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LOCAL OPPOSITION AGAINST HIGH-VOLTAGE GRIDS: PUBLIC RESPONSES TO AGENCY-CAUSED SCIENCE-POLICY TROLLS

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ABSTRACT

High voltage (hV) transmission grids are projects of societal importance that potentially have controversial social and environmental impacts. Former research shows that public opposition is sparked by the perception of negative local impacts and unjust concessionary processes. In this paper we complement these perspectives by assessing the institutional practices of the regulatory agencies in dealing with scientific uncertainties. The regulatory agencies' 'ways of doing things' are often designed to serve policy and management needs. A critical point is that the demarcation between scientifically based facts, values and assessments are often blurred in the decision-making process. This paper draws on two Norwegian case studies to investigate how the regulatory agencies dealt with 1) electromagnetic fields and health risks, and 2) overhead lines versus sea cables. We argue that ambiguities and uncertainties that arise in the hV transmission line processes create 'trolls', and we explore how the local inhabitants and affected stakeholders in the two cases responded to these and how it triggered further opposition. By investigating how and why trolls appear and are handled, we conclude by discussing how public opposition related to hV transmission grids may be reduced – and how some 'trolls' may crack.

KEY WORDS: Renewable energy planning, value assessments, public engagement, decision-making, monster, public issues, boundary objects.

Introduction

The upgrading of Europe's energy infrastructure, including the construction of new high Voltage (hV) transmission grids, is crucial to meet Europe's energy and climate goals[i]. Although there is a general public support for increased development of renewable energy infrastructure in most European countries, the endorsement often turn to opposition in concrete projects (Toke, 2005; Aas, Devine-Wright, Tangeland, Batel, & Ruud 2014). Public opposition related to new energy infrastructures can be both costly and halt the realization of renewable energy (Toke Breukers, & Wolsink, 2008; Tobiasson & Jamash, 2016). As a consequence, regulatory authorities as well as the transmission system operators (TSOs) want to improve their understanding of public opposition, hence to identify problematic issues and then minimize them (RGI, 2013). In social science research on energy infrastructure, public opposition was previously often explained as 'NIMBY' (Not In My Back Yard), claiming that affected people are likely to oppose renewable infrastructure placed near their homes and communities (Wustenhagen et al. 2007; Soini, Pouta, Salmiovirta, Uusitalo, & Kivinen, 2011). NIMBY has been criticized for simplifying a complex phenomenon and portraying individual objectors as selfish, ignorant and irrational (Devine-Wright, 2009; Devine-Wright & Batel, 2013). However, a more nuanced picture emerge in recent research, namely that many opponents are concerned with wider impacts on their local communities, including how projects might affect places of particular significance (Devine-Wright, 2009; Devine-Wright & Howes, 2010; Wolsink, 2013: Batel Devine-Wright, P., Wold L.C., Egeland, H. Jacobsen, G.L., & Aas, 2015). Besides, public opposition might emerge from the planning process, and in particular to what extent the process is perceived as sufficiently transparent, just and fair (Cotton & Devine-Wright, 2011). Studies have investigated measures for improved public involvement and influence on energy development projects (Devine-Wright, Devine-Wright & Sherry-Brennan, 2010; Schweizer-Ries, 2010; Cotton & Devine-Wright, 2012; Aas et al.,

2014). Knudsen, Wold, Aas, Haug, Batel, Devine-Wright, Qvenild & Jacobsen et al. (2015) demonstrated that local inhabitants can perceive grid development processes as unjust due to insufficient information and unsatisfactory involvement as seen from the view of some publics. However, less is written more specifically on what aspects of the public energy planning procedures that can trigger or escalate opposition. This is also the case with electricity grids.

In a concessionary process the regulatory agencies weigh and prioritize costs and benefits, some of which are uncertain, in manners that sometimes are difficult, inaccessible or incomprehensible to the public. Institutional procedures are designed to serve policy needs which is 'produced in institutional settings and under criteria of validity that are different from those of 'science' (Jasanoff, 2011, p.1). Jasanoff (ibid.) relates this type of knowledge-assessment process to that of a pianist who knows the techniques of piano playing intuitively. Several strands of social science research on technology and science (STS) contribute to shed light on institutional procedures. Jasanoff (2005) called for increased focus on the public in STS research, since much emphasize have been put on institutional relations between science, industry and authorities. The work of Wynne (2005) and Marres (2007) on ‘public issues’ underlined the importance of how ‘issues’ are articulated. Understanding and assessing how and by whom ‘issues’ are articulated, prior to, during or after participatory events, can be important for publics’ engagement into science-technology challenges (Wynne, 2005; Marres, 2007). Van der Sluijs (2005) elaborated how procedures of regulatory agencies seem to be built into the institutional settings and be constituted by 'bits and pieces of knowledge that differ in status, covering the entire spectrum from well-established knowledge to judgments, educated guesses, and tentative assumptions' (Van der Sluijs, 2005, p. 87). Similarly, studies on decision-making in the environmental conservation sector have depicted these as truly

instrumental, where value assessments and approximate judgments are glossed over or ignored (Bay-Larsen, 2012; Treffny & Beilin, 2011; Van der Slujis, 2005).

