

“Knowledge-based tools for sustainable governance
of energy and climate adaptation in the Nordic periphery”

Knowledge-based tools for sustainable governance of energy and climate adaptation in the Nordic periphery (K-Base)

Janne Hukkinen, Klaus Georg Hansen, Richard Langlais,
Rasmus Ole Rasmussen, Steen Jeppson, Jarkko Levänen,
Freia Lund Sørensen, Peter Schmitt, Stefanie Lange

NORDREGIO 2009

Nordregio
P.O. Box 1658
SE-111 86 Stockholm, Sweden
nordregio@nordregio.se
www.nordregio.se
www.norden.se

Nordic co-operation

takes place among the countries of Denmark, Finland, Iceland, Norway and Sweden, as well as the autonomous territories of the Faroe Islands, Greenland and Åland.

The Nordic Council

is a forum for co-operation between the Nordic parliaments and governments. The Council consists of 87 parliamentarians from the Nordic countries. The Nordic Council takes policy initiatives and monitors Nordic co-operation. Founded in 1952.

The Nordic Council of Ministers

is a forum of co-operation between the Nordic governments. The Nordic Council of Ministers implements Nordic co-operation. The prime ministers have the overall responsibility. Its activities are co-ordinated by the Nordic ministers for co-operation, the Nordic Committee for co-operation and portfolio ministers. Founded in 1971.

Stockholm, Sweden
2009

Contents

1. Introduction	11
1.1 Objective and key findings	11
1.2 Approach	11
1.3 Structure of the report	14
2. Analytical approaches for sustainability governance	15
2.1 Approaches for micro-level analysis	15
2.1.1 Inferences from historical analogies	15
2.1.2 Public information flow analysis	16
2.1.3 Micro-level actor network analysis	17
2.2 Approaches for macro-level analysis	17
2.2.1 Transition analysis	18
2.2.2 Macro-level actor network analysis	19
3. Application of knowledge-based tools for energy and climate adaptation in the Nordic periphery	21
3.1 Knowledge-based tools for policy anticipation phase	21
3.1.1 Indicators of historical analogies	21
3.2 Knowledge-based tools for policy planning phase	22
3.2.1 MCDA – Multicriteria Decision Analysis	22
3.2.2 Technological roadmapping	23
3.2.3 Indicators of public information flow	23
3.2.4 Micro-level actor network tool	24
3.3 Knowledge-based tools for policy implementation phase	25
3.3.1 Macro-level actor network tool	25
4. Feasibility of knowledge-based tools for practitioners	26
References	27

Preface

The research programme, *'Internationalisation of regional development policies – Needs and demands in the Nordic countries'* was commissioned by the Nordic Council of Ministers in the spring of 2005.

The aim of this programme is to undertake research on key issues, where it has been identified that new knowledge is needed, and where such knowledge could be seen to benefit the development and implementation of regional development policy in the Nordic countries.

The basis for the research programme is its Nordic character. Research should lead to new knowledge both for the academic world and for the world of policy and practice. Projects should add 'Nordic value', i.e. they should produce knowledge of relevance for several regions and countries across Norden. The research should moreover be comparative and collaborative across at least three Nordic countries or self-governed areas.

Three themes of high priority for the research programme have been identified; *'regional governance'*, *'innovation and regional growth'*, and *'demography and labour migration'*.

In addition to these priorities two additional crosscutting themes were also defined; 'the enlargement of the EU and the challenges for Nordic regional development policies' and the broad topic of 'the three dimensions of sustainable regional development'; i.e. social, economic and environmental sustainability.

The research programme has been launched in two rounds. In the first round during the spring of 2005 it was decided to fund five projects. These were reported during 2007. In the second round during the spring of 2007 it was decided that a further five projects should be funded. These will be reported in 2008 and 2009. All project reports are published in this publication series dedicated to this programme. At the end of the programme, a synthesising report will also be produced where the most important findings are discussed. This report is planned to be published in the winter 2009/2010.

Nordregio wishes to thank the Nordic Senior Official Committee for Regional Policy and the Nordic Council of Ministers for providing this unique opportunity to develop new research-based knowledge and for encouraging cooperation and the exchange of ideas between Nordic researchers.

Nordregio would furthermore like to thank all of the involved research teams and the programme's Steering Committee for their continuing contributions to the Nordic discourse on regional development.

Ole Damsgaard
Director

Margareta Dahlström
Coordinator of the research programme

Authors' Preface

What should local policy makers and practitioners in Nordic peripheries do in the face of climate change?

The question is an urgent one, because the impacts of climate change are felt most dramatically in Northern latitudes. This urgency motivated our research group to tackle the question pragmatically, by way of cases that from a substantial point of view are only loosely related but from the perspective of local communities and livelihoods are vitally important.

This report focuses on (1) the management of transitions to sustainable energy systems in West Norden, (2) the planning of an aluminium smelter in Greenland, (3) climate policy in Swedish municipalities, and (4) the implications of climate policy for reindeer management in Lapland. As a consequence of the studies, we can present a set of knowledge-based tools to assist policy makers and practitioners in their planning for sustainable adaptation to changes in energy provision and climate conditions. The case study working papers can be found as appendices.

Knowledge-based tools are practical indicators or checklists. They provide critical signals of a significant turn of events in the policy process (policy anticipation, policy planning and policy implementation) that the policy maker or practitioner in the field ought to be able to distinguish in her daily work.

We present the indicators and checklists in a generalizable form that practitioners and policy makers in peripheral regions outside Norden should also find helpful.

The K-Base authors

1. Introduction

1.1 Objective and key findings

Although geographically remote, Nordic peripheries are rapidly assuming center stage in global energy and climate policy. These regions are likely to experience the most dramatic impacts of intensified energy extraction and global climate change. Formulated as they are in national and supra-national centers of decision-making, energy and climate policies assume a contract between the center and the periphery with minimal asymmetries in costs and benefits. Unfortunately, asymmetries often cannot be avoided. As a result, the notions of Nordic identity, Nordic region and Nordic regional policy are more than ever intertwined with the global energy situation and global climate change. The situation presents both a challenge and an opportunity for Norden: a challenge because of the severe negative implications for the quality of life if energy and climate issues are not successfully governed; an opportunity because Nordic countries can become the model to be emulated elsewhere in regional adaptation to global change.

The research project Knowledge-based tools for sustainable governance of energy and climate adaptation in the Nordic periphery (K-Base) has developed instruments for local level practitioners and policy makers with which they can face the challenges and opportunities in energy and climate policy. The objective of K-Base has been to develop knowledge-based tools for policy makers and practitioners in Nordic peripheries to assist them in planning for changes in energy provision and climatic conditions in a sustainable way. Our research group has tackled the task by drafting knowledge-based tools on the basis of five case studies: (1) Climate policy and reindeer management in Lapland, Finland, (2) Transitions to sustainable energy systems in West Norden, (3) Public information flow analysis and (4) Actor network analysis of the planning process to construct an aluminium smelter in Greenland, (5) Climate policy in Swedish municipalities.

Our research has produced locally applicable knowledge-based tools for sustainable environmental governance in northern peripheries, applicable across policy levels and during different policy phases. During the policy anticipation phase, the knowledge-based tool we propose is the development of indicators that reveal analogies between contemporary and historical developments. For the policy planning phase, we propose indicators of public information flow, actor network tools, multicriteria decision analysis and technological roadmapping. During policy implementation, actor network tools applied simultaneously at multiple levels hold promise.

1.2 Approach

Our approach has been to develop knowledge-based tools for coping with changes in energy provision and climate conditions by considering the policy process as a complex system with multiple actors, levels and phases. Table 1 summarizes the structure of our work by describing each analytical approach, its level of analysis, the policy phase it applies to, the knowledge-based tool derived from it, the empirical cases and the responsible partners. Table 1 raises several conceptual issues that need clarification at the outset.

Table 1. Structure of the K-Base work

Analytical approach	Level of analysis	Policy phase	Knowledge tool	Primary case	Complementary case	Partner
Inferences from historical analogies	Micro with macro links	Anticipation of changes in climate/energy policy	Indicators of change in policy atmosphere and discourse	Lapland reindeer management	Energy transitions in West Norden (RU, NR, HUT)	HUT
Transition analysis	Macro with micro links	Ongoing policy planning	Indicators of change in policy and strategy	Energy transitions in West Norden	Climate policy in Swedish municipalities (NR)	RU
Public information flow analysis	Micro with macro links	Ongoing policy planning	Indicators of public information flow	Alcoa Greenland	Alcoa Iceland (GHR)	GHR
Micro-level actor network analysis	Micro with macro links	Ongoing policy planning	Actor network tools	Alcoa Greenland	Alcoa Sub-Arctic Canada (NR)	NR
Macro-level actor network analysis	Macro with micro links	Policy implementation	Indicators of change in politics, tactics, and project flow	Climate policy in Swedish municipalities	Lapland reindeer management (HUT)	NR

Legend: GHR = Greenland Home Rule; HUT = Helsinki University of Technology; NR = Nordregio; RU = Roskilde University

First, our work is about multi-level environmental governance, as seen from the perspective of local peripheries in Norden (column 2 in Table 1). We are interested in how climate change and energy policies formulated at national and supra-national levels of governance influence environmental policy and natural resource management at the local level, and how local governance can adapt to and occasionally transform the higher level policies. Our case analyses go both ways, some focusing on micro-level governance but also looking at macro-level linkages, others focusing on macro-level governance but also extending to micro-level linkages.

Second, we see knowledge-based tools as key instruments with which local policy makers and practitioners can adapt to the policies formulated at higher levels of governance (column 4 in Table 1). We make a conceptual distinction between analytical approaches (column 1 in Table 1) and knowledge-based tools. Analytical approaches are the approaches that we as researchers have used in our case studies (transition analysis, information flow analysis, actor network analysis, historical analogy analysis). These approaches, however, are of little immediate practical use to the policy maker or practitioner. We have therefore moved on from the analytical approaches and developed hands-on knowledge-based tools—specified in terms of indicators or checklists—for practitioners to identify in their daily work. Knowledge-based tools provide critical signals of a significant turn of events in the policy process (policy anticipation, planning or implementation) that the policy maker or practitioner in the field ought to be able to distinguish in her daily work. They can be indicators of a significant branching point in the course of development that locks the path to the future, or of a major disruption in the ordinary flow of matters that changes how things are done in the future, for example. We have been able to identify these indicators only by doing detailed case studies in which we have applied the analytical approaches. To help practitioners and policy makers in their daily work, however, we characterize the indicators and checklists in a more generalizable form that practitioners and policy makers elsewhere in peripheral regions should be aware of and monitor.

Third, coping with a policy phase in our terminology means having a frame of reference against which to assess the meaning and significance—for the periphery—of the anticipated, planned, or implemented policy (column 4 in Table 1). For this assessment, we use indicators and checklists defined with reference to scenarios as the analytical framework that unifies the case studies. Scenarios are normatively oriented and factually supported narratives of the future, articulated for the purpose of making sense of future developments. Indicators/checklists are categorizations or measurements of key phenomena in the scenarios. Since different stakeholders to a particular environmental issue hold different views of what constitutes a desirable future, several alternative scenarios and related indicators can be developed for the issue.

Fourth, we see three policy phases (column 3 in Table 1) during which coping with energy and policy changes in Nordic peripheries can take place: (1) policy anticipation, when the overall direction of policy change can be articulated but its details are unknown, (2) policy planning, when the details of alternative policies are being laid out, and (3) policy implementation, when a particular policy has been chosen. While the last two phases are widely recognized features of the policy cycle, we introduce policy anticipation as a key policy phase to be aware of in peripheral regions. As our case studies illustrate, it is often the local actors' lack of attention to major shifts in policy preparation in higher levels of administration that takes the peripheries by surprise and raises local level sentiments of being at the mercy of decisions made in the centers of power. Our knowledge-based tools aim to enhance local capacities to anticipate major policy shifts.

Fifth, we have primary and complementary cases (columns 5 and 6 in Table 1). Here our aim has been to increase confidence in the results with theoretical and methodological triangulation. Each primary case has been analyzed with one main approach. At the same time, each case has also been informed by another approach to check whether or not the results converge with the primary approach.

Sixth, we frequently refer to policy maker practitioners. We have fused two roles, policy maker and practitioner, into a single one to emphasize the hybrid character of policy and practice at the local level in Nordic peripheries. Policy making and practical livelihoods tend to be deeply integrated at the local level (Hukkinen 2008, Jamison 2001). An elected municipal council member in Sweden, for example, also has a daily profession, making this person a hybrid policy maker and practitioner. Or an active reindeer herder in Finland may also be an active political voice for the herder community vis-à-vis the central administration.

