# **Strategic Research as a Mode of Academic Engagement:** Assembling Smart Energy Futures for Finland

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## Abstract

Strategic research indicates a problem- and future-oriented, collaborative process of knowledge creation. Analyzing a Finnish research project, Smart Energy Transition, and a related Delphi survey, we conceptualize strategic research as visioneering and as translations of technologies, time frames and narratives into a relational actor network. We ask 1) How does strategic research condition and contribute to academic practices of visioneering, 2) What are the available means to problematize futures and create intressement in a Delphi survey, and 3) How do academics carrying out strategic research align themselves as part of actor networks? We find that strategic research brings forward and operationalizes new practices in the boundaries between science, business and policy. In our case, the notion of disruption was used to problematize futures. Moreover, plural time frames of short-term changes in actor networks and long-term speculative visions supported intressement. Alignment of academic actors in the project hinged on several issues including research methodology, specific academic backgrounds and expertise, public energy discourses, and national and industry interests.

**Keywords:** smart energy, disruption, visioneering, strategic research

## Introduction

'Smart grids' and 'smart energy' have become prominent labels for an ongoing technological change in energy sources, distribution systems, business logics, and demand (Ferrari and Lösch, 2017). Visions of a smarter energy production system include ideas on how to tackle global environmental problems while at the same time creating pathways for new cleantech industries, new jobs, and sustainable energy production (Leipprand et al., 2017). Yet, key technologies, their diffusion and integration with existing systems and the local contexts, contain significant uncertainties. Visions of smart energy are thus representations of anticipated and desired, yet highly uncertain and debated, futures (Ferrari and Lösch, 2017; Ballo, 2015; Engels and Münch, 2015; Butler et al., 2015).

While futures research and scenarios have been identified as particular forms of creating expectations and demand for new technologies and securing resources for further development of the technology (Bell, 2011; Geels and Smit, 2000; Borup et al., 2006), the active work of making visions and the unfolding of their impacts has received less attention. In this paper we follow a track identified by Ferrari and Lösch (2017) and focus on visioneering and 'visions as socio-epistemic practice'. We conceptualize such practices with the help of actor network theory and the notion of translation (Callon 1986a, 1986b; Latour 1993). At their core, actor networks are composed of human and non-human actors, scientific facts, engineering achievements, and social arrangements, each of which have identities and properties that have been adjusted to fit each other. Actor worlds come together via translations of existing entities into specific networks by the selective and purposeful interpretation of their key properties (Callon, 1986a, 1986b).

Visions as socio-epistemic practice strongly implicate a political and practical involvement of academics and blurring boundaries between science and society. Addressing such conditions, science and technology studies have highlighted the multiple ways in which academics and the institutions of science are intertwined with the surrounding society (e.g. Jasanoff, 2015, 2009; Nowotny et al., 2001). The thesis of entrepreneurial science (Eztkowitz, 2011) emphasizes the interaction of academics and the private sector in commodifying knowledge. Yet, the increased emphasis on impactful science also calls for further societal contributions. A broad range of academic work related to, for example, energy futures can be conceptualized as scientific policy advice (SPA), which is characterized by field-specific expert knowledge (Kropp and Wagner, 2010) and transdisciplinary pragmatic approaches to problem solutions (Leipprand et al., 2017). To spur such work, national research policy agencies have introduced specific funding schemes and criteria that reflect a research paradigm of future-oriented, challenge-driven *strategic research* (Rip, 2002, 2004; Aarrevaara and Dobson, 2016), which is also the institutional context of our study.

Science and technology studies have furthermore called for attention to modes of engagement and ongoing boundary work between science and the users of scientific knowledge (Lam, 2010; Möllers, 2017). Researchers should conform to a T-shaped identity of being both generalist and specialists (Rip, 2004). They also need to become the double servants of politics: First, they are expected to contribute to political processes by providing insights into the challenges ahead and visionary ideas about them, and second, to help decision makers to better address such challenges. Overall, the tenets of strategic research call for ongoing boundary work between science and politics or business (Lam 2010, Möllers 2017). Academics in strategic research not only tailor their knowledge into particular social concerns and thereby bridge between the conceptual domains of basic and applied research (Calvert, 2006; Möllers, 2017), but also actively construct demand for their knowledge and make themselves useful in the given political and practical contexts (Latour, 1993; Calvert, 2006; Hoppe, 2015).

We contribute to the discussions on visions as practice and strategic research by drawing attention to the ongoing tailoring and adjustment of the research activities vis-à-vis social expectations. More specifically, we take a Delphi survey as a particular research operation and trace how the survey questions reflect the processes of tailoring and pragmatic interests around the survey. The empirical material stems from a large research project called Smart Energy Transition (SET). The project was funded by a strategic research program of the Academy of Finland, premised on producing useful knowledge for societal purposes, and designed to use futures study methods in a constructive manner. Drawing on data including the funding application, project-internal position papers, participant observation, presentations, and interview data, we provide a close-range account of attempts to problematize energy systems, interest actors, and create a politicized space of possibilities in relation to smart energy technology. Specifically, we ask 1) How does strategic research condition and contribute to academic practices of visioneering? 2) What are the available means to problematize futures and create interessement in a Delphi survey? and 3) How do academics carrying out strategic research align themselves as part of actor networks?

We also aim at a pragmatic contribution. By following up how time scales and uncertainties were constructed and negotiated in the empirical case, we want to highlight the questions of closure and convergence in visioneering. Strategic research is premised on grand social challenges that call for concerted action. Yet the involvement of researchers in policy processes should thrive on transparency and openness regarding the means, paths, and potential actors (Leipprand et al., 2015). We address these issues in respect to existing concerns relating to the Delphi technique (Riikonen and Tapio, 2009), as well as addressing them on the broader level of strategic research.

