powered vehicles going up and down the valley"*; the realization that such projects were *"never gonna happen, at least not in my lifetime"* (emphasis added), led him to discontinue participation and instead *"focus on tangible projects that could actually be achievable."* The promise of achievability/viability linked the future under discussion to the lifeworld of the participants, created investment and kept the participants involved; uncertainty eroded it. As another participant, Faye, commented in one of the workshops in November 2013, *"you can have this energy, you can have this drive, but you soon run out if you don't see that [the idea] is feasible."*

Importantly, the increasingly pronounced need to relate to the future by building on the present configured the role of academic participants of the SEFS project in a way that was directly opposed to the "opening up" ambitions at the heart of the engagement. The academics were cast into the role of those who, drawing on their disciplinary expertise, would foreclose possible futures by assessing participants' ideas according to the viability criteria; throughout, the participants turned to

the academics with questions about technical and economic feasibility. This expert leadership role was resisted by the academics, as it was contrary to the ambitions of “opening up” the socio-technical futures of OPV/energy technologies that the project was aiming to achieve. Taking on the role of experts would have foreclosed creative engagement with the future, reproducing elite narratives already embedded in energy systems research. Withholding expertise, however, was frustrating to the participants as it increased uncertainty, threatening to undo the collaboration entirely as futures under discussion were rendered ever more hypothetical and open.

From co-production to cooperation in upstream techno-science

By June 2013 OPV had “come unstuck” in all the five inquiry themes, and in feedback sessions participants were raising concerns about the SEFS project becoming “a talking shop,” worrying whether “anything tangible is going to come out of this.” The way of relating to the future that made sense for the assembled public, namely the lived futures model, was dominating the open futures model of the upstream participation framing. The growing tension threatened to undo the project, as well as the relationship between the project and the public. At the same time, it was clear that the SEFS project was valuable to both participants and academics through its broader overspill effects. The organizational and knowledge support the SEFS framework provided was enabling the residents to develop projects relevant to their concerns, and creating social learning (Krzywoszynska et al. 2016). The ideas, motivations, and desires around the future local energy system—first expressed by the participants, and further developed in collaboration—were providing valuable insights for the academics into what makes energy systems and technologies, including OPVs, socially robust. In addition, the SEFS project as a space of encounter between academics and publics was spurring new research directions and insights, overspilling into teaching, and creating new research networks and projects. There was therefore a desire from both the public and us as the organizers to continue maximizing the positive outcomes of the collaboration, while minimizing the tensions the open futures model introduced.

This tension was accommodated by reconfiguring the project from being a space of co-production, focused on joint attainment of a shared objective, into being a zone of exchange between the academic team and the participating public. The participating residents received support to continue building viable projects around socio-technical change in the locality, while the academic team continued to generate academic learning from the SEFS spaces of encounter. But while this partnership generated multiple and diverse impacts in the lifeworlds of participants and academics alike, only some of them arrived in the form of co-created outputs or fully collaborative activities, as we discuss in more detail elsewhere (Krzywoszynska et al. 2016).

Conclusions

In their book *Future Matters* Adam and Groves argue that the task for contemporary experts on the future is not about knowing that future, but rather aiding individual and social endeavours to choose wisely from a spectrum of options and preferences with their associated potential effects (2007, 34); this has been the stated task of public participation in techno-science, particularly in relation to the techno-scientific upstream. However, it has been increasingly recognized that presenting options always creates opportunities for un-democratic foreclosure. Since then the question has become how to meaningfully involve publics in the creation of those foreclosures—how to open up participation processes and contents to the agency of publics.

This paper presented a case study of an experiment in such an opening up. The project's key methodological innovation consisted of introducing *participatory* methods to public engagement with *upstream* techno-sciences. We argued that one productive way of overcoming the foreclosure of participation is by creating opportunities for publics to self-assemble around techno-scientific issues as localized and relevant to ongoing concerns. This corresponds with Wynne's call for not just engaging with publics through participation exercises, but for "actually learning to respect, hear, understand and respond in terms [sic] to the issues which ordinary publics develop as concerns arising from their experience of innovation, science-as-institutionalized, and their forms of

governance” (2007, 101). Future socio-technical change will be necessarily situated, unfolding differently in different places. This is most obviously the case for energy-related techno-sciences such as OPVs, whose development will be linked both to locally-specific infrastructures (energy grids, weather patterns, built environment) and to socio-material and similarly locally specific practices of energy generation and demand. However, all socio-technical innovations, including geoengineering, genetic modification, nanotechnology, and synthetic biology, are spatially situated, and thus involve actual, place-specific publics in the early stages of their development, which could help to ensure their greater social robustness. The co-dependence of societal and spatial effects also means different situated publics will experience different impacts from these techno-scientific developments, which further calls into question the legitimacy of using disconnected “laboratory publics” to speak on their behalf.