Seventh, the tight coupling of the roles of a policy maker and practitioner also raise issues of knowledge, expertise and evidence in policy. The nature of the policy concern at hand, that is, the impacts of energy provision and climate change at the local level, is characterized by systemic risks with epistemic uncertainties (Renn 2008). The policy concern is systemic in the sense that the specific risks to human health and environment arising from climate change and energy choices have broader socio-cultural consequences. The policy concern contains epistemic uncertainties in the sense that there is a lack of knowledge about the fundamental phenomena relating to local level climate change impacts. This ignorance about the specifics of a very complex phenomenon persuades us to question the traditional notion "evidence-based policy", where knowledge is understood to be diffusing from the "factual" realm of scientific research to inform the "normative" realm of policy making. Instead, we take a humbler view to knowledge as a heuristic for good practice. Such knowledge arises not just in the realm of research but also in the realm of practice. Such knowledge is also explicit about the moral orientation underlying its factual basis: the search for factual evidence is guided by what the practitioners consider to be important things to know for the good of their livelihood (Hukkinen 2008). An important source of the heuristic knowledge we rely on are the hybrid experts, that is, the policy maker practitioners.

1.3 Structure of the report

Although our empirical work consists of several case studies across the Nordic periphery, we focus in this final report on the knowledge-based tools. The report is structured along two dimensions (Table 2). First, in Section 2, we describe the analytical approaches with which we developed the knowledge-based tools for sustainability governance. The analytical approaches are divided into those primarily suitable for understanding micro-level environmental governance and those primarily suitable for macro-level environmental governance (although as our cases illustrate, the two levels frequently interpenetrate each other and have intermediate levels as well). Second, in Section 3, we describe the application of the knowledge-based tools for energy and climate adaptation in the Nordic periphery during the three policy phases detailed above: policy anticipation, policy planning and policy implementation. We conclude by considering in Section 4 the feasibility of the tools for policy maker practitioners. Detailed descriptions of the case studies can be found as appendices to this report.

Table 2. Knowledge-based tools according to policy level and policy phase

Policy level	Policy phase		
	Policy anticipation	Policy planning	Policy implementation
Micro-level	● Indicators of historical analogies (3.1.1)	● Indicators of public information flow (3.2.3) ● Micro-level actor network tools (3.2.4)	(● Micro-level actor network tools 3.2.4)
Macro-level	(● Indicators of historical analogies 3.1.1)	● Multicriteria decision analysis (3.2.1) ● Technological roadmapping (3.2.2)	● Macro-level actor network tools (3.3.1)

Note: number code after bullet-pointed knowledge-based tool refers to the section in which the tool is described in detail. Tools in parentheses indicate cross-level linkages.

2. Analytical approaches for sustainability governance

2.1 Approaches for micro-level analysis

In our case studies we utilized three primarily micro-level analytical approaches. In the Lapland reindeer management case, we made inferences about the impacts of today's climate change policy on peripheral regions on the basis of historically analogous situations (section 2.1.1). In the Alcoa Greenland case, we made an analytical triangulation with two approaches: an analysis of public information flows and an analysis of micro-level actor networks (sections 2.1.2 and 2.1.3, respectively).

2.1.1 Inferences from historical analogies

The overall aim of the case study on Lapland reindeer management was to study the implications of climate change for the reindeer herding livelihood and develop a set of indicators to measure those implications. We had two specific objectives: first, to evaluate the usefulness of historical analogies in the analysis of our data; and second, to develop an indicator or indicators for monitoring analogies between historical and present situations. Our empirical data includes three types of material: a re-analysis of 51 expert interviews conducted during the so-called RENMAN project (The challenges of modernity for reindeer management: integration and sustainable development in Europe's subarctic and boreal regions; see Forbes et al. 2006); analysis of three documents concerning historical environmental changes in Upper Lapland that were written by reindeer herders during the RENMAN project (Heikkinen et al. 2003); and unstructured discussions with reindeer herders during two field trips in Sámiland (23.-25.4.2008 and 21.-23.9.2008).

According to local reindeer herders, the key drivers of change in their livelihood are not so much the changing climatic conditions as they are the new climate and energy policies. They base their assessment on historical knowledge concerning earlier large scale changes in the ecosystems in which they conduct their livelihood. Historical land use policies in Lapland caused substantial harm to reindeer herding. While studying the recent history of reindeer management in Upper Lapland in cooperation with our informants, we found two changes in particular that were in many ways very similar to the changes that have been anticipated in public discussion in Finland as a result of today's climate and energy policies. These historical disruptions are hydropower reservoir construction since the 1950s and intensive forestry since the 1960s. These observations paved the way to the analytical approach we developed and the analysis we undertook.

We analyzed the history of Upper Lapland reindeer management in relation to the present situation with what we call the historical analogy approach. Analogies are a tool with which human cognition generates new knowledge based on earlier knowledge (Fauconnier and Turner 2002; Gentner et al. 2001; Coulson 2001). Analogical situations are not entirely similar with each other, but there are strong common denominators between them. Analogy has to do with the relations between objects, not the objects themselves. In the environmental field, for example, a typical analogy is industrial ecology, which not only helps us to understand the interactions between industry and environment in terms of material and energy flows, but also facilitates the formulation of potential systemic remedies to persistent environmental problems (Ausubel and Sladovich 1989; Allenby and Richards 1994). Analogical situations can be discerned at different spatial and temporal scales. Haila and Dyke (2006, 14) have argued that "Analogue models cannot be directly "fitted" from one situation to another. Instead they suggest qualitatively important aspects and processes that deserve particular attention in studying the other situation." In this study we have looked for historical situations in our case study area that are analogous to climate change, especially from the policy point of view.

Our research shows that policy discourse prior to the historical decisions after World War II to construct hydropower reservoirs and launch industrial forestry in Lapland have much in common with today's policy discourse on climate change. Climate change today has led to growing interest in hydropower construction and forest cutting in Lapland, because both are promising sources of renewable energy. Our working paper details the analogies between historical and current events. Here is one example. First, we can observe heightened political attention and rapid legislative changes in conjunction with the historical mega-projects and climate change today. Second, both the historical mega-projects and today's anticipated climate-related energy projects have similar social, ecological and economic impacts on the livelihoods. The historical mega-projects have destroyed reindeer pastures and required rearrangements in the livelihood. We can already see deterioration of pastures as a result of existing forestry and hydropower reservoirs.

Inferences from historical analogies assist policy makers and practitioners to identify the local challenges of climate change and develop tools for responding to them. Although the key challenge of climate change is local adaptation and mitigation, today's global climate scenarios and national adaptation strategies can say little about the local impacts of climate change. Our study shows that changes in both climatic conditions and climate policy impacts even inside a relatively small case study area (approx. 4 500 km²) can be dramatic.

2.1.2 Public information flow analysis

Public information flow analysis and the related knowledge-based tools were developed in the context of the Alcoa Greenland case study. The study comprises an analysis of the public information flow within a well defined topic, a well defined period of time, and a well defined set of media. The issue is the ongoing consideration of whether or not to give political approval to the USA based multinational aluminium company, Alcoa Inc, to construct an aluminium smelter in Greenland. The process involves a series of political decisions starting in 2006 with the acceptance of Alcoa's interest in Greenland hydropower potential. In 2007, a Memorandum of Understanding for 2007-2009 was signed between the Greenland Government and Alcoa. The MoU assumes that a series of political decisions be taken. Three political decisions with the most public interest are 1) location of the aluminium smelter, 2) choosing the ownership model (Greenland as a partner or a concession on hydropower resources), and 3) final political decision on whether or not to accept the project.

Our case study focuses on the decision concerning the location of the aluminium smelter in Greenland. This decision was taken by the Greenland Parliament during the first five months of 2008. The analysis of public information flow is primarily based on information flow in the two national newspapers *Sermitsiaq* and *AG*. An analytical model for all information related to the aluminium project was designed. Any article related to the aluminium project was analysed on both objective criteria, including date, sender and length; and subjective criteria, including position expressed (positive or negative) in regard to several topics such as ownership, economy and environment. The data was organized in a database which forms the basis of statistical findings. Alongside with the empirical analysis of public information flow, separate analyses of the internal political and administrative information and decision flows were conducted. The two sets of information flow—the public and the internal political and administrative—were compared. The knowledge-based decision tool was developed on the basis of these findings, taking also into account the key dimensions of sustainable governance such as structures, processes, culture, time and resources.

We have not analyzed whether or not the prevailing societal conditions favor sustainable governance, as such analysis was considered to be beyond the scope of developing a knowledge-based decision tool. Nevertheless, an analysis of Greenland societal preconditions for adapting knowledge-based decision tools would be a pertinent future research project. In the absence of such study, it remains an open question if the Greenland socio-political system is geared toward the principles of governance for sustainability.

2.1.3 Micro-level actor network analysis

We also applied micro-level actor network analysis in the Alcoa Greenland aluminium smelter case. In the Alcoa Greenland case, our purpose in applying two different analytical approaches (public information flow analysis and micro-level actor network analysis) was to improve the validity of our knowledge-based tools with analytical triangulation, given the importance of that particular case.

The case of Alcoa Greenland is well-suited for the actor network approach. As a focus of research it is explicitly and implicitly interdisciplinary in nature. The approach is question-driven—often a hallmark of interdisciplinary research (Klein, 1996)—and uses actor-network-theory in its most methodological sense, as a *sociology of associations* (Latour, 2006). Its theoretical claim is that our notions of sociological concepts are rediscovered and re-represented as we follow and describe the actors themselves, as they move through their actions and interactions, as strings of mediators, thereby constituting actor-networks. By following the actors in the Alcoa Greenland case, we create the social that is relevant for understanding that complex of interactions.

The very idea of “the social” exists in the configuration and description of the actor-network: materially, spatially, temporally and abstractly; it lasts as long as the actor-network has meaning for the actors. In other words, the *performance* of a study based on actor network theory, by virtue of its intricate and thick description, seeks to expose as much as it can of the complex interactions between actors so that they are clearly discernible, so that as much knowledge as possible can be gathered, inscribed and preserved, until the extent of the enquiry suffices (Law, 2004; Latour, 2005; Langlais, 2006). We followed as many of the relevant actors as possible. In-depth interviews (recorded, where possible), text analysis (reports, public records, policy statements, decision documents, etc.), participant observation at meetings of various kinds, group discussions (an element of action research), thick description and archival searches have been used. As such, this has, by definition, been eminently suitable as an integrative approach for a process of interdisciplinary teamwork (Lattuca, 2001).

Conflicting understandings and knowledge of the scientific “story” of climate change may be recruited for a variety of political ends. By studying the micro-level in Greenland, we address whether there is something different about *climate* change in aboriginally-informed knowledge tools; why that is so; and how that is being transformed into effective *social* change. The local appears in some cases to be superseding the national, and the relative weights of different jurisdictions are in flux. The degree to which this is applicable indicates the manner, directions and speed with which planners, stakeholders and decision-makers are expected to (re)act. Who is doing what? Are any of their actions especially innovative when considered from an international perspective? Do they demonstrate that they understand the scientific “story” and knowledge about climate change in different ways? As programmatic responses proceed, are specific spatial and regional development impacts (changes in employment, mobility, etc.) generated that can be of concern in Greenland? How does that feed back to the municipalities who have been bidding for the Alcoa Greenland smelter project? Can planners cope with the need to develop 100-year plans that can cope with the smelter project? It appears to us that the relations of power and the space for change are being re-arranged.

2.2 Approaches for macro-level analysis

Two of our analytical approaches can be characterized as being primarily macro-level but with micro-level links. We conducted a transition analysis of energy system transitions in the peripheries of West Norden and a macro-level actor network analysis of the implementation of climate change policy in Swedish municipalities.

2.2.1 Transition analysis

The case study on energy system transitions in the peripheries of West Norden had two phases. The key question in the first phase of the study was the capacity and characteristics of existing energy systems and their development, including an outline of the key energy sources, how they have been developed during the last decades, and what have been the most marked changes. To understand the ongoing changes, their economic and political underpinnings were mapped, including an analysis of the economic and political measures with which energy goals were pursued. Different policies and instruments in particular were analyzed. Data sources for this part of the analysis were official documents, reports, statistical agencies, but also a number of personal contacts as well as interviews with 9 key persons in the national energy agencies.

The second phase of the analysis focused on local adjustments to changes in the periphery of West Norden. A key issue was the regional autonomy and dependencies in structuring regional and local energy systems, including an understanding of the local and regional responses to the overall policies. Key questions were how the local and regional producers and agencies have been involved in laying out strategies for future development, what kinds of networks have been developed, and what have been the driving forces of local adjustments to changes. Besides access to strategy and development documents, interviews were conducted with a total of 39 key managers and decision makers in the Nordic periphery and West Norden. They provided in-depth understanding of the options and adjustment processes that have been decisive for the present structure, as well as determining future directions of change.