The paper is organized as follows. We begin by elaborating on the concept of strategic research and how it encourages a close interaction among academics, politicians, and other societal stakeholders. We then briefly introduce the Delphi survey as a futures research method and the data we draw on, and proceed to focus on the SET research proposal, the ways to meet the request for politicized co-creation of research, the resulting actor network and the problematization of energy futures. Thereafter we follow more closely the technical elements of the network and process of drafting the Delphi survey questions and the technology portfolio. In the discussion section we return to the notion of strategic research and argue that it can be understood as an active way of constructing possible futures.

## Strategic research as translation

Rip (2002, 2004) dates the rise of *strategic research* to the 1970's and claims that such research blends aspects of 'basic' and 'applied' research into a new concept which reflects a practice of scientific inquiry combined with social engagement. At least since then, and voluminous through institutions such as EU Framework programs, problem- and solution-oriented research has proliferated. A brief look at our case study also highlights the logic. In the case of Finland, the Strategic Research Council (SRC) at the Academy of Finland was founded in 2014. The SRC aims to provide the scientific community with an opportunity to produce scientific information for government policy and decision-making. More specifically, the goal is to engage the end-users of research knowledge as early as possible and through this early engagement have the research needs of the end-users considered by the research teams. The logic of the funding instrument rests on co-creation or co-design on the one hand and the shared goals and practices of interaction on the other (Aarrevaara, 2015; Aarrevaara and Dobson, 2016).

The practice of social engagement and co-creation can be understood in different ways. Studying the scientific policy advice related to German Energiwende, Leipprand et al. (2017) claim that academics engage with advocacy coalitions and with the narratives they use in order to promote political goals. Supplementing politics, scientific work and the facts derived from it are used to pinpoint problems, potential actors, means–ends chains, and potential policy pathways. Controversies and gaps between opposing advocacy coalitions can be (and have been in the German case) mediated by providing knowledge that is normative but transparent. Being located close to policy making, researchers may become the "cartographers of policy pathways" (Edenhofer and Kowarsch, 2015; Leipprand et al., 2017). Yet, we suggest that the framework of scientific policy advice delivers a rather linear view on academic futures creation which does not fully take into consideration how researchers are embedded in the broader society that provides them with resources and commissions them to attempt translations and carry out practices of visioneering.

Visions as practice can alternatively be understood as attempts to translate existing entities into a network with a joint effect of constructing viable socio-technical arrangements. Ferrari and Lösch (2017, 79) suggest that socio-epistemic practices of visioneering can: "produce and designate spaces of possibility," "normatively translate the use of the spaces of possibility into an urgent need for the current society," and ultimately also "result in practical changes in the socio-technical arrangements and constellations they address." Visioneering hence contributes particularly to the aspects of problematization and interessement that Callon (1986b) identifies as the early moments of translations.

Sociology of translation underscores the active and open-ended nature of futures making. Callon (1986a, 1986b) and Latour (1993) describe technology development as the deliberate building of actor networks through which some actors can become prominent "spokespersons." Such actors seek to assemble actor worlds and enlist the needed social and technical components of envisioned future technologies by defining what and who is needed and how each actor should participate in the scheme. If the translation is successful, actors are mobilized and aligned, and action results (Freeman 2017). With this vocabulary, it becomes apparent that each element—be it organization, social actor, or a technical component—may have an interest in future energy solutions and a need to be represented in the actor network. Strategic research as an engaged form of collaborating with end users of research, hence can be viewed as attempts to assemble actor networks, represent entities and speak-for aligned interests.

Interests are suggested and represented through simplifications that contain the essential role of each actor for a particular actor world. The castings that are suggested and formulated in a responsive manner by spokespersons may however be challenged. Callon highlights that simplifications, which are needed to assemble the actor world, contain the seeds of controversy as they are but partial images of actors, as if they only existed in order for the project to unfold. Indeed, Latour (1993, 65) insists that translations are by definition misunderstandings that serve to align the diverging interests of the parties involved. It follows that not all translations succeed and dissidence will follow (Callon, 1986b). Moreover, if the work of translating actors and assembling interesting futures is premised on productive misunderstandings, the request for transparency around scientific policy advice becomes conceptually difficult: each of the viewpoints of actors are partial, science-actors are no different and ultimately the viewpoints and workings of actors cannot be transparent to others but merely translated.

For these very reasons, the notion of translation can be also used to conceptualize the interface between science and society. Freeman (2017) suggests that research projects at the same time realize translations and are realized by them. This is to argue that the work of researchers may be organized by the same principles (of administration and governance) that they are to study (Freeman, 2017) and that researchers look for demand for their research and move horizontally between the laboratory and the social context of the produced knowledge (Latour, 1993). In our empirical case, it is to argue that insofar as the researchers are successful in participating and speaking an entity such as smart energy transition (for which no shared understanding exists), they also constitute (a need to study) smart energy transition. It is this dynamic that we seek to capture with our first research question: How does strategic research condition and contribute to academic practices of visioneering?

The notion of tailoring (Calvert, 2006; Möllers, 2017) highlights the problematic aspects of visioneering and the boundary work that is performed between science actors and the users of knowledge. It denotes, firstly, efforts by researchers to tailor forward, i.e. point out how their results can be applied and what the relevance of their work is. In our empirical study, we have operationalized the question of forward tailoring in asking how the background of researchers affected the SET project proposal and the Delphi survey questions. On the other hand, reverse tailoring, Möllers (2017) suggests, involves attempts to redefine the social problems as formulated by funders to better fit the researchers. Turning this into an empirical question we report on how the SRC and the specificities of the call, the contemporary political power balance of Finland, affected the research proposal and the Delphi survey as a particular operation.

