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The 'Sustainable Energy Concept' – making sense of norms and co-evolution within a large research facility's energy strategy

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ABSTRACT

The analysis presents an evolving 'Energy Concept' and strategy at an energy-intensive research facility in order to contribute understanding of how organisations may implement renewable energies and improve energy efficiency whilst also delivering broader socio-economic benefits. A framework is developed that infuses institutional perspectives with a micro level view. It facilitates positioning of strategy against instrumental/altruistic and factual/relational extremes and analysis of organisational strategy in the face of internal/external stakeholder, and institutional forces. Applied to a seven-year case this supports understanding of strategy 'purpose' and 'inputs' as they co-evolve along a project time-line. It is found that the energy strategy evolves from a dominantly instrumental but stakeholder-driven position towards approaches aligned with deliberate public good provision in areas beyond direct organizational interests, and that changes required significant redefinition of the design and operational models. Developments are explained as largely the result of internal agency and culture-building influences from an energy department equipped with concrete management tools and autonomy. At the case level, the study concludes that the Energy Concept implementation has sparked a change in energy management at large global research facilities. The work also demonstrates that longitudinal, multi-level institutional analysis can contribute to deeper understanding of strategy development.

1. Introduction

Population and economic growth pose ever increasing challenges for resource availability and environmental quality (Gerland et al., 2014), while climate change constitutes both a serious threat to human well-being and a difficult policy challenge (IPCC, 2014). In turn, energy consumption plays a pivotal role within both resource consumption and climate change (Chu and Majumdar, 2012). Reflecting such concerns, the European Council agreed a new 2030 policy framework with targets in these areas in 2014 (European Council, 2014). Across the EU, these require collective reductions (from 1990 figures) of 40% for greenhouse emissions and at least 27% gains in renewable energy and energy efficiency. Considering that the infrastructure to produce and distribute energy and the industrial production infrastructure that consumes much of it are long-lived, these percentages indicate a level of change that is dramatic. It is not enough that new stock reflects the percentage reductions listed in targets, as averages across entire economies must be reduced. We interpret that this will require combinations of (increasingly) higher efficiency, near 100% carbon free energy supply, and energy recycling.

Indeed, it is considered that we are at a pivotal point of deep change for our energy systems. Around the world, large utilities are rewriting business models, the manner of grid operation is changing rapidly, and renewable and variable generation sources are comprising larger portions of the energy mix (Beckman, 2013; World Energy Council, 2015). This "new energy reality" (Beckman, 2013) is also creates markedly increased volatility in energy markets (World Energy Council, 2015). Logically, industrial and public investments with high-energy footprints and long lifespans will be particularly exposed to such developments.

In this analysis we examine the development of a multipartite European public investment in a large science Research Infrastructure (RI) facility named the European Spallation Source (ESS). As of 2015, it is under construction in Lund, Sweden and will be collectively owned by 17 partner countries. Costing some 1.85 billion euros, it is projected to come online in 2019. Prior to project start, an energy system concept was presented that helped

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differentiate a Scandinavian bid for the ESS placement (European Spallation Source Scandinavia Secretariat, 2008). The article presents a case description, and an analysis of how the energy strategy for the ESS developed over a seven-year period (2008–2015).

Titled the 'Energy Concept' it promised a number of social and environmental benefits but the means to achieve these ends reach far beyond that which could be considered 'established norms' within similar organisations (cf. Hallonsten, 2012; Kaiserfeld and O'Dell, 2013). Such include the building of formal 'energy culture'; improved energy efficiency; 100% renewable sources; and the recycling of waste heat (European Spallation Source Scandinavia Secretariat, 2008).

However, the manner in which the ESS departs from established RI morphology, technical function and operational praxis, may pose challenges for the organisation. Both internal management goals, and external public expectations (including censure) play an important role in how organizations behave. Many leaders of organizations, be they public or private, recognize the importance of operating so as to achieve or maintain a 'social licence' and the conditions expected by 'social licensers' may be considerably more demanding that those imposed by regulation (Gunningham et al., 2002). On the one hand, demands from social actors for reduced resource consumption, and reduced carbon footprints are escalating (cf. Lilja, 2009; While et al., 2010) as part of this social licence. However, on the other hand, such efforts will increase technical and management complexity, create new resource dependencies with external parties, and require an organisation to perform against non-traditional goals. When viewed from institutional and resource dependency perspectives (cf. Oliver, 1991) this can be expected to generate institutional tensions within the organisation across a range of circumstances.