To understand the ongoing changes in energy systems, the theoretical focus of the project was on *transformation processes* in which society changes in fundamental ways over longer periods of time, with an emphasis on the role of policies in bringing about structural change, and how their management involves sensitivity to existing dynamics and regular adjustment of goals to overcome the conflict between long-term ambitions and short-term concerns. A key point in this connection is that societal functions are fulfilled by socio-technical systems, which consist of a cluster of aligned elements, e.g., artifacts, knowledge, markets, regulation, cultural meaning, infrastructure, maintenance networks and supply networks, and that transitions in the transformation process are conceptualised as system innovations, i.e., a change from one socio-technical system to another. The project has probed these socio-technological changes, with an emphasis on three different levels:

- The micro level comprising individuals or *individual actors* such as companies, environmental movements etc., often characterized by niche level of technological changes related to individual actors and technologies;
- The meso level comprising networks, communities and organizations, often characterized as *socio-technical regimes*, relating to dominant practices, rules and shared assumptions where the interests, rules and beliefs that underlie political policy are mostly geared towards optimising rather than transforming systems;
- The macro level comprising conglomerates of institutions and organizations such as cross-regional cooperations and national policies, relating to what is referred to as *socio-technical landscapes* encompassing material and immaterial elements at the macro level: material infrastructure, political culture and coalitions, social values, worldviews and paradigms, the macro economy, demography and the natural environment.

A key concept to describe changes in socio-technical systems is transition management, particularly in relation to policy strategy focussing on the process of induced change towards sustainability. On one hand, transition management recognizes *endogenous technological* change, where issues such as the stock of human capital determine the rate of adjustment. On the other hand, *external relations* including access to knowledge are integral factors in determining whether regions provide the relevant system of reference for knowledge-based economic development. In this connection the concept of Triple-Helix becomes relevant as a perspective on the integration of the micro, meso and macro levels.

2.2.2 Macro-level actor network analysis

Our second macro-level approach is macro-level actor network analysis, which we applied in a case on municipal climate change policies in Sweden. The general impetus for studying climate change policies in Swedish municipalities stems from a curiosity to know why the climate change issue has been motivating *some* municipalities *more* than others to respond *actively* and concretely to its implications. What are the motivations that succeed in making a shift to acting on climate change? This is especially interesting since much of the key literature on the subject laments that this has not been happening. We have been surprised to see that a small number of municipalities have actually shifted to a degree of active response. It leads us to wonder if a more profound shift in the orientation of governance for sustainable development is occurring, or whether it is merely a shallow expression of a temporary fashion.

When checking the literature for precedents for this study, we find some theoretical postulations (see section 2.1.3) about how processes of municipal response to climate change might, could, or should, take place, but disproportionately little empirical research that describes or analyzes actual concrete attempts at active response. One reason is that to date such active responses have been few, thus making it even more imperative to study how they proceed, and why (Lundqvist and Biel, 2007; Wilson, 2006). Bylund (2006), for example, studied a Stockholm Local Investment Programme case that concerned sustainability, not climate change response.

In order, then, to perform this integrative theoretical and empirical enterprise, several techniques and methods were used. We performed investigative telephone interviews, with the person in charge of climate change response, in every municipality (all 290) in Sweden. Applying several detection indicators that we have derived, those results are being cross-checked with other data from other sources (e.g., municipality membership in international climate change organizations and networks, consultations with national authorities). Candidate municipalities are being re-assessed for usefulness as choices for further study. The data from Steps 1 and 2 are used to produce a map of all Swedish municipalities, showing the coarse levels of climate change response activity.

The object of the study was to discover what we didn't already know about concrete climate change responses in Swedish municipalities. It was therefore important that we established contact with each municipality in a particular way. On the one hand, we wanted as much as possible to avoid having any preconceived notions. On the other, it was essential that the enquiry was done so that it would be *the individuals who represented the municipalities who would tell us what they themselves considered to be the appropriate answers to our questions*. In other words, there should be as much self-selection as possible by each and every respondent, at all levels of contact.

The municipal register maintained by Statistics Sweden (SCB) was used in order to create a catalogue of all Swedish municipalities. We listed the municipalities alphabetically, to create a geographically-neutral randomization of the order that we would contact them in. In our contacts with each municipality, the chain of referrals eventually came to a stop only when we reached the person who was considered by his or her colleagues to be the one most suitable for answering queries about climate-change-related issues. Most frequently, the person we ended up talking with was an officer from the municipal environmental office (an inspector, a manager, an Agenda 21 coordinator, an ecologist, or, in some cases, an energy adviser).

In sum, we know little not only about how municipalities, but also how the other actors that are active in communities, use and manipulate the rhetoric of sustainability and climate change. It is possible that they enlist that rhetoric as a justification for doing what they would want to be doing anyway, at the same time as its use might unintentionally influence their actual work and its outcomes.

3. Application of knowledge-based tools for energy and climate adaptation in the Nordic periphery

3.1 Knowledge-based tools for policy anticipation phase

3.1.1 Indicators of historical analogies

Analogical situations are not entirely similar to each other, but there are strong common denominators between them. Three *common denominators characterize the analogies* between the historical hydropower and forestry mega-projects and present climate change policies striving for large scale renewable energy production in Lapland:

- *Center versus periphery* confrontation, which refers to dominance and dependence relationships between the centers of power and peripheral regions.
- *Underestimation of the effects* of the policy or project under consideration, which refers to political discourse that is dismissive about the negative impacts of change.
- *Erroneous assumptions* about the upcoming change, which refer to the positively biased assumptions about the change resulting from policies.

These denominators play a crucial role in indicator development based on historical analogies. Given the unique historical development of each particular region, it is impossible to develop universal indicators. However, the three denominators provide overall guidance on what types of things to look for in any particular region with respect to climate policy. To craft the general denominators into more *specific indicators of policy change*, the following guidelines are useful:

Guideline 1. It is important to keep in mind that indicators based on historical analogies are knowledge-based tools for the policy anticipation phase, as opposed to policy planning or implementation. They are therefore not intended for everyday monitoring the way most indicators are. These are rather tools for planning long-term strategies for local adaptation to climate change, or for professional training intended to maintain the proficiency of local policy maker practitioners in climate adaptation. At the same time, we emphasize that “long-term” here does not stand for “slow and relaxed attention”. On the contrary, major policy change often picks up momentum quickly and requires alertness to recognize the windows of opportunity for influence.

Guideline 2. To be able to exploit historical information, the policy maker practitioner should be able to distinguish what are from today’s point of view the relevant historical changes from the irrelevant ones. This is where our common denominators come into play. Local policy maker practitioners can interpret the policy impulses coming from higher levels of administration or the feedback coming from the field level through the “historically enlightened” lenses that have been focused on center-periphery confrontation, underestimation or erroneous assumptions. In this way local policy maker practitioners can evaluate policies-in-the-making from the local point of view.

Guideline 3. Local policy maker practitioners can use the results of their evaluation of policies-in-the-making to empower their local community. This works both upstream and downstream

in the policy cycle: if local policy maker practitioners observe indications of center-periphery confrontation, underestimation of impacts or erroneous assumptions, they can send systematically structured monitoring information back to higher level policy makers; and if local policy maker practitioners receive critical feedback from the field concerning these indicators, they have good reason to adjust their own policy.

Guideline 4. Clever actors can change the structures they are part of. Historically informed indicators empower the local community in an institutional sense. If local policy maker practitioners see themselves as active players in the broader scheme of policy making and find out ways of influencing it, they are in a position to develop self-determined, local survival strategies for the turbulence of multi-level climate governance. A community's knowledge of its local history is part of its intellectual property, and indicators inferred from historical analogies constitute a tool for the community to exploit the intellectual property in a way that helps it to adapt to climate change in its own way.

3.2 Knowledge-based tools for policy planning phase

Based on the analytical approaches outlined in section 2, four knowledge-based tools for policy planning phase have been analyzed, applied and tested in connection with the project: two for macro level policy planning (multi-criteria decision analysis and technological roadmapping described in sections 3.2.1 and 3.2.2, respectively) and two for micro level policy planning (indicators of public information flow and micro-level actor network tools described in sections 3.2.3 and 3.2.4, respectively). The macro level tools have been applied in connection with the analysis of energy system development in the Nordic periphery. While the empirical basis obtained from documents and statistics have served as key components in outlining the technological basis, the roadmaps have been tested through interviews with stakeholders in the region, and used as a means of identifying potential conflicts and deficiencies in policy measures. The micro level tools are based on the Alcoa Greenland case. It should be noted that the indicators of public information flow grew out of the public information flow analysis but is also closely related to technological roadmapping described in section 3.2.2. and acts thus as a link between the macro and micro level tools.

3.2.1 MCDA – Multicriteria Decision Analysis

Technology managers increasingly face problems of group decision where the scale and complexity of research, development and alliance efforts in emerging fields of technology mandate correspondingly sophisticated forms of group coordination. Multicriteria Decision Analysis (MCDA) methods are often used to help decision-makers in such situations. Decision Analysis is a set of systematic procedures for analyzing complex problems by dividing the decision problems into more manageable parts; analyzing each part; and logically integrating the parts to produce a meaningful solution. In general, **MCDA problems involve six components:**

- A goal or a set of goals the decision maker wants to achieve,
- The decision maker or a group of decision makers involved in the decision making process with their preferences with respect to the evaluation criteria,
- A set of evaluation criteria (objectives and/or physical attributes)
- The set of decision alternatives,
- The set of uncontrollable (independent) variables or states of nature (decision environment)
- The set of outcomes or consequences associated with each alternative attribute pair.

MCDA is a generic approach. To highlight how it might be applied as a knowledge-based adaptation tool in environmental policy, we will have a closer look at one of its pragmatic variants, technological roadmapping.

3.2.2 Technological roadmapping

Several approaches have outlined variations of approaches to knowledge based decision making, which in many ways are variations of the MCDA described above. There are several ways of defining the key components. In our project, a general model of information flows and thresholds was outlined, leading to the following *suggested structure of an adjusted technological roadmap in determining and testing the relevant policy measures*:

Phase 1. Preliminary activity phase, defining the essential conditions and outlining the scope and boundaries for the technology roadmap. In this connection the activity includes identifying also the critical issues determined by questions of systems maintenance versus systems integration, and systems replacement.

Phase 2. Development phase, encompassing (as general examples, but each step is case sensitive):

- identify the “product” of the roadmap, i.e. the overall structure to be analyzed
- identify the critical system requirements and their targets
- specify the major technology areas (transform requirements)
- specify the technology drivers and their targets
- identify technology alternatives and their timelines
- recommend which technology alternatives should be pursued
- create the technology roadmap

Phase 3. Policy phase, outlining the policy measures and testing them towards existing as well as suggested forecasts of future conditions.

Phase 4. Follow-up activity phase (optional).

Technological roadmapping and multicriteria decision analysis (section 3.2.1) can be applied on micro, meso, and macro scales, provided adequate background indicator information is available. Such *background indicators* should be developed in advance and should in the case of energy systems encompass:

- Major technology areas
- Critical system requirements
- Transform requirements
- Technology drivers and their targets
- Technology alternatives and their timelines
- Policy measures
- Historical outlines
- Forecasts of future conditions.

3.2.3 Indicators of public information flow

The knowledge based decision tool that grew out of the analysis of the public information flow and the internal political and administrative information flow in the Alcoa Greenland case is a set of indicators to give the political system a way of measuring the state of the public information flow in relation to the internal political and administrative information flow. These are some of the key characteristics required of such an indicator system:

- One indicator of the inclusion of the public is the number of public debates on important policy issues. We consider it important to require at least three public debate contributions from ordinary citizens per month during three months.
- The nature of these contributions can be defined beforehand as at least a comment to an article on the electronic news sites (sermitsiaq.gl or knr.gl) or in the national newspapers.

- These measurements are based on the principles of sustainability governance: it is assumed that the political system is interested in including the public in decision making before final decisions are made.
- The information that is available to politicians and administrators should also be made available to the public.

One of the dominating arguments from within parts of the existing political and administrative elite is that in projects of the size comparable to that of the aluminium project, the public cannot be trusted with all the information and that some of the information has to be confidential. Such attitudes clearly illustrate the limits of the existing political and administrative system to fully integrate the principles of sustainability governance.

3.2.4 Micro-level actor network tool

Actor network analysis can also be used as a knowledge-based tool at the micro level, focusing on the policy planning phase. Here we draw from the Alcoa Greenland mega-project case. We investigate how knowledge is obtained, applied and communicated within the mega-project's planning process.