A priori, we do not think that strategic research necessarily produces an excessive need to tailor or particularly problematic identities for researchers. It calls for extending roles or switching them

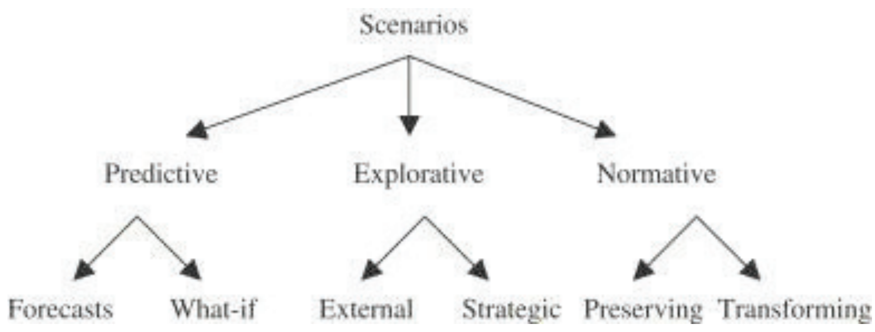


**Figure 1.** Scenario typology (Börjeson et al., 2006)

towards entrepreneurial scientists, but as Lam (2010) reports, such roles are increasingly common. Indeed, existing research on the SRC also indicates interesting results regarding the changing role of researchers (Aarrevaara, 2015; Aarrevaara and Dobson, 2016). Their central aim in the projects is to pursue high-quality research, but alongside this, a picture emerges of researchers actively functioning as a type of facilitator within the project. Such activities are clearly linked to their will to influence societal matters and processes. Rather than focusing only on the scientific work, these researchers put time and effort into building cooperation systems, not only between researchers and stakeholder partners, but also between the different stakeholder partners. Such triangle-like cooperation building is seen to benefit the issue to a degree that makes such actions worth the effort. This finding is particularly interesting as it surpasses the idea that researchers need external mediators between the scientific world and the rest of society in order to get their message across.

## Delphi-survey as a tool for scenario-building, problematization and interessement

Before moving to our empirical analysis on the translation efforts around smart energy technology, we briefly introduce the Delphi survey as a technique and a key ingredient of these efforts. The Delphi survey as a technique was developed in the 1960's to conduct anonymized and iterative polling of expert opinion (Linstone and Turoff, 2010; Gordon, 2000). Diverting from the aim of producing reliable predictions, Turoff (1970, see also Hasson et al., 2000) has developed a 'policy Delphi' and suggested that Delphi processes can be geared to explore underlying assumptions leading to different judgments and to educate respondents on a topic.  Delphi surveys are frequently used to support scenario work (Nowack et al., 2011) and useful basic distinctions between Delphi methods can be derived by considering differences in scenario types. An established way to classify scenarios is to distinguish between scenarios of probable, possible, and preferable futures (Börjeson et al., 2006; Masini, 1994). Scenarios of possible and preferable futures imply an increasing scope of action as futures are not viewed as being determined but as being actively made. Indeed Börjeson and colleagues (2006) suggest that the purpose of scenario building might be used as a basis for a typology (Figure 1).

Predictive scenarios spotlight particular technologies (Geels and Smit, 2000) and may seek to address the conditions of their further development in the form of a what-if analysis. In the field of energy studies the 'grid parity of photovoltaics' exemplifies predictive deterministic scenarios. Normative scenarios are more outspoken in terms of political goals: They are built on a desired end-state and look for the means to achieve this state. Backcasting as a particular method can be viewed as a transformative scenario that is built on a problematic view of current trends and a need to change the parameters and structures of the system in which futures unfold (Robinsson, 1982). An example of this type of scenario setting would be processes that fix and aim at, for example, a given share of renewable energy production. Exploratory scenarios, according to Börjeson and colleagues (2006), seek to answer the question

'What can happen?' referring to either external factors or strategic actions in particular futures. Specifically, in comparison to the what-if type of scenarios, they state that "explorative scenarios resemble what-if scenarios, but the explorative scenarios are elaborated with a long time-horizon to explicitly allow for structural, and hence more profound, changes" (Börjeson et al., 2006, 728). Exploratory scenarios of, for example, smart energy technology may thus play with long enough time periods in order to evoke uncertainty and complexity and yet leave the desired end-state or outcome unarticulated. In general, Delphi studies need to strike a balance between time scales that either allow or limit exploration of new emerging solutions (Börjeson et al., 2006; see also Ferrari and Lösch, 2017).

## Data and methods

The case we use consists of three layers: the call by the SRC, the research proposal by the SET consortium and the Delphi survey planned by researchers in the project. In terms of the level of the SRC, we rely on previous published work (Aarrevaara 2016; Aarrevaara and Dobson, 2016). Our analysis covers a period from initial drafting of the project plan "Smart Energy Transition: Realizing its potential for sustainable growth for Finland's second

**Table 1.** Key phases of the analyzed futures work

| Phase | Available and used documents | The role of the documents |
|---|---|---|
| Assembling the consortium | Consortium memorandum 19.03.2015 (5 pages); Consortium memorandum 01.04.2015 (7 pages); A list of the intended members of the technology panel 22.04.2015 (Excel sheet) | Early ideas on what smart energy is, who could be in the consortium and the adjunct technology panel, and how technological disruption should be conceptualized |
| Submitting the proposal | Project application 29.4.2015 (19 pages) | First formal ideas about the Delphi survey, including a five-year time frame |
| Redefining the scope of the project after a positive funding decision | Position papers by six project partners (each 1–2 pages long) | The exchange of ideas amongst project partners regarding which technologies should be studied in the whole project |
| | Memorandum of a meeting on work package 1 (WP1), held on 7.1.2016 (4 pages) | The first meeting of the Delphi group; the memorandum presents the first listing of technologies for the Delphi survey |
| Planning the Delphi survey | WP1 Delphi interview guide, 15.1.2016 (3 pages) | Presents the first formulation of the intended questions for the Delphi survey |
| | Interview notes from first-round interviews (9), February 2016 (each with approx. 3 pages of text) | Documents 1) interviewees' understanding of the disruptive features of new energy technology, 2) suggested changes to the planned survey questions |
| | The Delphi questionnaire's technology descriptions, 20.3.2016 (1 page) | Introduces each selected technology with one sentence to be used in the survey. |
| | Survey questions and respondents' comments on the test run of the survey on the eDelphi platform 29.3.2017 (54 pages) | This presents the first demo version of the online survey and the responses of trial users |
| | The report on the first round results of the Delphi survey, 20.4.2017 (110 pages) | This presents the final survey questions as well responses and discussion of the questions |