Smits (2006) introduced the 'monster' metaphor to address how decision-makers, stakeholders and the public struggle in handling uncertainty and new technology. Bay-Larsen (2012), used the 'troll' as a synonym to Smits' (2006) 'monsters' in a study of Norwegian biodiversity conservation, and the challenging interface between science and policy. Are similar mechanisms as those identified in Smits' 'monsters' (2006) and Bay-Larsen's 'trolls' (2012) relevant to describe particularly challenging procedures in energy planning? Can institutional planning procedures of the regulatory energy agencies operating in the science-policy interface cover up uncertainties? Are decision-makers weighting pros and cons and different concerns against each other in ways that later make them erupt as 'monsters' (Smits, 2006) or 'trolls' (Bay-Larsen, 2012), sparking or escalating public opposition? This study explore both whether 'trolls' appear, what form they take and how they may be responded to by stakeholders, drawing on examples from two Norwegian case studies from energy planning, the hV transmission line projects Ørskog-Sogndal and SydVestlinken. To exemplify the challenges we look specifically at how the regulatory agencies[1] dealt with uncertainties around 1) Electromagnetic fields (EMFs) and health risks, and 2) choice of overhead lines or sea cables. We end by discussing how public opposition may be reduced - can 'trolls' be avoided?

Public grid planning in Norway

Grid planning and development in Norway is regulated by the Energy Law (1990). The concessionary process can be divided into three main phases; planning, approval and

[1] We use the term regulatory agency to refer both to the regulatory authorities, Norwegian Ministry of Oil and Petroleum (MoPE) and The Norwegian Water Resources and Energy Directorate (NVE), as well the public transmission grid operator Statnett, which despite of different mandates outlined below, play key roles in hV transmission line planning and decision-making in Norway.

implementation. In the planning-phase, the developer, which in our cases is the national TSO Statnett[ii], assesses the need for grid development before notifying the regulatory authority Norwegian Water and Energy Agency (NVE[iii]). The notification is subject for public consultation and public meetings before the Environmental Impact Assessment (EIA)-programme is approved by NVE. Statnett is then responsible for executing the assessments required, normally by engaging external experts. The outcome of the EIA-programme[iv] represents the primary knowledge base upon which decisions are to be made, including consequences for environment and society. NVE receives the EIA and the application from Statnett, and the application is then subject to a public hearing. During the hearing phase, NVE arranges open information meetings and do on-site inspections to better evaluate the application (Sataøen, Brekke, Batel, & Albrecht, 2015). Based on the EIA, results from the public hearings and own assessments, NVE recommends alternatives to the Ministry of Petroleum and Energy (MoPE), which is the final decision-authority[v] .

The Energy Law § 1-2 emphasize that the affected public and private interests are to be considered as a part of the broader socioeconomic profitability assessment (Lovdata, 1990). Consequently, the regulatory authorities are obliged to consider how public and private interests are impacted and how the extent of damage can be mitigated during the licensing process (Winge, 2013). Local inhabitants and affected stakeholders can provide comments either through written statements during public consultation or by participating on public meetings arranged by NVE. The inputs will be evaluated and weighed by the decision-maker up against all other relevant public and private interests and concerns. Even though the EIA is the formal knowledge-base for decision-making in the grid development process, the Energy Law gives NVE and MoPE statutory authority to exercise their own assessments when weighing different concerns, interests and impacts (Winge, 2013).Thus, it is not given that recommendations based on the EIA will be followed by the regulatory authorities.

Monsters and trolls in energy planning

To analyze how the regulatory agencies handle uncertainty in the concession process we draw specifically on what Smits (2004; 2006) termed 'monster theory'. The framework was drawn up to address the publics' discomfort and the 'moral gut feelings at stake' with introductions of new technology (Smits, 2004; 2006). *Monsters* can be defined as a type of boundary objects[vi] that at the same time fit into mutually excluding categories such as ' knowledge versus ignorance, objective versus subjective, facts versus values, prediction versus speculation, science versus policy' (Van der Slujis, 2005, p.87). Thus, when a phenomenon fits into mutually excluding categories it is perceived as confusing and 'unnatural'; a monster (Smits, 2004; 2006). Van der Sluijs (2005) applied Smits' monster theory to the science-policy interface and practices of handling uncertainties related to environmental problems. Because environmental problems are complex in nature and difficult to examine in every detail, so-called objective scientific facts are increasingly mixed up with other types of knowledge like judgments, assumptions and guess work (Funtowicz & Ravetz, 1993; Van der Sluijs, 2005). In line with Bay-Larsen (2012), who followed in the steps of Smits and Van der Sluijs and studied the science-policy interface in Norwegian biodiversity conservation, we have chosen to refer to *trolls* rather than *monsters*, as trolls have a long mythological history in Norway. Our concern is then how the troll metaphor can be applied as a reference for assessing the practices of regulatory agencies in coping with uncertainties and the complex weighting of multiple interests in the science-policy interface of energy planning, especially in the dialogue with local publics and affected stakeholders.