Knowledge is naturally embodied in people's minds and is thus to some degree mobile. This commonplace is useful to recall because it strengthens the notion that place matters. With regard to Greenland, what are the relevant institutions, and more precisely, who are the individual experts? Are they totally Greenland-based or are they (and their knowledge) imported? To explore this further we need to distinguish between those forms of knowledge that can be easily codified (e.g. information to the municipalities about how the planning process is intended to take place) and so-called tacit knowledge, which is bounded to the knowledge carrier and difficult to transfer (e.g. expert knowledge of impacts caused by aluminium smelters in arctic-peripheral locations). In regional development planning, this distinction is critical, as it highlights the question of how far local/regional communities are able to organize and finally institutionalize learning processes and thus shape and foster their regional development path (cf. the discussion on learning regions by e.g. Hassink, 2001). In particular, what is the situation with regard to a peripheral-arctic environment (and its specific geo-political, historical and socio-cultural setting) with an assumedly low critical mass of available knowledge carriers in relation to such a highly 'knowledge-loaded' mega-project?

The applicability of our findings and their compilation in knowledge-based tools rests upon the critical reconstruction of the planning process around the Alcoa Greenland mega-project (cf. case study report). We propose the following checklist of practical tools for knowledge-intensive mega-project planning in specific arctic-peripheral environments:

- Screen who identifies sources of knowledge that inform the stakeholders concerned.
- Identify the sources of knowledge used to explore any issues/impacts related to the project.
- Assess how such kinds of knowledge were used in the past.
- Explore how local knowledge management system can be incorporated in specific governance configuration established for the megaproject. What kinds of networks/coalitions are needed?
- Identify cornerstones (of this governance configuration) with regard to the flow of knowledge (acquisition>application>dissemination). Who are the powerful institutions/actors?
- Identify and inform who decides which kinds of knowledge are valuable. Which kinds are thought of as less important? How will decision-making process(es) be designed?
- Investigate what kinds of knowledge can be localized and exploited in the home region. What other kinds need to be imported from other regions (e.g. experts and their tacit knowledge)?
- Analyze how a local knowledge management system can assure that different kinds of knowledge are communicated to the public and stakeholders in an effective way.
- Assess how a local knowledge management system can assure that different kinds of knowledge are being maintained and institutionalized so that they contribute to and help organize the permanent absorption of (new) knowledge in this respect so that it contributes to a localizable learning process within a specific community?

3.3 Knowledge-based tools for policy implementation phase

3.3.1 Macro-level actor network tool

The knowledge-based tool we propose for policy implementation—macro-level actor network tool—draws from the example of climate change policy implementation in Swedish municipalities.

Since policy integration takes place over time and usually implies simultaneous implementation of policy and the involvement of multiple levels of government and governance, it is fascinating to consider the role of the individual bureaucrat or stakeholder in that maze of interactions. In their research on how high-level policy (i.e. the Kyoto Protocol and Swedish national policy) is implemented across and between multiple levels, even to that of the “individual,” Lundqvist and Biel (2007) conclude, following Dietz, Ostrom and Stern (2003), that “nested layering” of institutional arrangements, a mixture of institutional types and “analytic deliberation” among the parties and the public can increase legitimacy of implementation processes in multi-level settings. In the same context, the specific notions of cost instruments, trade-offs and their associated social dilemmas are discussed by Hammar and Jagers (2007). Pierre and Peters (2005) develop a typology of models of governance, between the extremes of “state-centric” and “governance without government,” a middle way, where institutions and the state play important roles, in an intensive complex of interactions both vertically and horizontally, between various actors in a flux of power relations.

When it comes to the actual implementation of policy, it is often left to planners to have to consider the implications of the trade-offs chosen so that the intended synergies can be secured and the potential for further synergies increased. Conflicts, hazards, costs, decoupling and risks are among the decelerating factors (Hibbard, et al., 2007) that are implicated when choices of strategies are closed. Schmidt-Tomé (2006), in his recent study of integration of risks, natural hazards and climate change into spatial planning practices, echoes—interestingly, given its perspective—the conclusions of several of the authors above (Nilsson and Eckerberg, 2007; Lundqvist and Biel, 2007; Pierre and Peters, 2005; Dietz, Ostrom and Stern, 2003) in an insistence on the importance of detailed communication processes that ensure “inter-disciplinary, inter-regional and inter-governmental cooperation to obtain multi-dimensional views . . . the development of appropriate adaptation strategies [in spatial planning] is a slow process that should integrate all relevant actors and stakeholders” (pp 27-28). In so far as those studies have made progress in identifying the important components in achieving appropriate combinations of different aspects of sustainable development, we in turn have proceeded to study concrete responses and to follow the actors themselves, in search of the meaningful patterns.

4. Feasibility of knowledge-based tools for practitioners

We conclude by assessing the feasibility of the knowledge-based tools for sustainable environmental governance with the help of five questions: Who should use the tools? Why and how to use the tools? When and where are the tools applicable? How to ensure the use of the tools? What is the impact of the tools?

Who should use knowledge-based tools for sustainable environmental governance? All of the knowledge-based tools described above are designed to be used by individuals we have characterized as local policy maker practitioners. These hybrid experts are common in the remote regions of Norden, where as a result of the real-life constraints on people and resources an individual not only holds an office related to policy making but also practices a local livelihood (Hukkinen 2008). These hybrid experts typically know the key changes in their own region's environmental history and are also committed to applying such knowledge to improve local living conditions. To facilitate knowledge application, we have in the previous sections deliberately transformed the original analytical approaches into hands-on tools such as indicators and checklists that local level policy maker practitioners can easily identify in their daily work.

Why and how to use the tools? As the preceding sections show, most knowledge-based tools can be condensed into indicators or checklists. We consider the use of the checklists and indicators to be an indispensable pre-condition for implementing mega-projects in arctic-peripheral environments and their specific settings. Here the role of knowledge and the complex interplay between localized and non-localized (imported) sorts and sources of knowledge is of great importance. There is always the risk that such projects will only be governed by the functional logic of global footloose investors and a certain policy elite in the region at hand, as in our Greenland and Lapland cases. A local knowledge management system should ensure not only the incorporation of all sorts of local expertise, but also maintain and further develop the specific lessons learned (learning by doing, learning by interacting etc).

When and where are the tools applicable? The tools we have outlined can be applied both in desk studies and in connection with workshops. Furthermore, despite our indicative categorization into micro and macro levels, the tools can be applied on micro, meso and macro scales with feedbacks from one scale to another. Provided adequate background information (see section 3.2.2) is available, we believe the tools can be used to outline and test policy measures at all three levels. The main advantage of multi-level cross-fertilization is, however, that it enables the identification of missing links that may be crucial in the development of a coherent and inclusive national strategy for sustainable environmental governance.

How to ensure the use of the tools? Given the knowledge-intensive nature of today's environmental policy issues, we think knowledge-based tools should become part of the professional training of local level policy maker practitioners. The training is particularly important today when local policy makers often come from outside the region are not familiar with the local situation and history. Cross-scale exchange of knowledge would be facilitated by organizing the training in cooperation with local inhabitants.

What is the impact of using the tools? In the long-run the application of knowledge-based tools for adaptive environmental governance can contribute to the endogenous development capacity of specific peripheral environments and to their capacity to shape their own regional development path, against the background of the broader geo-political context. We realize, of course, that the application of checklists and indicators will inevitably challenge some specific "organizing resources",

such as the Greenland Home Rule or the Forest and Park Service of Finland in our cases. However, investment in local knowledge-based tools is worthwhile in the long-run as it can help to better facilitate the complex and extremely knowledge-intensive planning processes. The tools can also improve the assessment of the potential environmental, social and economic impacts of mega-projects and make the whole process more transparent.

While the tools we have outlined hold clear potential for local level empowerment, they also hold more complex and ambivalent political implications. Let us return to the Alcoa Greenland case. We found that most of the information during the smelter planning process came from people or organizations involved in the political decision making or administration relating to the project. There were only a few contributions in the public debate from NGOs and independent experts. This reflects the weak role of independent voices such as the press in a small country like Greenland. It is reasonable to ask this: If the political system had access to the knowledge-based tools developed in this project, would they in fact be likely to use the tools to promote a wider public discussion before political decisions? In the Greenland case, the questions of time and timing turned out to be key elements influencing the promotion of public discussion. In more than one instance the actual political decision was taken before including of the public in the discussion. We cannot say on the basis of our analysis if this was the plan or just an accident. We can only hope that a deeper grounding of knowledge-based tools in the local culture as we have sketched in this report and its case studies would lessen the likelihood of exclusive politics.

References

- Allenby, B. R. and D. J. Richards (Eds.) 1994 *The Greening of Industrial Ecosystems*. Washington, DC: National Academy Press.
- Ausubel, J. H. and H. E. Sladovich (Eds.) 1989 *Technology and Environment*. Washington, DC: National Academy Press.
- Bruun, H. (2007) Genomics and the transformation of knowledge: The bioinformatics challenge. In Glasner, P., P. Atkinson, and H. Greenslade (Eds.) 2007 *New Genetics, New Social Formations*. Routledge, New York, USA.
- Bruun, H. and R. Langlais (2003) On the embodied nature of action. *Acta Sociologica*. Vol. 46(1), pp. 31-49.
- Bruun, H., R. Langlais, and N. Janasik (2005) Knowledge networking: A conceptual framework and typology. *VEST: J. for Science & Technology Studies*. Vol. 18(3-4), pp. 73-104.
- Bulkeley, H. (2006) A Changing climate for spatial planning. *Planning Theory & Practice*. Vol. 7(2), pp. 203-214.
- Bulkeley, H. and K. Kern (2006) Local government and the governing of climate change in Germany and the UK. *Urban Studies*. Vol. 43(12), pp. 2237-2259.
- Bylund, J. R. (2006) *Planning, Projects, Practice*. Human Geography, Stockholm U.
- Cohen, M. J. (2006) Ecological modernization and its discontents: The American environmental movement's resistance to an innovation-driven future. *Futures*. Vol. 38, pp. 528-47.
- Coulson, S. (2001) *Semantic Leaps: Frame-Shifting and Conceptual Blending in Meaning Construction*. Cambridge University Press, New York, USA.
- Dietz, T., E. Ostrom and P. C. Stern (2003) The struggle to govern the commons. *Science*. Vol. 302, pp. 1907-1912.
- Dolšák, N. and E. Ostrom (2003) *The Commons in the New Millennium*. MIT Press.
- Engel, K. H. (2006) Mitigating global climate change in the United States: a regional approach. *NYU Environmental Law Journal*. Vol. 14(1), pp. 54-85.
- Fauconnier, G. and M. Turner (2002) *The Way We Think: Conceptual Blending and the Mind's Hidden Complexities*. New York, NY: Basic Books.
- Feichtinger, J. and M. Pregernig (2005) Imagined citizens and participation: Local Agenda 21 in two communities in Sweden and Austria. *Local Environment*. Vol. 10(3), pp. 229-242.