century" (SET) in early 2015 to the roll-out of the Delphi survey questions in April 2016. [1]

The empirical material that we draw on mainly consists of internal project documents of the case project. As all the authors have themselves worked in the project, participated in several meetings, and exchanged emails with other project partners, this offers a more thorough background understanding of the case. Table 1 lists the key steps in the analyzed project, the documentation that has served as the empirical material, and the key insights or role the document has in the analysis.

Most of the above documents are management documents containing abbreviated text describing discussions in meetings or presenting plans and lists of items for upcoming work. They have mainly been written for project participants rather than for an external audience, with the major exception of the funding application. We have approached the text as a factual description of the choices made in the project, placing emphasis on how actors and technologies were brought into the realm of smart energy. The outcome of such work is a changing list of relevant elements. In addition, and in particular relating to the moments of problematization, we have analyzed the discursive strategies of the SET proposal text and metaphors of disruptions that were placed in the proposal and the Delphi survey questions.

In addition to drawing on the documents created and interviews made during the planning of the survey, we interviewed the key actors of the project in spring 2017 to verify our results. These interviews were conducted with the principle investigator of the SET project, the key academic content provider (who drafted the first version of the proposal), and the policy liaison officer of the project (who has a key role in facilitating the interaction between researchers, companies and the policy makers in the SET project).

## The consortium and grant application: Smart energy transition as a research proposal for strategic research

We have divided our analysis of the SET project into two parts. In this section, we focus on our first research question about the way strategic research configures visioneering. We account for the drafting of the SET proposal and for the way in which the content was tailored to fit both the involved researchers and the social context of the project. The next section dwells on the second research question and on the work that took place after the positive funding decision, highlighting the different views that existed inside the consortium, the adjustment of the work program and the Delphi survey as an element of visioneering.

The analysis of the empirical material is also informed by the notion of visions as practice. We hence analyze both the making of the proposal and the establishment of smart energy transition as a shared vision, and the operationalization of such vision and the interessement of an actor network through a Delphi survey with particular informants and questions posed to them.

### *The forming of the SET consortium in response to the SRC funding instrument*

Strategic research implies multidisciplinary and -sectoral work (Rip, 2002 and 2004). The SRC followed this principle by requiring the consortium consists of at least three research teams, which represent at least two different organizations (e.g., universities, research institutes, civil society organizations, or private companies). Moreover, the researchers needed to represent at least three different disciplines. Additionally, the candidates were informed that it was expected that at least two, preferably three, government ministries would be involved in the projects. This was in addition to stakeholders from the private sector and/or the civil society sector.

The SET consortium had little leeway or need to challenge these predications of strategic research. While the consortium drew on the established joint research efforts of the business school partner, the political science partner, and the environmental policy research partner, such a consortium was not regarded as competitive in the call. Rather, the initiators from these three units reached out for both expertise in energy and building technology and economics, and for an organization that represents users of knowledge. The final consortium included:

- a management studies department in a business school
- a political science unit
- a design department in an arts school
- an engineering department working particularly with solar and wind power production technology
- a building technology research unit
- an institution for economic research
- an environmental policy research unit
- a state-owned company for promoting energy efficiency
- the city administration of a mid-sized Finnish city.

The consortium members anticipated and inquired into other competing applications and sought to combine forces with other research institutions with an established position on energy-related research. These attempts at mergers between consortia were however not successful: According to he consortium leader, the consortium came out to be an “innovative but not obvious” collection of partners and sought a viable niche by rephrasing emerging energy technology as *major societal disruption*.

### *The drafting of the funding application and the problematization of energy futures*

In the first call of the SRC in 2015, the three main themes for strategic funding were (1) the utilization of disruptive technology and changing institutions, (2) a climate-neutral and resource-scarce society, and (3) equality and its promotion (Aarrevaara and Dobson, 2016). The SET project application was written for theme 1 of Disruptive Technologies and Changing Institutions. Overall, it built upon a view of global technology change disrupting Finnish energy systems. The first formal version of the research plan, which was used to assemble a further consortium, envisioned the following energy future:

> Breakthroughs in the development of smart grids, metering, power storage, power-to-gas, power-to-chemicals and the Internet of Things jointly represent a disruptive set of technologies influencing Finland’s spearheads of growth: digitalization, cleantech and the bioeconomy. These smart energy solutions will cascade into new business ecosystems with unprecedented opportunities for cleantech development, but also leading to radical shifts in the role of producers, service providers and consumers. When combined with renewable energy cost reductions, this transition is disrupting the old rules of the energy system and shifting industry boundaries like the ICT revolution did. The IEA (2014) has estimated that the global energy transition creates a 50 000 billion dollar cumulative market in the next 20 years. The Smart Energy Transition (SET) project tackles the ongoing changes and demonstrates how Finnish industry can benefit from the emerging disruptive technologies around smart energy. (Research plan Smart Energy transition)

The consortium certainly stated rather boldly that it had insight into the forces that are going to affect Finnish actors in the future in a significant way and even cause disruptions in the energy systems. The notion of disruption, used by both the SRC call and the SET proposal, thus serves to evoke uncertainty and problematize energy futures. The text also enlists other fields of technology and actors, such as consumers, into the network. However, playing with the notion of disruption effectively undermines any direct predictions. Moreover, being uncertain about which areas and for which actors the ramifications of smart energy disruption might be most significant, the application serves as an explorative starting point. Finally, by inserting the notion of transition and by seeking to find effective ways for Finnish actors to cope with this disruption and even benefit from it, the plan takes a transformative view of the future, seeks to interest policy actors, and questions how to effectively steer social development towards a low-carbon energy system.