While studies like Smits (2004; 2006), Van der Slujis (2005), Curry & Webster (2011) and Bay- Larsen (2012) focused on scientific and political institutions' handling of uncertainty monsters or trolls as such, we expand the focus to address the responses to potential trolls from affected local stakeholders, responding to Jasanoff (2005) and Marres' (2007) call for

bringing the public back into STS studies. Our analytical focus is specifically on how regulatory agencies – consciously or unconsciously – handle uncertainties related to impacts of hV grid development. In line with the reasoning around monsters, we explore the following approaches available for the regulatory agencies to handle uncertainties – consciously or inconciously; *troll exorcism* (Smits, 2006; Van der Slujis, 2005), *troll adaptation* (Smits, 2006; Van der Slujis, 2005) and *troll assimilation* (Smits, 2006; Van der Slujis, 2005). We also extend this analytical framework by referring to *Troll detection* (in line with Curry &Webster, 2011) and *bewitching of trolls* (drawing on literature such as Skogen, Krange, & Figari, 2013; Fine & Turner, 2001) as responsive approaches affected stakeholders can use. Both approaches and responses are explained below.

Troll exorcism can be described as a way to expel uncertainties by calling for more science to reduce ambiguities (Van der Slujis, 2005). *Troll adaptation* is another option where the prevailing uncertainties are adjusted into already existing categories (Smits, 2006). One way to do this is to twist the discussion towards quantified references, and thereby diminishing the dilemma of comparing incommensurable values. In this way, numeric references are used to legitimize value-based decisions. Finally, there is a strategic option of *troll assimilation* which refers to a process where the uncertainties are more systematically addressed, contemplated and if possible accommodated during the decision-making process (in line with Curry &Webster, 2011 and Van der Slujis, 2005).

Moving on to stakeholder responses, we have borrowed Curry and Webster's (2011) *troll detection strategy*, to describe how affected stakeholders respond to the authorities' strategies. Within the scope of this paper we have defined troll detection as a way in which the impacted stakeholders dig into the uncertainties and demand increased accountability and transparency from the regulatory agencies. In short, this is a strategy to expose the trolls so that they crack. Another outcome for the impacted stakeholders is what we have termed

bewitching of trolls. By drawing on literature in the field of science versus policy (Skogen et al., (2013) and Fine & Turner (2001)), there is an opportunity for proposing and spreading rumors both as a form of cultural resistance and as a means to try to fill in information gaps in the regulator agencies' argumentation. This could cause bewitched trolls which may grow into 'cruel creatures' that intensify opposition and conflicts between impacted stakeholders and regulatory agencies, a phenomenon which became quite manifest during the Norwegian monster-debate in 2010 (Ruud, Haug & Lafferty, 2011). Based in these approaches, we do not only aim at discussing how such trolls are influencing public opposition, we also aim at discussing whether this opposition can be reduced. Can the trolls actually disappear?

Methodology and cases

We chose a case study design (Yin, 2014) with two transmission line projects in Norway to ensure variation in terms of geographic and demographic characteristics, temporal stage in the planning process and the need arguments used to legitimize the projects. The first case is the Ørskog-Sogndal transmission line localized in the fjord district of West-Norway covering a stretch of nearly 300 km. When finalized, the transmission line will run through 15 municipalities and two counties. The planning of the grid development project started in 2005 andthe final concession was given in 2011, except from two sections getting final concession in 2012. The need was related to improved security of supply in Mid-Norway, as well as connection of the production of new renewable electricity production in the area. The second case, SydVest-linken, was to be located in the eastern part of Norway and connect with Sweden. The Norwegian section was planned to stretch over 60-110 kilometers in rather densely populated areas just south of the capitol Oslo. Two counties would be affected on both sides of the Oslo fjord covering several municipalities. The notification of the project was sent in 2009 and the EIA program decided in 2012. The need for the line was related to

ensure security of supply and reduce bottlenecks in the common Nordic electricity market. However, in 2013 the project was, according to Statnett abandoned due to lack of socio-economic profitability.