- Flyvbjerg, B. (1998) *Rationality and Power: Democracy in Practice*. The University of Chicago Press, Chicago, USA.
- Forbes, B. C., M. Bölter, L. Müller-Wille, J. Hukkinen, F. Müller, N. Gunsley and Y. Konstantinov (Eds) 2006 *Reindeer Management in Northernmost Europe: Linking Practical and Scientific Knowledge in Social-Ecological Systems*. Springer-Verlag, Berlin, Heidelberg.
- Fudge, C. and J. Rowe (2001) Ecological modernisation as a framework for sustainable development: a case study in Sweden. *Environment and Planning A*. Vol. 33(9), pp. 1527-1546.
- Gentner, D., K. J. Holyoak and B. N. Kokinov (2001) *The Analogical Mind: Perspectives from Cognitive Science*. MIT Press.
- Haila, Y. and C. Dyke (2006) Introduction: What to Say about Nature's "Speech". In Haila, Y. and C. Dyke (Eds.) 2006: *How Nature Speaks? The Dynamics of the Human Ecological Condition*. Duke University Press, Durham and London.
- Hammar, H. and S. C. Jagers (2007) Is there a trade-off between cost-effective climate policies and political legitimacy? In Lundqvist, L. J. and A. Biel (Eds.) 2007 *From Kyoto to the Town Hall: Making International and National Climate Policy Work at the Local Level*. Earthscan.
- Hassink, R. (2001) The learning region: A fuzzy concept or a sound theoretical basis for modern regional innovation policies?, *Zeitschrift für Wirtschaftsgeographie*. Vol. 45, pp. 219–230.
- Heikkinen, H., H. Magga, S. Nevalainen, and O. Jääskö (Eds.) 2003: Kuuluuko sääsken ääni taivaaseen? Poromiesten analyysi poronhoidon murroksista Suomen Lapissa 1900-luvulla (Is the Mosquito Heard in Heaven? Reindeer Herders' Analysis of Disruptions in Reindeer Management in Lapland, Finland in the 1900's) in Finnish. *Technology, Society, Environment*. Vol. 3/2003. Espoo: Helsinki University of Technology Laboratory of Environmental Protection.
- Hibbard, K. A., P. J. Crutzen, E. F. Lambin, D. M. Liverman, N. J. Mantua, J. R. McNeill, B. Messerli and W. Steffen. (2007) "Group report: Decadal-scale interactions of humans and the environment." In Costanza, R., L. J. Graumlich and W. Steffen (Eds.) *Sustainability or Collapse? Report of the 96th Dahlem Workshop on Integrated History and Future of People on Earth (IHOPE)*, Berlin, 12-17 June 2005. MIT Press and Dalhem University Press.
- Holliday, C. O., S. Schmidheiny and P. Watts (2002) *Walking the Talk: The Business Case for Sustainable Development*. Berrett-Koehler.
- Hukkinen, J. (2008) *Sustainability Networks: Cognitive Tools for Expert Collaboration in Social-Ecological Systems*. London: Routledge.
- Jamison, A. (2001) *The Making of Green Knowledge: Environmental Politics and Cultural Transformation*. Cambridge: Cambridge University Press.
- Klein, J. T. (1996) *Crossing Boundaries: Knowledge, Disciplinarity, and Interdisciplinarity*. University Press of Virginia.
- Langlais, R. (1995) *Reformulating Security*. Ph.D. diss. Human Ecology, Göteborg U.
- Langlais, R. (1999) Envisioning a sustainable Arctic. In Petersen, H. and B. Poppel (Eds.) 1999 *Dependency, Autonomy, Sustainability in the Arctic*. Ashgate.
- Langlais, R. (1999b). Securing relations and sustaining northern futures: The Kola Peninsula and the reformulating security discourse. In Wall, D. et al. (Eds.) 1999 *Securing Northern Futures*. Canadian Circumpolar Institute.
- Langlais, R. (2006) Reassembling the social: A review. *Science Studies*. Vol. 19(1), pp. 93-95.
- Langlais, R. and H. Bruun (1999) The human dimensions of interdisciplinarity. In Turunen, M. et al. (Eds.) 1999 *A Terrestrial Transect for Scandinavia/Northern Europe*. Ecosystems Research Report 31. European Commission.
- Langlais, R., P. Francke, J. Nilsson and F. Ernborg (2007) Turning Point on Climate Change? Emergent Municipal Response in Sweden: Pilot Study. Nordregio Working Paper 2007: 3. 40 pp.

- Latour, B. (2005) *Reassembling the Social*. Oxford University Press.
- Lattuca, L. R. (2001) *Creating Interdisciplinarity: Interdisciplinary Research and Teaching Among College and University Faculty*. Vanderbilt University Press.
- Law, J. (2004) *After Method: Mess in Social Science Research*. Routledge.
- Lundqvist, L. J. and A. Biel (Eds) 2007 *From Kyoto to the Town Hall: Making International and National Climate Policy Work at the Local Level*. Earthscan.
- Nilsson, M. and K. Eckerberg (Eds) 2007 *Environmental Policy Integration in Practice: Shaping Institutions for Learning*. Earthscan.
- Olsen, K. H. (2006) National ownership in the implementation of global climate policy in Uganda. *Climate Policy*. Vol. 5(6), pp. 599–612.
- Pierre, J. and B. G. Peters (2005) *Governing Complex Societies: Trajectories and Scenarios*. Palgrave.
- Renn, O. (2008) *Risk Governance: Coping with Uncertainty in a Complex World*. London: Earthscan.
- Rummukainen M., S. Bergström, G. Persson and E. Ressner (2005) *Anpassning till klimatförändringar* [Adaptation to Climate Change]. SMHI Serie RMK 106.
- Schmidt-Thomé, P. (2006) *Integration of Natural Hazards, Risk and Climate Change Into Spatial Planning Practices*. Geological Survey of Finland.
- Stern, N. (2006) *The Economics of Climate Change*. <http://www.hm-treasury.gov.uk>
- Sweden. 2006. Klimat- och sårbarhetsutredningen. Översvämningshot [Flood Threats]. SOU 2006: 94.
- Tsing, A. L. (2005) *Friction: An Ethnography of Global Connection*. Princeton University Press.
- Voss, J.-P., D. Bauknecht and R. Kemp (2006) *Reflexive Governance for Sustainable Development*. Edward Elgar.
- Wilson, E. (2006) Adapting to climate change at the local level: The Spatial Planning Response. *Local Environment*. Vol. 11(6), pp. 609–625.

Contents

Appendices: Working papers on case studies

Climate policy and reindeer management in Lapland, Finland	33
Decision processes, communication and democracy: The aluminium smelter project in Greenland	57
The proposed ALCOA aluminium smelter in Greenland: A case study report	89
Transitions to sustainable energy systems in West Norden	111
A reflection on 1294 conversations: A discursive essay on knowledge-based tools in Swedish municipal response to climate change	137

Climate policy and reindeer management in Lapland, Finland

Jarkko Levänen and Janne Hukkinen

1. Introduction: A Global phenomenon in a local context

This study is about the implications of climate change on peoples' living conditions and the sustainability of local reindeer herding livelihood in Upper Lapland, Finland. Climate change influences social and ecological systems in various ways and many of its impacts are unknown. Studying these implications requires a multidimensional approach with context-based indicators. In this study we evaluate the possibilities to exploit local historical knowledge in indicator development and in local adaptation to climate change. We also aim to find out and understand better the relationships between central and peripheral Nordic regions at different scales.

Local variation in the impacts of climate change will be remarkable and the impacts can be even opposite to the general extrapolations of climate change effects. Environmental challenges in northern peripheries are central issues in climate change discussion. These areas are likely to experience the largest and most dramatic impacts of climate change. In that sense it is interesting and enlightening to take a well-defined area under analysis and try to identify specific local impacts of climate change. Our case study area, Lappi reindeer herding co-operative (RHC), is a particularly interesting area to study in the context of climate policy for various reasons. Firstly, it has never been a conservation area and that is why many environmental hazards – such as strong influences of intensive forestry and hydropower – have taken place and are interconnected there. Secondly, the environmental history of the area is at the same time emblematic to many peripheral areas in the Nordic areas and an extraordinary one.

Focusing on the social dimension is important because climate change does not treat humans equally. It is ironic that people in the sparsely inhabited northern peripheries cause the least of all climate change yet suffer the most from it. Even though the Nordic countries are very similar in many ways, for example in geographical and economical conditions, we should avoid oversimplified generalizations while doing measurements concerning changes in the environment and estimating the possible influences of climate policy in the different areas of Norden. Local historical and cultural knowledge offers a good source of information for exploring the special character of the Nordic areas.

We began our research with the aim to understand the influences of climate change on the Lappi RHC and the reindeer herding livelihood and to develop indicators that could measure those influences. As preliminary results, we introduced a set of indicators (see Levänen 2008). As we went deeper in our analysis we became more convinced about the essential role of historical information in local adaptation to climate change in our case study area. Since our initial study we have focused on further development of our research method, the historical analogue approach. Good experiences from our own case study have encouraged us to evaluate the possibilities and limitations of its applicability in different Nordic peripheries. We believe that under certain conditions our approach can be broadened and used as a tool to better understand the effects of climate policy in different Nordic peripheries. In this paper we introduce the development process of historical analogue approach. The most illustrative way to do that is by describing our practical case study and its theoretical foundations. We have treated scenario construction in depth elsewhere (Levänen 2008).

In the following sections we will first introduce our case study area. After that we will give an brief introduction to the theoretical basis of social-ecological systems (SEs), path-dependence theory and finally the historical analogue approach. We argue that the so-called shifts between sustainability phases are usually represented occasionally in SEs and those can also be found in

the history of the Lappi RHC. Briefly, this kind of shift means a transition from one balance level to another in a particular SES. After that we will describe how we studied the impacts of climate change with the help of an SES model. The model was outlined in light of local knowledge and history. With the model we estimated the impacts of climate change on different parts of the SES and on the environment in the Lappi RHC. After collecting the information, we were able to compare the present situation with the historical ones through the analogy approach.

The historical analogy approach highlights the importance of understanding the meaning of history in today's environmental policies and politics. Our purpose in the historical review was to find out issues that have forced changes in the reindeer herding livelihood before and identify which of those changes are so meaningful that they could be considered as shifts between sustainability phases in the SES of the Lappi RHC. In the Analysis and discussion-section we identify common denominators for historical shifts between sustainability phases and look for analogies in changes of circumstances just before the historical shifts and compare them with today's changed circumstances. Finally, we will discuss if climate change could be seen as a future shift, analogous to the historical ones, between sustainability phases in the reindeer herding livelihood in the Lappi RHC and how unwanted changes could be avoided with clever use of historical information.

2. Case study area: Lappi reindeer herding co-operative

Reindeer herding is in many ways an important livelihood in Lapland, Finland. Reindeer herding has a long history and it has a special meaning for local people as an important manifestation of the local Sámi culture. Sámi are the only indigenous people in the European Union area. There are about 9000 Sámi living in Finland and the total Sámi population is estimated to be over 75 000¹. Traditionally practiced herding is also strongly place-bound, since it cannot be practiced elsewhere. Even though reindeer herding is, as a way of life, protected by many national and international statutes, its existence has become threatened during the past few decades.

The Finnish reindeer husbandry area covers 114 000 km² which is 36 % of the surface area of Finland. This area is divided into 56 geographically defined reindeer herding cooperatives (RHCs). All RHCs are presented in Figure 1. Each reindeer herder is a stakeholder in one cooperative. The role of the cooperatives is to take care of their reindeer and prevent them from causing damage or straying into other RHCs. In public administration, reindeer herding falls under the Ministry of Agriculture and Forestry's (MoAF) department of fisheries and game.

Cooperatives differ in size and number of reindeer. Herding methods also vary as do the natural circumstances, environment and culture. In the south there are many small-scale cooperatives with only a few full-time reindeer herders. In the north cooperatives are typically larger. Reindeer husbandry has the highest importance for the local economy in the northern area. Thirteen northernmost cooperatives form the so-called Sámi homeland area². This area is defined in the Finnish law.

The Lappi RHC is located in the northern part of the Finnish reindeer husbandry area in the Sámi homeland and its place of domicile is the Sodankylä municipality (the Lappi RHC is darkened in Figure 1). The Lappi RHC is one of the largest reindeer herding cooperatives. In 2003 there were 151 reindeer owners and 7012 reindeer (8000 is allowed in the law) living in the area (Magga 2005, 1). Hence it is reasonable to talk of a locally remarkable livelihood.

1. Source: The Saami Parliament web-pages (<http://www.samediggi.fi>).

2. Sámi homeland area is defined in the constitution of Finland (17§ and 121§) as culturally autonomous area. About half of the Sámi of Finland lives inside the area.

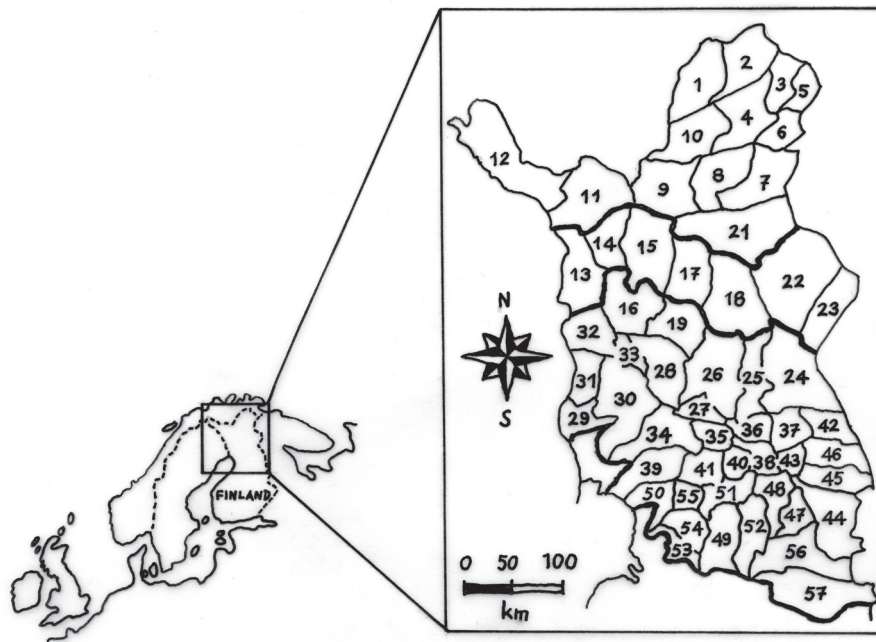


Figure 1. Reindeer Herding Cooperatives in Lapland, Finland. The Lappi RHC is number 21. Illustration J. Hukkinen.