In the subsequent project meetings, the research group further crystallized the key logic to be placed in the application. The proposal claimed: international technology development will both push towards a change in the Finnish energy system and create business opportunities for Finnish companies in international markets; the process will create both winners and losers as existing resources and competences become redundant. The sheer force of international technology development is suggested to undermine any conservative strategies. Moreover, the consortium agreed to claim that, with proper policy tools, disruptive technologies can be taken into use and acted upon in a more concerted way, as the project name 'Smart Energy Transition' suggests.

The notion of disruption runs through the three levels of our empirical examination: the call, the proposal and the Delphi survey. Disruption was regarded to imply a particular time frame. Whereas Leipprand et al. (2017) suggest that longer time frames contribute to more proactive and change-oriented energy discourses, the SET proposal endorsed a short-term view. Quite explicitly, the development of the new Finnish actors in the energy field was regarded as interesting within a time scale of five years, whereas long-term predictions were regarded as difficult to make and uninteresting from this point of view. A retrospective interview with the principle investigator of the project revealed the logic for short termism. Insofar as disruption can be viewed as a rearrangement of existing actors and their interest, one can study and contribute to such change in the short term.

The plan included a dedicated work package (WP1) that was to study "the rate, direction and impacts of the technological transition" as well as "the possible directions, triggering factors, rates and impacts of ongoing disruption in smart energy technologies." Our participant observations indicate that such a 'techy' work package fit the engineering members of the consortium and was seen to both strike a balance with other work packages driven by social science and raise the credibility of the proposal. The work package was further split into the subtasks of conducting a Delphi survey to establish the rate and direction of technological change within a five-year time span, and a separate task, projecting the anticipated developments in digitalization, cleantech, and bioeconomy. In other words, the problematization occurred by suggesting that energy futures can be acted upon instead of a view of global developments to which Finnish actors simply need to adjust. Hence, the project plan aimed to organize processes in which multiple, distributed actors could fill in details about how the likely changes in the Finnish energy system could potentially unfold. Yet, by initiating a set of core technologies, the academics working in WP1 nevertheless acted as spokespersons for a particular network.

Tailoring as boundary work took place in respect to selecting a theme within the SRC call. Our ex-post interviews reveal that making disruption the mainstay of the proposal was regarded as a very risky strategy. Yet, the consortium stuck with theme 1 and the notion of disruption, as this was broadly viewed to fit the credentials of the consortium better than 'climate neutrality and resource scarcity', the alternative theme in the call. Tailoring took place also as the proposal was tuned politically. The writers of the application regarded the upcoming parliamentary elections and the pending success of an agrarian party as an added reason to put emphasis on aspects of biofuels. Hence, tailoring of the proposal and research interest was far more than lip service (cf. Calvert, 2006) but rather included a substantial realignment of the work program.

The technology focus of the application and notions such as *smart grid* and *intermittent power production* reflect a productivist technology discourse but also forward tailoring, i.e. the expertise areas of the consortium. It is obvious that the application was premised upon (and also created future demand for) such expertise (cf. Latour, 1993). However, while the consortium had extensive technical and business knowledge—particularly in the area of solar energy—the decision was to put the focus on a broader set of technologies related to renewable energy. This was to signal that the potential impacts of disruption, the actors implied, and the work of the SET project were to span existing industries and several sites in which energy is used: In addition to energy production technologies, the application included work on buildings and vehicles as sites in which energy can be produced, stored, and used in a distributed manner. Parallel to this, there was a more fundamental shift from the narrow areas of expertise of the consortium researchers towards studying the broader impacts of the disruption on less familiar terrains.

The SRC and the notion of strategic research pushed the SET application not only toward interdisciplinary work but to include non-academic actors. The initiators of the project hence enlisted practitioners and interest groups as carriers of interests by asking for Letters of Commitment. Such letters were particular devices for tailoring as they demonstrated the potential applicability and short-term relevance of the results. Interessement thus proceeded already at the point of drafting the proposal and prior to any 'strategic research'. The following actor categories were drawn into the domain of smart energy transition:

- equipment technology manufacturers
- energy companies
- measuring and sensor technology
- energy efficiency services
- consultants
- smart traffic.

## SET in motion: Crafting an energy disruption into a Delphi survey

The planning of the Delphi study was already started when drafting the application. Key technologies, such as new forms of intermittent power production by solar and wind sources, were mentioned in the application. However, much of the content of the survey remained open at the time of submitting the application. After a positive funding decision, the partners thus needed to reassemble visions of smart energy and relevant research foci. After establishing the first ideas about the content, the planning of the Delphi survey followed guidelines given in previous research (e.g., Gordon, 2000; Riikonen and Tapio, 2009). Accordingly, organizers need to select a few knowledgeable and willing respondents and create a background understanding of the issues through interviews. Thus, it was the SET project partners and the few interviewed external actors who had the opportunity to draw in technologies, trends, observations, or emerging knowledge pools to the energy vision created for the survey.