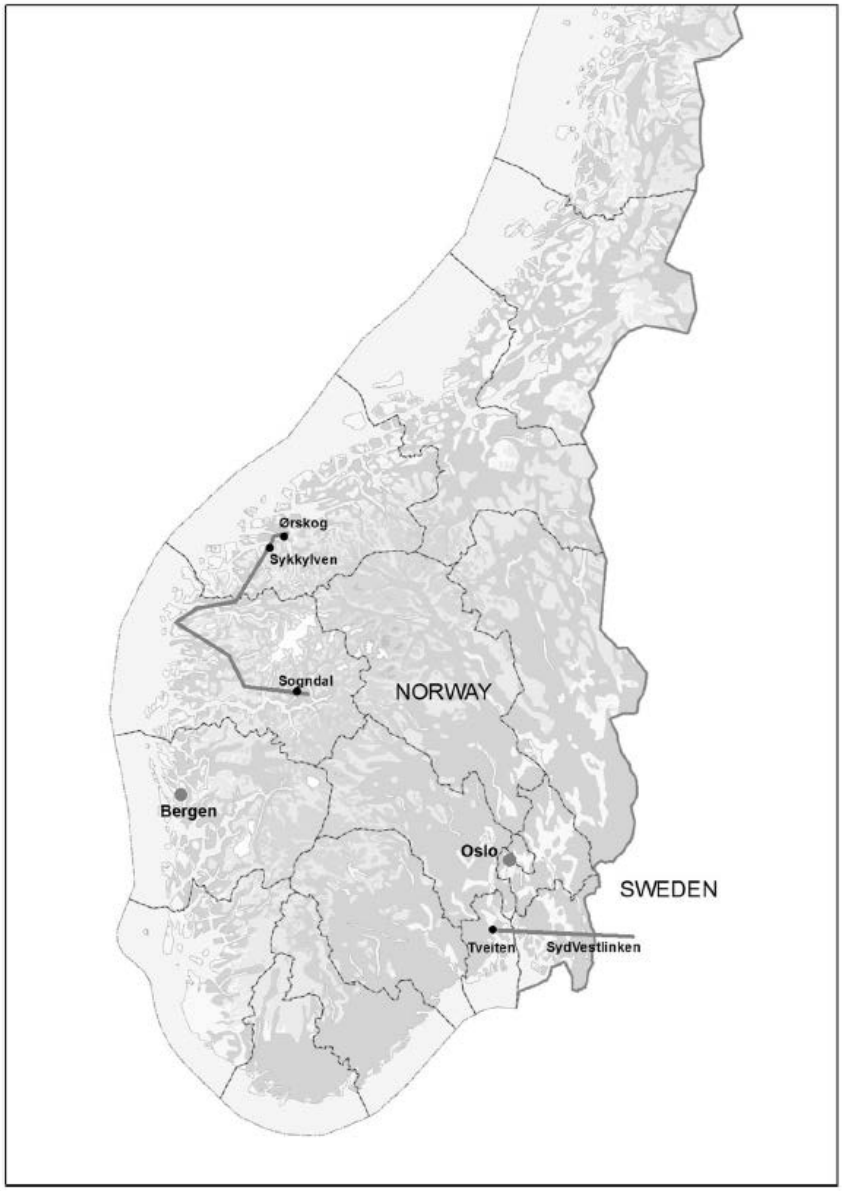

Figure 1. Map of Ørskog-Sogndal and SydVestlinken transmission lines.

Data collection

We collected data through two principal methods; individual semi-structured in-depth interviews and focus group interviews. A total of 36 representatives from national, regional and local authorities, grid companies and interest groups (including NGOs and local action groups)

were interviewed individually. Three related, but not completely identical interview guides were developed, tailored to authorities, grid companies and interest groups, respectively. We also conducted 7 focus group interviews (4 in Ørskog-Sogndal and 3 in Sydvestlinken), with 3-8 local inhabitants in each group, comprising a total of 39 local inhabitants. The focus group discussions were aimed at facilitating discussion among those eventually having to live near the transmission lines in their everyday lives, and this method is useful for investigating group feelings, perceptions and opinions, as well as comparing and contrasting perceptions across groups (Krueger, 1994; Conradson, 2005). The main objective was to get an impression of how the local inhabitants perceived the concessionary process, how decisions were made and justified, and what were their concerns triggering opposition. Our sampling strategy for the focus groups involved getting in touch with a local person that assisted in inviting a variety of participants based on gender, age, class/education, occupation and residence in proximity to the planned transmission line. This recruitment method ensured the anonymity of the participants since the research scientists at no point knew their full names and contact details.

All individual interviews and focus group interviews were transcribed in full and imported into the analytical software Atlas.ti v.5.2– in which we marked and assigned quotations into specific themes/codes. A coding scheme, based on the principles of Thematic Analysis (Braun & Clarke, 2006), was basically developed in a bottom-up way, based on the data. Statements were marked and categorized into different themes and sub-themes, the main themes being*: trust, need case, perception of the planning process, compensating measures, energy policy* and *perception of the project*. Many statements concerned more than one issue, and were thus categorized in more than one sub-theme/code. Sub-themes were developed and for this analysis we looked into responses under the four categories *trust, perception of the planning process, compensating measures* and *perception of the project*. *Trust* issues were related to the informants' trust in the regulatory authorities and the system. *The planning*

process category comprised issues such as perception of procedural justice, information and communication flow and opportunities for participation. Statements about subsea cables were included as a sub-theme under *compensating measures* and issues concerning *perception of the projec*t included among others health concerns and EMF. The quotes included in this paper were then translated into English. Individual interview quotes were sent to the relevant informant in original and English for final approval. For the purpose of this paper we have categorized the informants into three main categories, *regulatory agencies* consisting of regulatory authorities (NVE and MoPE) and the TSO (Statnett); *local inhabitants* and *affected stakeholders* that includes representatives from regional grid companies, interest organizations and local and regional authorities.