We further argued that in opening up the participation laboratory we must attend to the largely overlooked relationship between publics and futures in public participation. We argued that public participation, especially in the “upstream,” tends to frame its engagement with the future through a combination of belief in progress and the openness of the future. The future is constructed as an arena of unlimited creative agency; “as an empty space into which we move unhindered, its vacancy allowing us the freedom to transform and improve our lives” (Adam and Groves 2007, 57). Engaging with futures as if they were open is also a product of a particular positionality of, for example, researchers involved in the creation of futures, who work from the position of commentators not directly implicated in the unfolding of those futures. The open future model enables creativity, but simultaneously ruptures relationship of ownership, responsibility, and care: as the open future belongs to everyone, it essentially belongs to no-one.

Such a relationship to the future can be upheld when working with laboratory publics—externally assembled groups of individuals with little personal investment in the futures under discussion. However, when the participation process engages situated, self-assembling publics, a different

relationship to the future can come into view. Self-assembling, localized publics, while being a performative effect of the participation process, also embody and express locally relevant ways of being a public and, crucially, of doing future-oriented politics. For localized publics, as we showed, *the future is already full*. The localized future both demands recognition of the long temporal shadow of already present processes, and demands an ethic of care.

The open futures model produces what Adam and Groves refer to as “institutionalised irresponsibility”: the capacity to generate futures is not matched by taking responsibility for their materializations. This irresponsibility, Adam and Groves suggest, needs to be addressed by moving away from working with open futures, and towards developing visions of the future, and their materializations, in relation to already unfolding and existing socio-material structures and power relations. Working with situated publics in relation to local futures creates such an opportunity. However, the challenge now lies in creating ways of engaging with publics around localized futures in ways that unite an attention to latent futures with the creativity enabled by the open future model.

Furthermore, working with non-laboratory publics also requires us as participation experts to take responsibility for the performative political effects of participation projects. The case study discussed in this paper has highlighted unique challenges associated with this mode of working with actual publics in the techno-scientific upstream. It is only in very specific situations that production of knowledge based on the hypothetical open futures model will be a satisfactory objective for both publics and scientists; this will be particularly challenging in the case of “upstream” science and technology. Understanding locally relevant terms of engaging with the future, and creating methodologies that will respond to these terms while delivering the desired substantive objectives requires both time and flexibility. This means participation projects will need to adapt to the specific ways of being a public in a particular place and develop the genuinely alternative and locally relevant ways of relating to the future. It means taking seriously the local politics that come with and are

generated by self-assembling and localized publics. The difficulties of accommodating such politics within the confines of “participation events” draws our attention to the broader context within which all participation efforts are situated, the task of creating better science-society relations. Therefore, we see a need to further develop ways of working with publics that are not based exclusively on consensus, but also on compromise (Van Den Hove 2006): on partial connections, ongoing dialogues, and a give-and-take between institutions and publics. This will require a serious revisiting of the much-disputed Habermasian model of rationality that continues to underlie public participation assessment, and a re-evaluation of the role of strategic positioning with respect to participants in public participation.

Author biographies

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Notes

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1. E.g. a recent review article states that "Organic photovoltaic devices (...) offer great opportunities for low-cost solar energy conversion, due to several technological advantages of organic materials. (...) With low-cost materials and processes, some statistical studies have shown that PV modules based on organic semiconductors are expected to have a much lower energy payback time and better environmental sustainability with less greenhouse gas (CO₂) emission than inorganic PV technologies" (Cao and Xue 2014, 2124)
 2. For a discussion of this stage of the project, see (Krzywoszynska et al. 2016).

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Fig. 1: The opening project exhibition, researchers and participants interacting around the model of the town.