Both more need and leeway for reinterpretation of the execution of the survey appeared within the consortium. In particular, the time frame and the technology mix—the technologies that are suggested to cause the disruption and amplify its effects—needed to be redefined.

### *Turning from predictive to strategic Delphi*

While discussions during the phase of writing the SET proposal listed five-year, 15-year and 30-year spans, the final plan did not specify other time spans than a five-year technology outlook that was to be based on predictive technology forecasts. Reconsidering time scales from the point of view of strategic research, it however became evident that a longer study frame was also desired. The position papers from November 2015 suggested a study of the potential impacts running up to 2025, whereas a later project meeting (07.01.2016) suggested the following time horizons: 2020 for a technology outlook, 2030 for a policy-level futures study, and 2045 for a scientific outlook. In the Delphi interviews and the demo version of the survey, the project group responsible for the survey indeed trialed different time scales for different questions. However, as this appeared to create confusion, the time frame was fixed to run to 2030.

### *Fixing a technology portfolio*

The technology portfolio of the survey was another subject that was modified after the funding decision. We account for the changes in tables 2 and 3. In the first phase, the consortium leader requested a focus proposal from each participating research institution detailing the key energy production and storage technologies that should be studied and the other relevant technology areas. This process is documented in position papers by six participating research institutes (see table 2 for a summary). These position papers exhibited a wide range of issues, potential impacts, and areas, branches, and industries that seemed to be challenged by smart energy technology. Compared with the application document, they added weight on the dynamics of industrial restructuring and put less emphasis on digitalization and on the Internet of Things. Another change in orientation is the stronger presence of bioenergy that came through in the mentioning of alternative biofuels for cars, the availability and competing uses of forest biomass and the challenges associated with all energy production that is based on burning organic matter.

Soon after the position papers were written, WP1 assembled to plan the Delphi survey. Some technologies were considered to be too radical. For example, fusion energy was discussed as a possible item on the list of technologies, but

**Table 2.** Summary of the technology portfolios in the position papers written by individual academic partner organizations (6)

| Which renewable energy production and storage technologies should be analyzed? | What other key technologies should be included? |
|---|---|
| Production technology<br>• Photo voltaics (PV)<br>• Wind<br>• Geothermal<br>• Hydro<br>• Solar thermal<br>• Heat pumps<br>• Bioenergy from agri- and silviculture, biogas<br>• Old renewables (water, wood)<br>• Tidal<br>• Heat pumps<br>• Heat storage in district heat networks for surplus wind power<br>• The integration of energy production from different low-carbon, renewable sources<br><br>Storage technology:<br>• Hydrogen<br>• Water/networks<br>• Electric vehicles<br>• Batteries<br>• Power-to-gas technology, power-to-chemicals technology[2]<br>• Ground and water heat storage | • Net-zero energy buildings<br>• All new energy-efficient construction technologies, HVAC and automation systems, and building-scale heat and power systems<br>• LED lighting and smart appliances<br>• Automation and control technologies<br>• Measurement technologies, data mining, data analytics, anomaly detection,<br>• Smart metering, power transmission and grid technology, smart grid, demand response<br>• Digitalization: the Internet of Things<br>• Functional energy chains e.g. from electricity to chemistry (material synthesis), electricity to food (food production) and electricity to gas<br>• Existing gas-operated systems & the utilization of existing infrastructure<br>• Transport: from oil to alternative propulsion systems (electric and advanced biofuels etc.)<br>• Wild cards? Including CCS, nuclear fusion<br>• Process industries, especially steel, other metals and concrete<br>• Green chemicals<br>• Competing uses for biomass (biochemistry) |

group members expressed anxiety about this issue. It would follow that other novelties such as biomass from algae production would need to be included. The time span and uncertainty about developments were not the only difficult aspects of scoping the technology portfolio: The content resonated between thinking about their significance in Finland and for domestic operations, and their significance in the export markets of Finnish companies. As no existing or emerging actors and interests in these to-be-excluded technologies were identified, translation did not occur and they were considered as empty promises that might create uncertainty but could not be effectively used to arrange actor networks. In a later phase, carbon capture and storage, and a novel concept of a 'power-to-food' energy chain, were also excluded as no existing actors or sites of relevant development could be identified. On the other hand, the portfolio came to include technologies such as large-scale solar heat and wave power since they had local technology actors in Finland (although apparent potential in Finland is less obvious).

The resulting iteration of the selection of technologies was presented in the Delphi interview guide, which was used to engage experts in the content of the survey. The interviews included six project partners, some of whom had been involved in writing the position papers, and four external practitioners in business and policy. Interviews affected the survey design in several ways: Energy demand and technologies of demand reduction gained prominence. This applied to the energy efficiency of buildings but also comfort expectations were mentioned.[3] The tendency of future studies to focus on energy production technologies (Zehner, 2014), which was clear in the scoping papers and the initial work plan of WP1, was thus partly resolved by the interview round conducted amongst diverse project partners in which both members of academia and practitioners raised concern about the overtly production-oriented focus of the intended study.

**Table 3.** Questions about disruptive energy technologies in the SET Delphi survey. Italics in the list refer to added technologies

*What is the role of the following technologies for the Finnish energy system in 2030? [options:* not significant; a promising alternative; a commercialized solution; a solution which has replaced key parts of the existing system*]*
*What is the role of the following technologies for Finnish exports in 2030? [options:* scant opportunities; some opportunities; major opportunities*]*
*How and where will the following technologies be taken into use by 2030? [options:* as off-grid solutions; as part of local distribution networks; as integral parts of the national systems; used during peak-loads*]*

- PV
- *Solar heat*
- *Wind energy*
- *Wave energy*
- Li-ion battery storage
- Other chemical storage of power
- Fuel cells
- Automated systems of demand response
- *District-level heat storage*
- *Geothermal heat*
- Heat pumps
- Carbon capture and utilization (CCU)
- *New ways of utilizing forest biomass in energy production*
- *Utilizing waste streams in energy production*

Moreover, as the interviewees had criticized Finland for a tendency to stick to forest biomass as the mainstay of new energy systems, they also politicized the survey by adding a question about the future of biomass in the case where burning was ruled out. Finally, the interviews also caused the above-mentioned shift in timescales. Instead of working with the five-year frame, the final technology portfolio was connected to the year 2030 (table 4).