RESULTS

Electromagnetic fields – a health risk or not?

A public concern in most grid development processes is the issue of electromagnetic fields (EMF), (cfr. European Commission, 2010). When planning a transmission line, Statnett and NVE follow the recommendations from the Norwegian Radiation Protection Authority (NRPA)[vii]. In terms of EMF, NRPA's role is to provide updated and informed recommendations to ensure that electromagnetic exposure is kept at acceptable levels.

The health risks related to EMF was an issue of concern to local inhabitants, interest organizations and municipalities both in Ørskog-Sogndal and SydVestlinken. The concerns were strongest amongst the local inhabitants as some had prospects of living close to the proposed transmission lines. The complaints related to EMF were both a general dissatisfaction with the type of information provided by the regulatory agencies, and more specific complaints about calculations of safe distances to households.

According to the Act on Radiation Protection and Use of Radiation (2000)[viii], an assessment is required when residents are exposed to over 0,4 microTesla (μT) as research has shown a minimal increase in child leukemia for those growing up with such exposure levels in their neighborhoods (e.g. NRPB, 2004). The local inhabitants in both cases expressed that they mistrusted the information provided by the regulatory agencies. Also the NRPA had little credibility amongst the local inhabitants. One said that;

> *'We have been told that it [the EMFs] is about the same as from a stove. But you have this insecurity concerning how much electricity they are sending through when the measures are made, and how trustworthy these measures are (...).They refer to data from the mid-1990s. (...) I believe newer research results (...) could have taken us out of this valley of shadows'. (Local inhabitant, SydVestlinken)*

A key concern was that the recommendations were based on outdated information and, more importantly, that the calculations used to ensure safe distance between power lines and households were based on average current load. The magnitude of the EMF depends on the amperage through the lines[ix] and the distance to the lines (Saxebøl, 2005). Many of the local inhabitants reacted against the fact that the NRPA uses the average current load instead of maximum current load as a basis for their recommendation of safe distance to settlements. They argued that the actual power load and EMFs were expected to be much larger in certain periods during a year. One interviewee had even bought his own equipment to do measurements of the electromagnetic fields. He said that;

> *'Well... (...) when it rains or they produce with full capacity (...) I measure [radiation] up against this limit and over it as well. They say it [the distance] has been set with good margins. I am thinking that when it is 16 times as strong magnetic field, then that safe distance zone should have been...yes...larger '. (Local inhabitant, Ørskog-Sogndal)*

As illustrated above, the issue of EMF is complicated. The uncertainty lies in the complication of providing exact research on what distances between households and power lines are safe in terms of health effects, as well as the inherent variation in EMF within a year. We argue that the strategy that the regulatory agencies use to cope with this issue can be referred to the strategic option of *troll exorcism* by attempting to ease the uncertainties associated with health risk and EMF in different manners. One way of attempting to diminish the uncertainties was by pointing to the recommendations and the authority of the NRPA. Both Statnett and NVE claim that they are following established and scientifically based procedures when using the average power load;

> *'There are a lot of questions concerning (...) the power load on the line. (...) And with a higher power load the fields get larger. The Norwegian Radiation Protection Authority is very clear in stating that it is the average load which is to be used as foundation for the calculations'. (Representative from Statnett)*

> *'So it is the Norwegian Radiation Protection Authority that is our reference point. (...) We simply relate to what they say and rely on the current recommendations that this is not really such a large health issue. Seen in a larger perspective the real health issue is related to people worrying (Representative from NVE)'.*

While the explanation given by NRPA for the use of average power load as a reference point is anchored in international scientific research, this is still difficult to communicate given the hypothetic possibility for a slight increase in child leukemia. Consequently, the troll of EMF is expelled by the regulatory agencies by pointing to the recommendations of an authority higher up in the hierarchy, NRPA, which further legitimizes its recommendation by referring to scientific results. A related strategy was the toning down of EMF and health effects in cases where it was not raised as a concern in public meetings. One of the regional

grid companies told us that they had been recommended by NVE to leave out the topic of EMF in public meetings if not raised by the participants:

> *'(...) I discussed this with NVE, and had these information foils with 'electromagnetic field calculations and given distances' (...) and it was NVE who said that "I actually do not think you should present this, just keep them up your sleeve and then deal with it in case of questions"'. (Representative from Regional Grid Company)*

The reasons for toning down the EMF issue until asked about it was explained by both the NVE employee and the regional grid company as a way of hindering unnecessary worries amongst inhabitants living close to the power lines. The NVE employee recognized that EMF was a complicated topic and that there was frequently a discrepancy between scientific research and public expectations. One regional grid company said that it was difficult to find research that shows what a safe distance is. It is especially the topic of child leukemia that people bring up in public meetings even though there are several other studies showing no such coherence it was argued from one informant. The issue of EMF and health risk is first and foremost an example of communication challenges between authorities and local inhabitants, and in both cases we found that distrust in the official recommendations and guidelines from the NRPA had developed. Even though the probability of child leukemia is marginal (in line with NRPB, 2004), we found that local inhabitants in both cases tend to focus on the possibility of health risk without reflecting on the marginal probability. How the regulatory agencies circumvent the issue, is also an example of how they chose to articulate the issue (Wynne, 2005), and from the outset maybe aimed to tone it down, hoping the public would not make much of an issue out of it.