Several aspects make the Lappi RHC interesting in the context of climate change and Finnish environmental management in general. Social and ecological aspects have intertwined there in such a way that it offers a fruitful starting point for an SES analysis in the context of climate change and policy in the northern peripheries. Reindeer herding as a local livelihood plays a crucial role in this analysis. During the last decades many kinds of issues have emerged in Finnish Lapland that have caused conflicts over the principles of environmental policy. These conflicts have included disagreements concerning different livelihoods, Sámi people indigenous rights issues, nature conservation questions and regional policy. All of these have been interconnected in the Lappi RHC area.

The history of the Lappi RHC is an illustrative example of Finnish environmental politics. In the 1950's and 1960's those politics made possible the construction of two large hydropower reservoirs in the Lappi RHC area. These reservoirs demanded 516 square kilometers of land of the Lappi RHC. That means 11,5 % of total area of the Lappi RHC. (Lenstra 1973, 124). The loss of these areas caused major economical complications for the members of the Lappi RHC (Magga 2003, 45 - 47). Intensive forestry since 1960's has caused enormous losses of reindeer pastures. These losses, of course, have impacted the practice of reindeer herding livelihood. Hannu Magga (2003, 53) has calculated a conservative estimate of 150 000 hectares of pasture losses to forestry in the Lappi RHC.

The above-mentioned events are also good examples of political path dependence in Finnish environmental politics. Without taking a stance on which things have been right or wrong in the past, the fact is that politics that allowed for example hydropower construction and intensive forestry in the reindeer herding area have affected today's situation in the area and will continue to do so in the face of the forthcoming challenges. That is why history cannot be excluded in this study. History is a strong determining factor when we want to understand what kind of SESs are now facing climate change in the northern peripheries. Knowledge of history is also important when we want to study tools for local adaptation.

But, one might think: What do these historical and extraordinary local issues in the Lappi RHC have to do with climate change? Quickly thought, the answer is: Not so much. But if we want to understand the effects of climate change in a broader and deeper sense we must try to

construct a general view in which different kinds of aspects are included. This means that if we want to measure, for example, the impacts of climate change in Lapland, we cannot only measure changes in temperatures or the thickness of snow cover. In addition, we must try to understand the local ways of life and the combined effects of environmental changes and policies on the local circumstances. Historical information can contribute to our understanding of the present situation. Only by combining these issues are we able to generate tools that can provide reasonable information concerning change. After this, we can see the value of the Lappi RHC as a fruitful example of an SES in which the combination of intensive and fast climate change and extreme governmental environmental politics during the past five decades are intertwined today.

3. Theoretical framework: Climate change in a social- ecological system

3.1 Social-ecological systems

Social-ecological systems (SESs) or ecosocial systems as some have said are models whose purpose is to challenge traditional boundaries between “nature” and “society” (e.g. Dyke 2006) and research interactions between those two. In the following we will point out some key issues of the approach, namely complexity, surprise and shifts between sustainability phases. We will also explain what we mean by path-dependence in this study. We argue that it is crucial to pay attention to all these issues when studying the effects of climate change and policy.

An SES is a theoretical concept that synthesizes different kinds of information from various sources. The result is a framework that describes interactions between social and environmental factors in one particular area or network. The concept of SES is constructed within the tradition of sustainability studies. Sustainability is also a key performance criterion for Nordic climate policies. Another reason for using SES is its multidisciplinary nature, which is needed to understand the local implications of climate change.

In this research the definition of SES follows John Anderies, Marco Janssen and Elinor Ostrom: “A SES is an ecological system intricately linked with and affected by one or more social systems. An ecological system can loosely be defined as an interdependent system of organisms or biological units. “Social” simply means “tending to form cooperative and interdependent relationships with others of one’s kind” (Merriam-Webster Online Dictionary 2004). Broadly speaking, social systems can be thought of as interdependent systems of organisms. Thus, both social and ecological systems contain units that interact interdependently and each may contain interactive subsystems as well.” (Anderies, Janssen and Ostrom 2004). This definition captures briefly but fittingly both ecological and social dimensions of the SES framework.

We are aware that delineation between social and natural systems is not trouble-free, as for example Fikret Berkes, Johan Colding and Carl Folke (2003, 3) have also pointed out. We also want to emphasize that SESs are never separate from the outside society. Systems in societies, ecosystems, corporations, and in fact everywhere are linked in various ways and ultimately all things can be seen to be connected with each other via different networks in different levels (see for example Barabasi 2002). This is an important issue to pay attention to in the context of climate policy. The effects of climate change do not become realized only through ecosystems, which is

why those effects have to be considered as parts of larger phenomena that have various political and economical dimensions as well.

3.1.1 Complexity and surprise

The concept of SES – if it is constructed in a reasonable way – can focus attention to the complexity of the system and surprising events that the system has to face. This is quite a unique and new issue in sustainability studies. It is also an important area of research in the context of climate change. Climate change is a complex phenomenon that is difficult to perceive and it includes surprising events like extreme weather conditions or abrupt changes in temperature levels globally and locally.

Complexity has two dimensions in this study. First, complexity refers to the complex relationships between different parts of the SES of the Lappi RHC. All stakeholders of the system are connected to many other networks in many levels and so the system becomes complex (Hukkinen 2008). Second, complexity refers here to the complex nature of climate change. Even though lots of research has been done around climate change lately there still exist many uncertainties and disagreements among scientists and other groups about local impacts.

By surprise we mean unforeseeable events that take place in the system. As Haila and Dyke (2006, 18) write: “Perhaps the most critical challenge is to grasp that abrupt changes may take place in geometry of the possibility space of systems believed to be ordered and well-behaved. A possibility for a new phenomenon may arise instantaneously, but the actual realization of that possibility is not predictable, nevertheless.” By a possibility space Haila and Dyke mean “the potential range of behaviors of systems”. In this study surprise refers to the abrupt climate changes, that can, in some extent, be expected (for example, in light of large-scale future climate projections) but that still emerge surprisingly and at the same time redefine the whole possibility space of the SES locally.

3.1.2 Shifts between sustainability phases

A shift between sustainability phases in this study refers to the SES’s rapid shift from one sustainability level to another – for example a change in the conditions of reindeer herding leading to rearrangement of the livelihood. Marten Scheffer, Steve Carpenter, Jonathan Foley, Carl Folke and Brian Walker argue that the same kind of shifts exist in ecosystems. In the article called Catastrophic shifts in ecosystems (2001) they argue that “Stochastic events such as weather extremes, fires or pest outbreaks can cause fluctuations in the conditioning factors – but often affect the state – directly, for example by wiping out parts of populations. If there is only one basin of attraction, the system will settle back to essentially the same state after such events. However, if there are alternative stable states, a sufficiently severe perturbation of the ecosystem state may bring the system into the basin of attraction of another level.” (Scheffer et al. 2001, 591). The theory from ecological systems can be applied to the SES of this study, because reindeer herding as a livelihood is so strongly connected to nature that changes in ecosystems affect directly also the other dimensions of sustainability.

A shift occurs in the SES when reindeer herding proves to be unsustainable in the way it is currently practiced. The triggers of the shift can be ecological, economical, social or the sum of these. After the shift, a balance must be found from another level, meaning that for example the number of herders and reindeer must be adjusted to enable the survival of the livelihood. This does not mean that all herders of the SES could continue their livelihood but that the system can survive. It is important to note that these reasons do not have to affect reindeer herding itself but they still can affect the stability of the system. Scheffer et al. describe this – in the context of ecosystems – as follows: “Perhaps most importantly, all models of ecosystems with alternative stable states indicate that gradual change in environmental conditions, such as human-induced eutrophication and global warming, may have little apparent effect on the state of these systems but still alter the ‘stability

domain` or resilience of the current state and hence the likelihood that a shift to an alternative state will occur in response to natural or human-induced fluctuations.” (Scheffer et al. 2001, 595).

3.2 Path-dependence

Path-dependence means that historically established actions or structural factors extend their influence to present situations. Adrian Kay (2003, 406) defines path-dependence as follows: “A System is path dependent if initial moves in one direction elicit further moves in the same direction; in other words, there are self-reinforcing mechanisms or positive feedbacks.” It is also noticed that path-dependence affects the institutional, structural, social- and economical conditions of the system (e.g. Sotarauta and Viljamaa 2003, 66). Typically, from a path-dependence point of view, historical factors encumber today’s possibilities. Path-dependence theory was originally developed by economists who wanted to understand technology adaptation processes and industrial evolution but recently path-dependence is a widely used concept in several fields of the science. Our research shows that path-dependence is also a usable concept in environmental policy on different levels of society.

In this study path-dependence is a tool to analyze Finland’s environmental policies and politics³ historically. It facilitates a better understanding of the development of the local matters and ways of using natural resources and the overall environmental situation in Finnish Lapland today. It helps us to understand the dynamics between national and international environmental politics. It also offers good opportunities for research which focuses on the combined effects of the climate change and environmental politics.

3.2.1 Political path-dependence and shifts between sustainability phases in social ecological systems

Historical path-dependence exists also in environmental political decision making in Finland. Political path-dependence can cause shifts between sustainability phases in the SES under certain circumstances. This seems to have happened two times in the recent history of the Lappi RHC. We go into details of these shifts in the forthcoming sections. Next we introduce the theoretical connection between political path-dependence and shifts between sustainability phases in SESs.

Political path-dependence in environmental politics starts when the political atmosphere changes for some reason – typically because of global pressures or threats, like changed economical circumstances or environmental phenomena like climate change – and thus causes pressures towards decision makers. A new situation creates circumstances which we call *political cohesion*: a mobilizing force for the new politics inside a society.

Political cohesion requires changes in policies. It does not mean “unanimous decision” concerning the issue under discussion but instead a sort of political acceptance or agreement. James Moody and Douglas White (2003, 104) define a group’s structural cohesion as equal to “the minimum number of actors who, if removed from a group, would disconnect the group.” On the other hand, political sociologists (e.g. Putnam 2000) have focused on national level cohesion, asking for example “How do cohesive versus non-cohesive civil societies promote democracy?” Judith Maxwell (1996, 13) argues that social cohesion refers to a processes of “building shared values and communities of interpretation, reducing disparities and wealth, income and generally enabling people to have a sense that they are engaged in a common enterprise, facing shared challenges, and that they are members of the same community.”

³ The use of the terms politics and policy are commonly mixed or used as synonyms. In this paper we have made a clear distinction between environmental politics and environmental policies. By environmental policy we follow the Oxford dictionary’s (1995) definition: “a policy is course of action or principle adopted or proposed by a government, party, business or individual.” In practice this means in this study for example environmental policies which are carried out by different administrative actors like Ministry of Agriculture and Forestry or Forest and Park Service. By environmental politics we refer to wider phenomena that are linked with the power relations of the society. Environmental politics in this paper refer to the political apparatus that set environmental legislation and high-level environmental regulation. Briefly said, environmental politics sets the goals that environmental policies try to achieve.

We combine both structural and social points of view. Our argument is that in environmental politics cohesion becomes evident when “national reaction” to some international phenomena achieves national political acceptance, meaning that a critical number of supporters gather around a particular environmental agenda. It is also important to separate political cohesion from political consensus. In environmental politics consensus refers to environmental conflict resolution between different stakeholders (e.g. Scapple 1998) but cohesion here refers to the beginning of a path-dependent political process at the national level. (For more about theoretical basis of political cohesion see for example Mizruchi 1992).

The moment when political cohesion arises is crucial in environmental politics. Bringing a large scale phenomenon to the national level seems to cause different kinds of confusion in decision making, a period we refer to as *critical time*. The future path that has strong long term influences is then defined in a hurry. Facts and values are mixed on purpose in political discussions and arguments such as “Forest cutting must be carried out because forest cuttings must be carried out” or “Climate change must be paid attention because climate change must be paid attention” suddenly become relevant in a political discourse. Suddenly the point is reached where alternative options, or scenarios, concerning the future are ignored and a “path is decided”. Here we can see the political significance of scenarios (and indicators related to those scenarios) during the critical time.

After political cohesion, path-dependence starts to “live its own life”. It justifies itself and defines political discussion around the issue that it brought out. Typically path-dependence is not restricted by laws or regulations, as they can be changed by justifying them with reference to path-dependence itself. Next the political cohesion influences those executing policy – in our case primarily MoAF and the Forest and Park Service (FPS). These effects cause changes in the sustainability of local SESs.

3.2.2 Path-dependence and sustainability

As we have pointed out earlier, the SES can have various sustainability phases but only one at a time. Sustainability phase refers to a range in which a system can work in a sustainable way, meaning that the system is in relative balance ecologically, economically and socially. Balance here means a theoretical balance that does not pay attention to, for example, the scale of the system, meaning in this case the number of reindeer or herders. The shift between sustainability phases means a shift from one sustainability level to another. In theory this shift as well as path-dependence can be “positive” or “negative” for the SES. Following the literature (e.g. Anderies et al. 2004) we call systems that are able to reach new sustainability level as *robust systems*. We have simplified these issues in a Figure 2 that shows the behavior of a fictional SES in time.