Compared with the project plan, and in line with the position papers written by partners, the final version reflects an increasing need to account for storage technologies and other facilitating solutions for the increasing share of intermittent power production. It also builds on an actor perspective: Additions such as wave energy and geothermal energy were added according to ongoing technology development and automated demand response was added according to heightened interest amongst policy makers. On the other hand, biomass refers to the old established actors and interests that were refashioned into the new configurations of Finnish energy systems. These changes are partly effects of the SET researchers having been increasingly exposed to the topic in the early phase of the project. Hence the development of the survey reflects the basic premises of strategic research in which multiple stakeholders co-construct futures.

### *Using a Delphi survey to create interests and coordinate actors*

The choice to conduct a strategic Delphi resonated with Turoff's (1970) ideas on a policy Delphi: The survey was viewed as an opportunity to draw actors in, make translations, and suggest particular roles in new actor networks. This decision had strong impacts on the Delphi study. Rather than focusing on international technology development, it turned to focus on the ramifications of smart technologies in Finland. It also followed that the Delphi panel would be held in Finnish, consist of Finnish experts, and also include policy makers. Even the notion of expertise was changed. Instead of trying to poll the rate and direction of technological development amongst technology experts and speak to policy in the name of such expertise, the survey sought to consider the interests of potentially impacted Finnish actors.[4] Interessement did not however only take the form of invitations to partake in the survey, but also in the way that the questions were formulated. The categorization of potentially impacted domestic actors in the final survey was as follows:

- home owners
- the owners and operators of public buildings
- energy companies
- service business
- ICT and data management
- energy-intensive industries
- the transport sector
- agriculture.

The survey was also broadened towards further implications of the diffusion of novel energy technologies. It came to include questions on who is likely to suffer from this change. Potential “crises” or highly ambiguous futures were constructed against major CO2-emitting processes by asking whether they will perish or remain as “necessary evils.” Thereby actors such as coal-power producers, peat producers, and waste incinerators were also enlisted as relevant entities.

### *Disruptive narratives and prompts in the survey*

The SET project and the planned Delphi survey were premised on an image of the disruptive global technology forces that are affecting the Finnish energy system and its actors in a fundamental but unpredictable way. Listing energy technologies such as carbon capture and utilization created increasing uncertainty. Yet, in order to politicize the disruption, the survey was aimed at creating visions of potential strategic action. While the selected technology portfolio, the time frame, and the list of potential interest groups already suggest a particular actor network, future visions also depend on a narrative of problems, opportunities, and threats (Paschen and Ison, 2014; Leipprand et al., 2017). As the final part of our analysis, we thus briefly turn to aspects of narrating energy disruption in Finland.

The planners of the survey had used the notion of a ‘second wave of electrification’, which referred to “the electrification of energy systems as many renewable energy technologies relate to power production and many energy-efficiency technologies, including heat pumps and electric vehicles, require electric power as an energy form.” In addition to this, the Delphi interviews brought about new narrative structures of energy disruption. New representations of the key outcomes of the disruption derived from the interviews and included ‘post-fire era’, a ‘capacity market (as in telecom)’, the ‘decentralization of energy systems’, the ‘active role of prosumers’, and a ‘window of opportunity for system integration’. These open formulations were used in the Delphi questions in order to sensitize respondents to the magnitude and type of potential changes and the potential roles actors might assume.

## Discussion

The role of expectations and visions for technology development and socio-technical changes has been subject to wide academic interests (Borup et al., 2006). Following STS scholars such as Callon (1986a, 1986b) and Ferrari and Lösch (2017) we have suggested studying the acts and practices of visioneering. The analyses sought to shed light on how miniscule elements of visioneering such as Delphi survey questions reflect broader structures such as funding instruments.

Our first research question concerning how strategic research conditions and contributes to academic practices of visioneering appears to hinge on the notion of disruption. Disruption served to establish an explorative and constructive agenda for visioneering. The notion of disruption that the SRC used in the call, and that the SET project used in the proposal, effectively dispersed interest across academic silos. While disruption in the SET project was perceived to have a technical core, namely increased PV and wind power production, potential ramifications were proposed to be scattered across different technologies, industry sectors, and social actors. Moreover, the notion introduced uncertainties in who might be impacted upon and who should concerned and aim to develop strategic responses to new energy technology. To follow such a path of visioneering, practices may be aimed at translating existing, emerging and even missing entities into actor networks. Such bridging is clearly different from either predictive or transformative Delphi approaches. For STS scholars the implication is that strategic research may neither be traditional in the sense of predicting likely developments nor thoroughly political as providing means for predetermined ends, but rather speculative and explorative.

Our second question concerned the use of a Delphi survey as a tool for problematization and interessement. The Delphi planning began with a view of the major technological disruption brought about by intermittent power production and the need to store and use power in new applications during peak production. However, the heterogeneity of the consortium allowed for plural views of future development. The Delphi interviews proved critical in altering the content of the survey from its technology focus to the broader aims. The analysis of the SET project resonates with Zehner's (2014) claim that energy futures are often based on production technologies rather than addressing radically lowered energy demand. In this sense, the notion of disruption was not in itself enough to divert the path of the survey planning, but the interviews with the consortium members and external partners provided a reflexive space for thinking through the potential impacts of smart energy technology.