As we have illustrated through several of the quotes above, we found that the local inhabitants and affected stakeholders responded through what we termed *troll detection*. This way, local inhabitants and affected stakeholders attempted to reveal scientific, political or

administrative uncertainties as they demanded more clarity and insight into the calculations and assessments. An additional strategy we discovered during our analysis was *the bewitching of trolls*. The local inhabitants tried to fill in the missing information and the uncertainties on EMF by creating their own version of the story. This strategy became particularly striking in the case of SydVestlinken where the use of direct current (DC) transmission lines was planned. These types of lines do not generate EMF and related health risk issues (Arrillaga, 1998). Still, the local inhabitants were worried and leaned more on rumors than the information they received form the regulatory agencies. One said that:

> *'I think they have too little expertise or knowledge to say something about this issue in Statnett, which has actually never built a direct current transmission line before. So I thought it was incredible to be so bombastic about it [the health risk]'. (Local inhabitant, SydVestlinken)*

In the Ørskog-Sogndal case, rumors spread about incidences of breast cancer caused by EMFs near existing (AC) power lines, despite scientific results indicating no such correlation, One told us that:

> *'I see across the fjord, and....the woman on the right side [of the electricity grid] has breast cancer, and the woman on the left side has got cancer...it is a lot of breast cancer cases just under [the power grid]'. (Local inhabitant, Ørskog-Sogndal)*

In sum, our findings show that the regulatory agencies' strategy of *troll exorcism* does not seem to help in creating less concern about EMF, rather contributing to the stakeholder's *bewitching of trolls*.

Cable – a realistic alternative for transmission lines?

In addition to health concerns and EMF, visual impacts are commonly key concerns of local inhabitants in relation to hV transmission grids (e.g. Furby, Slovic, Fischhoff & Gregory, 1988; Soini et al., 2011; Batel et al., 2015). The main mitigation measure that would sufficiently reduce local dissatisfaction and increase acceptance in our cases was the use of earth or sea cable instead of overhead lines (Qvenild & Wold, 2014). The fundamental principle of the Energy Law is to ensure socio-economic profitability in energy projects. This principle becomes very visible in debates over the use of sea cables which in most cases are dropped in hV projects due to the high economic costs (MoPE, 2012, p.81).

In Ørskog-Sogndal there was mainly one cable alternative in the northern part of the line (Sykkylven municipality) that sparked a heated debate. A sea-cable in this area would remove the need for overhead cables and pylons, and two contested overhead fjord crossings through a popular tourist destination would be avoided. In SydvestLinken there were some possible routes which included longer sea cable alternatives. Yet they were perceived as unrealistic by regulatory agencies due to associated costs. A commonly shared feeling amongst the local inhabitants and affected stakeholders in both cases was a feeling of having witnessed a mere dummy procedure. In Sykkylven where many of the local inhabitants and affected stakeholders had used a lot of resources lobbying for the sea cable alternative, including financing their own cost-benefit study, the downfall was especially hard when the cable alternative was dropped. Many of the local inhabitants and affected stakeholders felt that they had wasted their time on an unrealistic cable alternative when they should instead have focused on seeking the best on-land alternative. One affected stakeholder said that:

> *'We engaged a lot of people and spent many resources on trying to realize a sea cable. But it seemed as though something was predetermined which could not be influenced*

and a lot of good arguments were not heard'. (Local Authority representative, Ørskog-Sogndal).

In both Ørskog-Sogndal and SydVestlinken the sea cable alternatives were dismissed due to high economic costs. In the case of Sykkylven, NVE wrote in a recommendation letter to MoPE the following:

'NVE cannot see that the potential environmental advantages related to a sea cable (...) will justify the additional costs (2400 MNOK) that this solution gives compared to the other routing alternatives. Consequently, NVE cannot recommend (...) a sea cable'. (NVE, 2011, p.2)

As the quote demonstrates, all decisions that result in negative environmental or societal impacts are apparently based on evaluations of all relevant aspects. We found that the regulatory agencies' arguments against sea cabling fit the strategy of *Troll adaptation* where the valuing of incommensurable measures is turned into a question of quantification of specific costs. As shown by the statement above, this was explained in concrete numbers while an assessment of the indirect costs linked to overhead lines such as loss in property value, tourism income and negative visual impacts were left out. Thus, the numeric specification of increased project costs were used to legitimize the decisions of dismissing sea cable alternatives, while the costs of the negative impacts of this dismiss was not specified, even if they (or at least parts of them) could have been assessed and calculated.