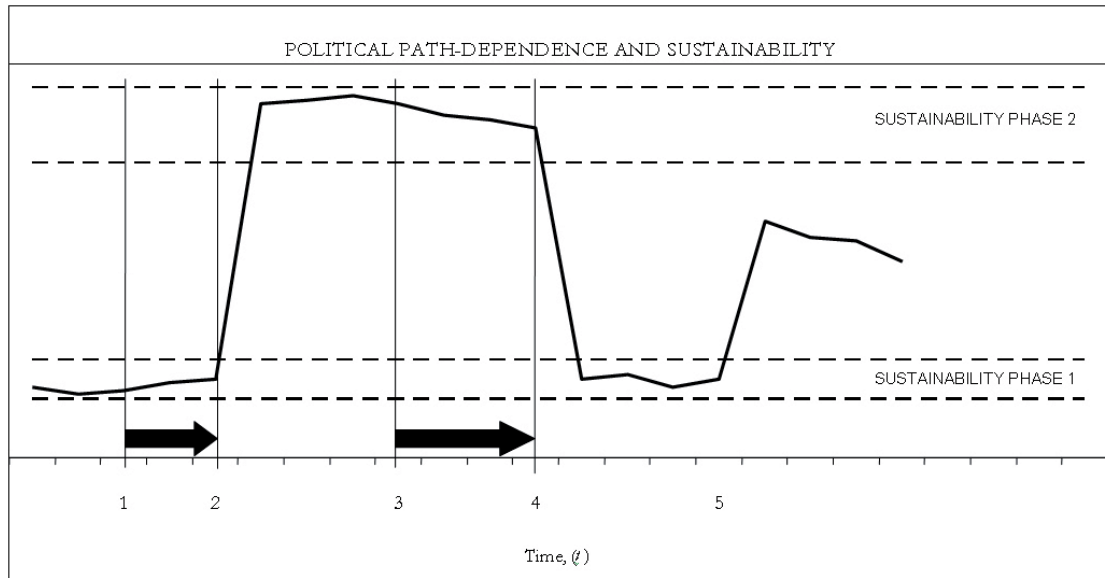


Figure 2. Path-dependence and sustainability (based on Hukkinen 2003).

In Figure 2 shifts happen between sustainability phases 1 and 2. Periods when path-dependencies exist in the politics of the SES are marked as black arrows in a Figure 2. As we can see, path-dependence precedes shifts between sustainability phases in that system. Path-dependent time before shifts (from t_1 to t_2 and from t_3 to t_4) is critical, because during that period it is – in theory – possible to prevent the shift from happening or at least intervene, if desirable. Obviously path-dependence does not always precede a shift and a shift does not automatically lead to the new sustainability level. Shifts can also lead the system out of balance. That is the case in t_5 in a Figure 2. Then the system is no longer robust.

3.3 Historical analogue approach

If we want to evaluate the possibilities to measure forthcoming shifts between sustainability phases in the local SES, we can exploit information gathered from historical changes. In this the *historical analogue approach* can be useful. Analogue approach helps the policy-maker practitioner (see the main report) to see the present policy situation as analogical to historical situations that preceded shifts between sustainability phases. Next we will explain how the historical analogue approach can help us to better understand particular present phenomenon and policies related to it.

The policy-maker practitioner must take three steps if she wants to anticipate a forthcoming shift between sustainability phases. The first thing to do is to contextualize phenomena that seem to be autonomous. It is reasonable to try to see a particular local phenomenon as part of some larger narrative. As an example we found some contexts for historical changes in our case study area: In the 1950's, after the Second World War, reconstruction was the main task in almost all European countries. Countries needed energy more than ever. Obviously reservoir construction in Finnish Lapland fitted that target well. In the 1960's industrialization increased heavily in the West. Finns based their economy on the paper industry. New and more efficient mills needed more and more wood and this explains also the increased forest cuttings in the Lappi RHC. Even though these are quite obvious issues, reasoning out the context for the historical situation helps us sketch analogies between the past and the present. The context of the present situation in Lapland is climate change and policies related to it.

After the political narrative, or path, is identified it is important to react quickly at the local level because the time after the identification is critical as we have pointed out earlier. When the policy-

maker practitioner understands a particular local phenomenon as a branch of a broader path, she can start to evaluate if it is possible to use historical analogue approach in adaptation to changed circumstances. In this, she must consider what kind of change could be defined as a shift between sustainability phases in her region or area. This may mean for example a change in conditions that forces significant rearrangements of local livelihood. Then the policy-maker practitioner can look for changes in the history of the area that caused similar shifts between sustainability phases. When similar historical situations are identified she can compare policy operations around those situations and the environmental impacts of them. Similarities can more obviously be found from the *ways in which politics are being practiced* and not from the substance of the discussions.

Third thing to do is to identify concrete common denominators in past and present policy operations that have caused a shift between sustainability phases locally. Observation of common denominators makes it possible to see present situation as a historical analogue of past situations and to anticipate possible shifts between sustainability phases. Identification of concrete similarities in policy processes (meaning for example new regulation and rules concerning natural resource management) is important because it gives a tool evaluate the relevance of those processes at the local level. Since common denominators are identified, they act as indicators of historical analogies. In *Analysis and discussion*-chapter we show how we have used common denominators in our case study as indicators for monitoring the impacts of climate policy operations.

4. About research and methods: Looking for shifts, impacts and paths

4.1 Social ecological system of the Lappi reindeer herding cooperative in the context of climate change

One of the most usable SES models in our view has been developed by Anderies, Janssen and Ostrom (2004). First, this model describes the relationships between different stakeholders well, and second, it has already been further developed for the context of reindeer management in Finland by Janne Hukkinen (2008) and thus discovered suitable for that context. The model is presented in the Figure 3

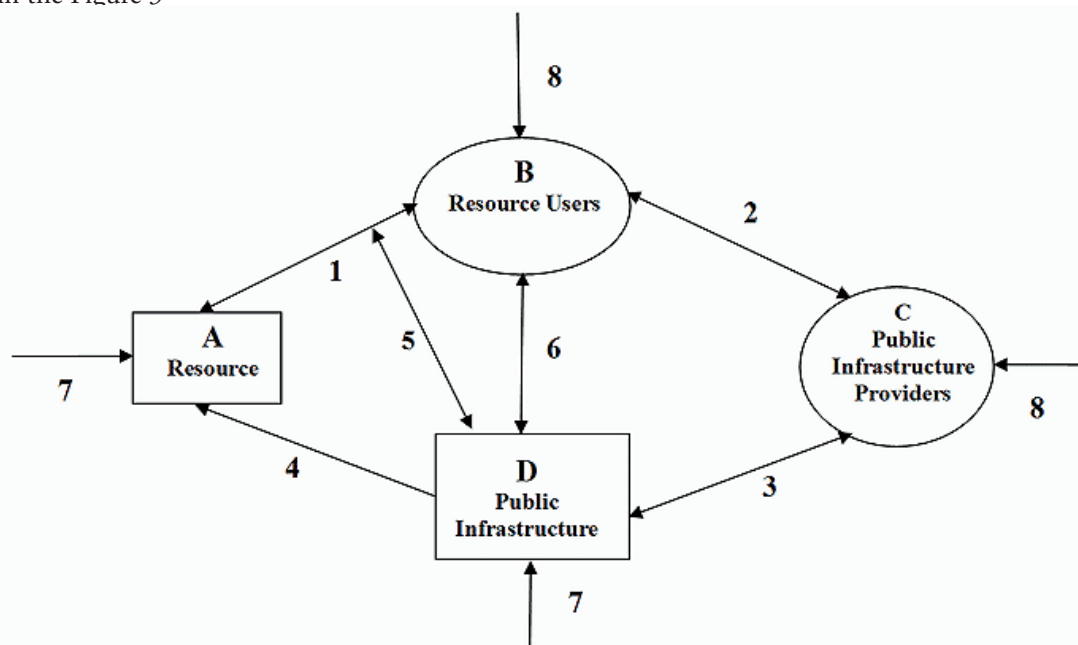


Figure 3. A Conceptual model of a social ecological system (Anderies et al. 2004).

As we can see from the Figure 3, this model pays attention to the configurations that affect the interactions among *resources* (A), *resource users* (B), *public infrastructure providers* (C), and *public infrastructures* (D). It also notifies the forces that are external to the SES. Hukkinen (2008) has divided these four “blocks” in the context of the reindeer management as follows: resources refer to reindeer and pastures, resource users to herders, infrastructure providers to officials such as MoAF and FPS, and public infrastructure to physical infrastructure such as fences and slaughterhouses and at the same time social infrastructure such as the social rules and the official regulations.

Although it is crucial to pay attention to the interactions between different stakeholders inside the SES, we will next focus on the external forces that are marked in Figure 3 as arrow 7 (external forces on resource and infrastructure) and 8 (external forces on social actors). According to Anderies et al. (2004), these external forces can refer to sudden and slow changes in the weather, economical

or political environments. Hukkinen (2008) argues that in reindeer management these forces can mean for example increased tourism or mechanization caused by the increasing climate variation or municipal zoning that erodes reindeer management. Also conflicts between herders and other land users, for example, can lead to the spreading of forestry. In this study external forces mean especially climate change and its direct and indirect impacts on the SES of the Lappi RHC.

The impact of climate change captures both social and ecological pressures on the SES (arrows 7 and 8). To get an extensive general view of the impacts of climate change on reindeer herding livelihood, it would be worthless to consider only impacts on pastures and reindeer. We must take into account the influences of climate change on those factors that directly or indirectly affect the livelihood. These include Finnish environmental politics in general and the officials that implement political decisions, such as MoAF and FPS, as well as the effects of politics and policies on herder's social organization in the Lappi RHC. The SES of reindeer management is not separate from the outside society and herders emphasize that while climatic conditions are meaningful for their livelihood, they are still only one factor.

Next we will discuss in detail the impacts of climate change on each part of the SES (A, B, C, and D in the Figure 3). After that we will introduce the shifts between sustainability phases in the history of the Lappi RHC and draw inferences from those to the present situation in Lapland.

4.1.1 Impacts of climate change on resources

Climate change influences directly and indirectly the reindeer and their pastures. According to Sara (1994) hard snow or ice on the ground or on the top of snow cover may prevent reindeer from reaching enough forage. Therefore the main issue for the herders during the winter is whether reindeer can dig through snow or not. If they are not able to reach enough forage, it can also reduce the amount of calves that are born in the spring (Jääskö 2003, chap. 4.2.). According to Kitti et al. these icing events usually occur in the autumn but they are also possible during warm periods in the winter. Snow conditions can also affect the summer pastures. In late spring, snowmelt determines when the growing seasons starts. If there is too much snow and if the melting season continues until the late spring the growing period of forage starts too late and there is not enough food for reindeer in the summer either. (Kitti 2006 et al., 151).

Temperature plays a crucial role in determining the movements of the reindeer. In the summer, if the weather is too hot, reindeer tend to stay on the windy slopes and on the tops of the mountains for the entire day and come down back to the valleys to feed only in the evening and at night. Also if the weather is really warm during spring, the snow in the mountains melts too fast causing floods and preventing the reindeer from moving from place to place. (Kitti et al. 2006, 151-152). In the winter temperature is also an important factor. According to Magga (2003, chap. 2.7.10) variations in climatic conditions affect directly reindeer pasture sites. Winter weather and snow conditions affect the amount and location of pastures.

The results of the earlier mentioned RENMAN research project confirm that recent winter seasons had less precipitation, shorter freezing periods, less snow cover and duration, longer periods of soil activity, and lower accumulation of litter and humus. (Müller-Wille et al. 2006, 368-369). These can be seen as the most dramatic impacts of climate change on the resources of the reindeer herding livelihood.

4.1.2 Impacts of climate change on resource users

The influences of climate change on the herders include financial losses and new kinds of difficulties in practicing reindeer herding as a livelihood. Changes in environment and especially the above-mentioned changes in pastures lead to the changes in reindeer herding practices. Thus changes are visible also in everyday life. For example, climatic changes can cause problems for using the snow

mobile in herding, especially in the early autumn and late spring if there is less snow in the forests. And if the terrain gets very wet after snowmelt it causes new problems for the herders who must also move on foot from place to place with the herd. These kinds of difficulties can make the helicopter the only way to gather reindeer from the fells and forests at least during the critical moments of herding when herds must be gathered quickly. This obviously leads to increased fuel costs for herders and causes many new arrangements. (See for example Jääskö 2003, chap. 3.4).

Extreme weather conditions can also lead to the need to feed reindeer in the forests. For example, in the Muotkatunturi reindeer herding cooperative (approximate 60 kilometers north from Lappi RHC) there was so much snow in the spring of 1997 that herders had to start emergency feeding (Jääskö 2003, chap. 2.4). Feeding arrangements cause remarkable financial losses for herders. Herders also emphasize that feeding does not belong to the traditional way of Sámi reindeer herding. The fact that many herders do not have financial possibilities to feed the reindeer or to use a helicopter in herding, creates new challenges to the livelihood and its' institutions.