Can expert panels and Delphi methods be expected to deliver radically new or innovative futures? To begin with, translations need to build on existing entities and seek to bring them into new relations. Destabilizing prompts, such as a post-fire era, were used in the SET project to suggest impact mechanisms and outcomes that could interest and even mobilize actors. Key challenges relate to balancing between radical, disruptive notions of futures and capturing the interests of practitioners and making disruptions actionable. The notion of translation and actor network theory in general provide some hints. The enrolments of existing entities and the translation that occurs between networks imply that futures are made of existing elements, altered relations and interest-generating misunderstandings (Latour, 1993). Moreover, our results highlight that time scales are important aspects of problematization and interessement. Whilst Leipprand et al. (2017) view longer time scales as important for putting forward strategic analysis, Ferrari and Lösch (2017) suggest time scales need to be plural: They need to include the established "old" elements, the emerging elements, and the missing elements. While the missing elements do not exist, they can be represented by laboratories and scientific formula (Callon 1986a), as well as field experiments (Ferrari and Lösch, 2017). Yet, based on our findings, multiple time frames are difficult to manage in a Delphi environment.

Our third question concerns the alignment of researchers as part of actor networks. We contend that the proliferation of strategic research as an academic identity and occupation requires better understanding of such alignment. One interpretation is that strategic research is being made on order for political purposes. Insofar as such research is transparent and the contributors are plural, such work may contribute to conductive policy processes (Leipprand et al., 2017). Another interpretation is that academic actors retain autonomy and use their existing knowledge resources, skills, and backgrounds to continue research efforts in their selected paths, engage in tailoring and push knowledge into the hands of users (Calvert, 2006). A third, more novel idea about the relationship between science and policy is to think along the lines of strategic research, the facilitation of knowledge making by heterogeneous actors and in terms of actor networks and translation. In this case, the roles of spokespersons and acts of translation constitute a new academic practice. This might be a creative practice, but it may also hide the politics of academic work. In the case of the SET project, staying rather firmly in the area of strategic Delphi research helped researchers to dodge normative questions about the desired end results and also the question of opting out from particular opportunities (cf. Felt, 2015). Hence, competing discourses, such as bioenergy and increased electrification, were present in the survey.

We have also claimed that SET researchers engaged in a different type of tailoring. This was evident in the planning of the project as well as in the execution of the work. The research proposal was drafted based on the resources and existing knowledge of the consortium, but also in anticipation of evaluators, the pending political climate, and other competing proposals, as well as on forming new alliances with other social actors. These results suggest that SRC funding has been able to create room for (or forced) researchers to create new combinations of knowledge and expand their activity towards participating in social change. For us, the gradual evolution of the research agenda represents a safeguard against academics being subordinated by political needs, even when they themselves are framing and then being faced with questions such as "How can Finland best benefit from smart energy disruption".

The question of alignment between researchers and pragmatic interests can be viewed as a layered phenomenon. On the most abstract level, strategic research calls for impacts such as contributions in the future success of a nation and expects researchers accordingly to pick and engage with grand societal challenges. On another level, the project consortium negotiated a fit between the resources, abilities, and academic histories in the consortium and the recognized challenges. Finally, the research methods indicate different forms of societal engagement and lead to more or less inclusive and responsive work processes. Hence, in our case the Delphi survey questions as the one outcome in the project were ordered and structured through these different levels: the SRC, SET and the Delphi survey as a futures study technique. In the current case, the middle level and the academic community of the SET project has proven particularly relevant.

## Conclusions

Energy futures are profoundly open, whilst being rooted in current technology development and social structures. The notions of translations, visioneering, strategic scenarios and strategic Delphi thrive from this position: Futures are actively made by combining existing elements and emerging elements into visions that are able to capture, create interest and even mobilize implicated elements and participants.

In this paper, we have suggested that academics addressing issues such as smart energy engage in visioneering. This notion highlights the active practices of translating existing entities into new networks. Such work is increasingly prominent as funding organizations push academics to engage in policy making and business, and to make contributions to solving grand social challenges under the rubric of strategic research. Our interests initially lay in the way policy and business actors influence academics, and the way that academics strive for sovereignty. However, the case also witnessed the notion of strategic research as a process of co-alignment through which new futures, new identities and new research settings are being crafted. Critical questions, however, also arise. The previous knowledge base, forms of expertise, and social networks certainly influence the perceived space of possibilities.

On a pragmatic level the overall objective of this paper has been to try to better understand closure and convergence in visioneering. Strategic visions derive power from convergence: They amplify particular possibilities and exclude others. The notion of disruption, which is in frequent use in strategic research, proved to open up space for possibilities. Yet closure, convergence, and alignment with existing interests are parts of an evident and needed process, and they also concern academics. Whilst such processes can be seen to take place on different levels, our results highlight the importance of both the collaboration inside the multidisciplinary consortium and the methodological choices (such as Delphi surveys and expert interviews). In our case they affected both the time frame and technology options of perceived smart energy futures.

Beyond dealing with issues of managing closure and convergence, this paper has also attempted to contribute to the academic practice of strategic research. Insofar as academics are explicitly called upon to engage in futures making and in the quest for recipes for success, both self-reflection and critical examination of researchers' agendas appear to us to be fundamental elements of strategic research.

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## Notes:

1 www.smartenergytransition.fi

2 Later power-to-x came to be used in all conversion processes in which the high supply of intermittent power production can be converted into other forms of energy (heat) and energy carriers (e.g., hydrogen and synthetic methane), which can then be further used in novel production processes reaching all the way to power-to-food which refers to using methane in protein production with anaerobic bacteria.

3 These topics did not become included as "technologies." Energy efficiency was however introduced in other parts of the Delphi survey.

4 Invitations were sent by personal email to about 250 email addresses.