The exemption from the general rule (which is normally no use of cables in the transmission grid) is instances where overhead lines are technically unfeasible, or where particularly important environmental values are to be preserved as emphasized in the Norwegian transmission grid network regulations. It is this last point that has created debate amongst interest organizations, municipalities and local inhabitants as this phrase has not been

operationalized or clarified in the legal reference. NVE recognizes that environmental impacts are described qualitatively and that a better approach would have been to assess environmental costs through socio-economic analysis (NVE, 2003, p.7). Winge (2013) explains the regulatory agencies' strategy as a way to avoid potentially costly precedent effects to other projects.

As was the case in the example of EMFs above, both local inhabitants and affected stakeholders reacted with both *troll detection* by demanding clearer answers from the regulatory agencies, and *bewitching of trolls* by filling in information gaps through the creation and spreading of rumors that were not substantiated. The troll detection strategy related to the cabling issue, is apparent in the way several stakeholders questioned the calculations. One of the stakeholders expressed the mistrust in this way;

> *'We actually have some companies in the municipality with expertise in sea cables which operate with completely different cost figures [than Statnett]. So it becomes very difficult to relate to those [Statnett's] numbers when we know that they perhaps are not completely correct (...). And then I become uncertain to what extent the numbers are updated or what [Statnett] knows of the latest technology'. (Local authority representative, SydVestlinken).*

Another stakeholder made the following statement:

> *'The price of cabling is probably (...) a lot lower, and we will manage to document that retrospectively. I am certain that we will make it. Then we will show them [Statnett] what it costs (...)'. (Interest organization representative, Ørskog-Sogndal)*

Further, several affected stakeholders had difficulties in making sense of the way economic, environmental and aesthetical concerns were weighed against each other. One of

the affected stakeholders questioned the value of EIAs when economic costs seemed more important anyway;

'It makes me wonder what we are assessing, well yes, we assess the societal and green impacts after having decided that the cheapest alternative will be selected anyway'. (Regional Authority representative, SydVestlinken)

We found that the regulatory agencies' strategies of troll adaptation, i.e. basing their decisions on calculations, resulted in a general stakeholder perception of mistrust. In addition, some local inhabitants turned to a strategy of *bewitching the troll* by creating rumors of the cabling process as being a mocking theater;

'Well, one can wonder if this is intentional manipulation (...). We never received a real assessment of what a sea cable would cost compared to an overhead line'. (Local inhabitant, Ørskog-Sogndal)

Our findings show that the strategy of troll adaptation has resulted in a general feeling of not being able to influence a process that was perceived as predetermined, thus triggering public opposition and protest.

CONCLUDING DISCUSSION

In this paper we have demonstrated how opposition towards hV transmission grids is sparked by the regulatory agencies' handling – deliberately or unconsciously - of complex and ambiguous issues. Inspired by literature of boundary work and issues and publics in general (Marres, 2007), especially Smits' (2004; 2006) monster metaphor, furthered and translated to trolls by Bay-Larsen (2012), we have drawn on two Norwegian cases to investigate how the regulatory agencies in the planning processes created various trolls. These trolls can erupt when scientific recommendations are ambiguous and when incommensurable consequences

and interests are involved and held against each other in ways that become incomprehensible to affected takeholders. The regulatory agencies often draw their decision on a mix of scientific recommendations, administrative judgments and value assessments that may be difficult both to communicate and for the public to comprehend. As a consequence, trolls are easily erupting due to prevailing uncertainties, but the question is whether they are detected and necessarily are bewitched?

We investigated two specific challenges; 1) EMFs and health risks, 2) overhead lines versus sea cables. These expose how incommensurable values or concerns are handled and balanced by regulatory agencies in ways that may risk triggering opposition from affected stakeholders due to eruption of 'trolls'. We found that the challenges described and conceptualized by Smits (2004; 2006), Van der Sluijs(2005) and Curry and Webster (2011) fit as an analytical framework to understand how the regulatory agencies handled the uncertainties. The strategies we identified were firstly *troll exorcism* where scientific uncertainties associated with health risk of EMF were expelled by pointing at the recommendations of the NRPA, without providing sufficient explanation for why average and not peak power load is used to calculate safe distances between power lines and households. Secondly, *troll adaptation* was used to justify overhead transmission lines instead of sea cables by referring to high socio-economic costs of cables while diminishing the impacts of overhead lines on non-quantifiable environmental and societal costs.

The trolls have sparked public opposition, which we have investigated by adding a layer of *local inhabitants' responses* to previous science-policy oriented studies (e.g. Bay-Larsen, 2012; Curry &Webster, 2011; Van der Slujis, 2005). This has enabled us to shed more light on how publics and not only institutions respond to trolls (Jasanoff, 2005), and that conflict reduction not only rely on simple participatory aspects of the planning process, but also how regulatory agencies and decision-makers articulate issues (Marres, 2007). The first

strategy applied by local inhabitants was *troll detection*, (in line with Curry & Webster, 2011) which refers to how affected stakeholders demanded more transparency and improved information from the regulatory authorities. The second strategy we have termed *bewitching of trolls*, which refers to how ambiguous data or blurred assessment procedures can lead to rumors to explain the information-gaps left by regulatory agencies. The two types of public responses were observed in both cases and issues. We interpret these responses of mistrust and opposition to be sparked by insufficient and ambiguous information on how the regulatory agencies handle incommensurable values or scientifically difficult concerns. This was especially striking when there was no 'correct' answer on how to measure non-quantifiable values against quantifiable ones.