Consequently, this analysis examines how approaches, capacities, and norms emerged – and how strategic context evolved – as the ESS worked to achieve the project and its Energy Concept. The framework developed to structure analysis also contributes to knowledge of strategy emergence and evolution as management priorities shift along the life cycle of a project to conceptualise, design and build an energy system. From a broad perspective, the analysis addresses efforts by an organisation to ameliorate its contribution to environmental crises that result from humankind's "extract, expend and expel" resource use pathways (Connelly, 2001). Thus, the discussion addresses contexts well beyond RIs and is relevant to wider audiences. Similar challenges are shared by other energy intensive facilities that pursue environmentally oriented management strategies with intent to deliver private and public goods.

Regarding "expend and expel" resource use patterns, this work is relevant where efforts are being made to retrofit industrial systems so that society can benefit from systemic energy efficiency (cf. Dovì et al., 2009; Majozi, 2009; Worrell et al., 2009). Regarding public good provision via work that extends beyond the direct interests of the organisation, this analysis aligns with the precepts of Corporate Social Responsibility (CSR) efforts (McWilliams and Siegel, 2001; cf. McWilliams et al., 2006).

Three interlinked areas are given special consideration in this article. The first concerns the basis for energy strategy development. This is a complex issue for energy intensive facilities that must address matters such as price volatility, climate discourse evolution, public opinion and policy shifts, and dynamics in security of supply concerns (Tan et al., 2009; World Energy Council, 2015). The second concerns how management mind-sets, accountability, agency, and priority setting can change along a project life cycle, and how such factors affect energy strategy evolution and implementation. The third theme relates to technical management issues; and how they are related to the norms and/or behaviour of actors in both traditional and newly created management roles. This area is especially affected by energy quality considerations, energy recycling opportunities and the increased management complexity that delivery of an energy strategy for the future may entail.

Key audiences can include practitioners involved with technical ventures requiring large amounts of energy (e.g. in the RI field and in energy intensive industries), researchers studying such efforts, and analysts in the field of social and organizational change. This work provides the first two groups a detail rich longitudinal case that provides insights into how proponents of clean and efficient energy systems may be empowered to achieve far-reaching change, and how the political economy of energy initiatives can change markedly through a project life cycle. It provides the latter group a framework for analysis of the interaction of organisational strategy and management, different interest groups within the organisations, broader institutional forces, and stakeholder influence as they co-evolve along a project time-line. Although policymakers and others with a desire to steer industrial energy strategy are not a primary target group, the analysis of how strategy develops – and the role of policy within such development will be pertinent to such actors.

1.1. Case study background

In 2003, after more than a decade of advocacy and lobbying by organisations such as the European Neutron Scattering Association (ENSA),[1] a design concept was adopted for a neutron source research facility heralded as the most ambitious and broad-based spallation source in the world – the European Spallation Source (ESS). The ESS is to support a diverse range of methods to extract subtle information about the properties and behaviour of many materials.[2] Spallation involves the displacement of neutrons from atomic nuclei using a particle accelerator to generate a neutron stream that in turn is directed at materials being researched. Measuring 'neutron scattering' when the neutrons interact with substances is vital for the development of materials and products across many technological fields: fuel cells; superconductors; structural engineering, transportation, and food technologies; pharmaceuticals; medical devices, and clean, or low carbon electricity or heat technologies. In this way, many scientists see "quality of life" in modern society as inextricably linked to the research outputs of a spallation source (OECD, 1998). The ESS is expected to employ some 450 staff and support a 5000 strong user community. Between 2000 and 3000 scientific-user visits will be hosted each year.

Fig. 1 provides an overview of the operational sequence for the ESS: acceleration of protons in a half kilometre linear 5 MW accelerator (1,2); the 'spallation' of neutrons from a tungsten target (3), neutron scattering and measurement processes in 22 (planned) instruments (4,5,6) and research data management (7).

In the period 2003–2008, a competitive European selection process played out that left three locations vying for the project: Lund, Sweden; Debrecen, Hungary; and Bilbao, Spain. Lund was chosen as the preferred site in May 2009. Central to this discussion is that the theme of 'sustainability', particularly related to energy issues figured significantly in the Scandinavian[3] proposal. 'Sustainability' themes were used to differentiate the Swedish project

[1] ENSA is an affiliation of national neutron scattering societies and committees that facilitates discussion and action. See http://neutronsources.org/neutron-centres/europe/ensa.html.

[2] Neutron scattering enables the study the structure and dynamics of atoms and molecules over an enormous range of distances and times: from micrometres to tenths of nanometres, and from milliseconds to picoseconds. Neutron scattering provides a unique combination of structural and dynamic information.

[3] Only Sweden and Denmark were represented in "Scandinavia", although Norway was part of the promised financing. Sweden hosts the spallation source research facility, while Denmark will host the data management centre.