There are no straight forward ways to handle these trolls. However, in order to reduce stakeholder opposition and the eruption of trolls, it is necessary to understand why such trolls appear in the first place, and how and with what degree of comprehension they are articulated and presented to publics and stakeholders. One answer may be found in the handling of the Energy Law which grants the MoPE statutory permission to base their decisions on their own assessments. The leading premise of the Energy Law is the aim of securing efficient provisions of energy/electricity supply to the benefit of the society. The reference is societally and not only socio-economic efficiency, but this is often not the reference in specific decisions. As long as an energy project meets the criteria of socio-economic efficiency, other negative societal impacts are likely to be accepted (Winge, 2013). This becomes especially apparent in the discussion over sea cables versus overhead lines, where the economic reasoning paves the way for accepting negative environmental and social impacts. The Energy Law provides the regulatory agencies the statutory right to choose when, to what extent and how they follow the recommendations of the EIAs or the arguments of other sectorial authorities. When the legislation, regulations and guidelines fail to give concrete and

verifiable specifications on which non-economic societal values to consider and what interests to take into account, the outcome of individual concessionary processes may easily become unpredictable and blurred. It is difficult to comprehend alternative options and why other societal concerns are not taking into account and trolls may erupt.

If the Energy Law had provided a more precise framework for how to accommodate societal value assessments beyond mere socio-economic concerns, trolls might erupt less often. Winge (2013) argues that the concessionary process would probably have acquired increased public legitimacy if such frameworks were obligatory. However, there seems to be few established practices for how social and environmental concerns are ranked and compared to economic concerns in the decision-making process. More specific procedures and assessment schemes had to be proposed, i.e. multi-criteria assessment tools that might enable regulatory authorities to better address and weight a number of societal concerns. We argue that the uncertainties in assessing incommensurable values should be made much more transparent early on in the decision-making process to better accommodate public opposition. In line with Bay-Larsen (2012) and Curry & Webster (2011), the strategy of *troll assimilation* may be a more promising alternative than the strategies of expelling ambiguities. Troll assimilation implies to learn to live with the uncertainty trolls and openly inform the public about how value assessments and uncertainties are taken into account in decision-making processes. A core reference could be multi-criteria assessment and accompanying decision making tools (Wang Jing, Zhang & Zhao, 2009). While it is probably impossible to avoid stakeholder complaints and public opposition, a more transparent and predictable decision making strategy enabling better public comparisons and scrutiny of alternative options, might crack and even bury the particularly wicked trolls that tend to cause public distrust and prolonged concessionary processes of hV grid development projects.

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End Notes:

[i] http://ec.europa.eu/energy/en/topics/infrastructure

[ii] Statnett is the system operator in the Norwegian energy system operating about 11 000km of hV power lines. Statnett is a state enterprise owned by the Norwegian state through the Ministry of Petroleum and Energy, http://www.statnett.no/en/About-Statnett/

[iii] The Norwegian Water Resources and Energy Directorate (NVE) is a directorate under the Ministry of Petroleum and Energy, with a mandate to ensure an integrated and environmentally sound management of the country' s water resources, promote efficient energy markets and cost-effective energy systems and contribute to efficient energy use.

[iv] The EIA applies to the Energy Law in cases where it is believed that the construction will have substantial impact on environment, natural resources or society, but EIA is regulated under the Planning and construction Act by 1990.

[v] MoPE was previously in our case-studies the appeal-authority, this was however changed in 2012.

[vi] Star and Griesemer (1989:393) defines boundary objects as '(...) objects which are both plastic enough to adapt to local needs and constraints of the several parties employing them, yet robust enough to maintain a common identity across sites. They are weakly structured in common use, and become strongly structured in individual-site use. They may be abstract or concrete. They have different meanings in different social worlds but their structure is common enough to more than one world to make them recognizable, a means of translation. The creation and management of boundary objects is key in developing and maintaining coherence across intersecting social worlds'.

[vii] the Norwegian Fields protection Authority (NRPA) which is the national authority in Norway on EMR organized under the Ministry of Health and Care Services

[viii] https://lovdata.no/dokument/NL/lov/2000-05-12-36

[ix] The amperage varies according to the energy-demand (effect) which fluctuates throughout the day and the year. Consequently, the size of the electromagnetic field will vary accordingly. A 420 KW line may in a 'high peak' period have a current load of over 2000

Ampere and consequently a much larger electromagnetic field than the average current load of 600-1000 Ampere.