4.1.3 Impacts of climate change on infrastructure providers

Impacts of climate change on infrastructure providers, the MoAF and FPS, are perhaps the most difficult ones to identify unambiguously. It is not easy to estimate the political influence of climate change when the entire global climate policy seeks its way forward. However, there are issues to be discussed that concern the infrastructure providers of the SES.

Climate change has changed the entire political atmosphere globally, which has caused changes in Finland too. Physical implications of climate change have been too widespread and fast to have been left without political recognition. Many influential parties from commerce and industry have enthusiastically taken part in it. For example Matti Vanhanen, the Prime Minister of Finland, has considered the calculations of the IPCC report so meaningful that he has concluded that “everyone should take them seriously”, and “underestimation of the climate change should be stopped immediately.”⁴ Jorma Ollila, the chairman of the boards of the corporations Nokia and Shell, has mentioned that “climate change is such a complicated problem that we must try to influence people’s attitudes in different ways. I would encourage rather radical means, too.”⁵ Everyone seems to want to *change* something because of climate change. These kinds of statements clearly show that environmental politics are in the mood for change because of climate change. Future changes will obviously influence the policies of MoAF and FPS.

4.1.4 Impacts of climate change on public infrastructure

Climate change will cause impacts on the physical infrastructure of reindeer herding and the social rules and regulations too. Climate change can also affect informal rules and ways of thinking about reindeer herding. Changes like these are difficult to measure but they are still very remarkable. How a reindeer herder views his or her livelihood will inevitably influence The entire SES of reindeer management.

There are also signs of change in physical infrastructures. Jääskö (2003, chap. 2.5) has reported that in the Muotkatunturi RHC herders have started to turn to the farming of calves instead of free-pasturing because of the changed climatic conditions, among other things. They see that this is the only way to protect calves from unexpected weather conditions, diminished access to nutrition and increased number of predators. Physical control of reindeer then increases costs and makes the livelihood more inconvenient.

4 Hautamäki, J. and Mielonen, M.: Vanhanen: Ilmastonmuutoksen vähättely on lopetettava heti. (Transl. J. L.) Helsingin sanomat 2.2.2007. Helsinki, Finland.

5 Nousiainen, A.: Ollila vaatii tiukkoja päästörajoja. (Transl. J. L.) Helsingin sanomat 27.1.2007. Helsinki, Finland.

4.2 Shifts between sustainability phases in the social ecological system of the Lappi reindeer herding cooperative

Two remarkable environmental shifts between sustainability phases emerge from the recent history (approximately 100 years) of the Lappi RHC. These are the beginning of the reservoir constructions in the 1950's and the turning to intensive forestry in the 1960's. Even though these two developments are strongly intertwined with each other they must be considered separately. Next, we will argue why these events can be treated as historical shifts between sustainability phases and after that we take a look at today's situation and argue that climate change can be seen as a possible future shift between sustainability phases in the SES of the Lappi RHC.

4.2.1 Reservoir construction as a shift between sustainability phases

The beginning of reservoir construction in 1954 can be seen as the first step to large-scale environmental changes in the Lappi RHC area. The reservoir construction began with wide-range forest cuttings. Magga (2005, 2) has argued that the cuttings were executed in a much larger area than the actual size of the reservoirs would have required. The reservoir constructions destroyed especially winter pastures, because reindeer are in the forests in the winter. Because of this, herders needed to find other areas for the winter pastures. Construction of the two reservoirs continued until their filling started in 1967 in Lokka and in 1970 in Porttipahta.

Until the 1960's the regulated upper limit for the number of reindeer in the Lappi RHC area was 10 000. Because of pasture losses, caused by the reservoir construction, that number had to be decreased by 1000 in the 1970's and again by 1500 in the 1980's. This means that the calculated amount of the reindeer decreased by 2500, which is 25 percent of the total amount of reindeer in the Lappi RHC. In reality, the loss was even higher because of insufficient calculation methods in the past. (Magga 2005, 2). Calculations made by the RHC show that the reservoir constructions caused equity costs of approximately five million Finnish marks (about 840 000 euro) plus annual losses of approximately one million Finnish marks (about 168 000 euro) for the herders of the cooperative. After long legal proceedings, herders got some compensation from the state but the herders' calculations indicate that it covered only about one tenth of the total economic losses. (Magga 2003, chap. 3.2).

The reindeer were also affected by the reservoir construction. Dewatering caused panic reactions among reindeer and many of them escaped to the neighbouring reindeer herding cooperatives. For example in 1968, while Lokka was filled, 6000 reindeer escaped from the the Lappi RHC to the north. Many reindeer also drowned in the new reservoirs. The construction also caused dispersion of reindeer herds. Statistics of the number of the reindeer show that thousands of reindeer disappeared during the forest cuttings in the 1960's, for example 3 400 reindeer during 1961-62 and 2 500 reindeer during 1965-66. (Magga 2003, chap. 3.2; 2005, 2-3).

Reservoir construction also destroyed many local settlements. Many villages (for example Kurujärvi, Korvanen, Mutenia, Riesto and Laiti) were left under the reservoirs and people, about 560 persons in total (Lenstra 1974, 71), had to move away. It has also been argued that it was the construction of reservoirs that first started to crumble traditional reindeer herding which has since ceased to exist. The reservoir construction also made fishing impossible in many rivers. Many local livelihoods became useless and people were forced to turn to the monetary economy. (Magga 2003, chap. 3.2; 2005, 3).

To sum up, the reservoir construction in the Lappi RHC can be considered as a shift between sustainability phases, because it started to destroy the traditional herd-based way of reindeer herding,

caused violent changes to the annual herding cycle and pasture location, and remarkable economic losses to herders. These effects obviously led to rearrangements of the livelihood. We have illustrated the most important changes in sustainability phases before and after reservoir construction in a Table 1.

	Sustainability phase before reservoir construction	Sustainability phase after reservoir construction
<i>Social dimension</i>	Village based living	Many villages destroyed
<i>Ecological dimension</i>	Enough pastures for free-pasturing	Free-pasturing threatened
<i>Economic dimension</i>	Natural economy	Monetary economy

Table 1. Sustainability phases before and after reservoir construction in the Lappi RHC.

4.2.2 Intensive forestry as a shift between sustainability phases

As mentioned earlier, the beginning of the reservoir construction and turning to intensive forestry are strongly connected with each other. According to Pekka Aikio (1977, 72-77), cuttings that affected harmfully reindeer pastures begun in the Lappi RHC area approximately in 1957. Those cuttings preceded the reservoir constructions and included aspects of intensive forestry, meaning for example the use of machinery, ploughing and defoliant. Intensive forestry has continued and expanded until this day. (Massa 1983, 99).

Forest cuttings create barren gaps in the forests that are prone to wind and snowstorms which in turn cause hardened snow covers in the winter and make it difficult for reindeer to dig food from the ground. Because of this, reindeer are more dependent on tree lichen (luppo in Finnish) which means vegetation that grows in trees. Tree lichen grows slowly and it appears only in old forests, hence cuttings affect also the amount of tree lichen. A remarkable amount of reindeer food (lichen and tree lichen) is also buried under the remains of the cuttings and is thus not accessible for the reindeer. Also, because of the intensive forestry, many forest truck roads have been built on pastures which have subsequently made grazing more difficult. (Magga 2003 and 2005).

Intensive forestry caused fragmentation of the forests in the Lappi RHC area, which has complicated reindeer herding. The reindeer must move between different pastures more than before to find food and shelter. At the same time the total amount of the pastures has decreased because of the cuttings. According to Magga (2005, 3-4) cuttings by the FPS have affected reindeer pastures so badly that reindeer herding is no longer possible in some parts of the RHC and because of that the number of the herders has decreased dramatically. Because of the decrease in the total amount of pastures, the remaining pastures are exposed to more erosive usage. These issues highlight the significant impact of intensive forestry, constituting a shift between sustainability phases in the SES of Lappi RHC. Again we have illustrated the most important changes in sustainability phases before and after intensive forestry in a Table 2.

	Sustainability phase before intensive forestry	Sustainability phase after intensive forestry
<i>Social dimension</i>	Number of herders approximately 60	Number of herders approximately 15
<i>Ecological dimension</i>	Forests protect winter pastures	Pastures and forests prone to snowstorms => hardened snow covers
<i>Economical dimension</i>	Herding is possible everywhere in the Lappi RHC	Herding is no longer possible in some parts of the Lappi RHC.

Table 2. Sustainability phases before and after intensive forestry in the Lappi RHC.

5. Analysis and discussion: Similarities and differences

In the previous section we have argued that climate change and related policies have already affected resources, resource users, public infrastructures and public infrastructure providers in the SES of Lappi RHC. We have also described two historical shifts between sustainability phases in that system. The historical shifts and the present situation have much in common. They all share a politically path-dependent context with several similar social, ecological and economic impacts.

Even though the impacts of climate change are remarkable, they have not yet led to large scale rearrangements of the reindeer herding livelihood, which was considered as a condition for the use of the term shift between sustainability phases in this study. So far climate change has not been a shift between sustainability phases in the SES of the Lappi RHC. We argue, however, that it *could* escalate to a shift, if the present trends in climate change and the related policies continue. We now turn to why this is so.

We start by analyzing shifts between sustainability phases in the SES of the Lappi RHC. We show that some common denominators can be found from historical shifts and the present situation. At the same time there are lots of differences too. After analyzing shifts between sustainability phases we discuss the possibility to measure forthcoming shifts between sustainability phases and explain the role of historical analogue approach in such measurement.

5.1 What is common in the shifts between sustainability phases?

A good starting point for the historical analysis is to notice that both shifts introduced above between sustainability phases in the Lappi RHC have influenced not only the livelihood but strongly the environment too. The two cannot be separated in the analysis. Another common denominator is strong political support or attention at the beginning of the change. For example, president Urho Kekkonen argued in the early 1950's that hydropower construction is "a prerequisite for national wealth" (Massa 1983, 109). Very strong political statements such as these are included in both shifts and nowadays we can see similar statements in political discussion on climate. A good example of the consequences of the political path-dependence is the so-called Kemijoki emergency law. It

was enacted soon after political cohesion on increasing hydropower and it gave authority for the Kemijoki Inc. to start construction in 1960. Less than ten years later it was repealed.

Both shifts between sustainability phases have also harmed considerably the reindeer herding livelihood. In the Lappi RHC the number of herders has decreased heavily during 1970 - 2003 (Magga 2003, 1) mainly because of the deteriorated circumstances related to land use. Both shifts have affected directly the grazing cycle system by changing the amounts and availability of pastures. Both shifts have also required rearrangements in the livelihood and thus living in the middle of continuous change has made reindeer herding less profitable or unprofitable (Magga 2003, chap. 5). Next we will point out some other similarities between these shifts.

5.1.1 Center versus periphery confrontation

Classical social science theories of center-periphery articulated in terms of dominance, dependence and imperialism⁶ illustrate development dynamics at the global level. Still the same principles can be adopted to understand the political dynamics of environmental issues on the national level.

Both historical shifts between sustainability phases and today's climate and energy policy include evidence of this kind of thinking behind the political decisions. Both reservoir construction and intensive forestry were supported by the idea of Lapland as a natural resource for central Finland. For example Massa (1983, 114) has argued that about half of the energy of the hydropower plants in Kemijoki is delivered via a main grid to the southern and south-western parts of the country. He has also pointed out (1983, 121) that the law-making concerning water-system construction in Lapland has reflected the opinions and needs of the centers and that the laws promote the interests of the hydropower companies. Also in today's discussions over Lapland's role in climate change policy the region is framed as an affordable resource of renewable energy such as increased hydro power or bio-energy, for example Mauri Pekkarinen, Minister of Trade and Industry, has strongly committed himself to increased hydro power construction in Lapland⁷

5.1.2 Underestimation of the effects of phenomenon

Before both historical shifts between sustainability phases in the Lappi RHC, political discussion has been dismissive about the upcoming change. It is remarkable that the phenomenon has been underestimated in all levels of public administration. Magga (2003, chap. 4) has clearly pointed out that decisions that have affected the reindeer herding livelihood have been underestimated, not only in national decision making, but also at the municipal level. We have also witnessed lots of underestimations of the effects of climate change in political discussions and in different media in Finland (e.g. Toiviainen 2007) and at international policy levels (e.g. Oppenheimer et al. 2007).

It is easy to find examples of different underestimations from the history of Lapland. E.g. Magga (2003, chaps. 3.2 and 3.3) describes thoroughly how the underestimation of the phenomenon has preceded both reservoir construction and intensive forestry. The underestimations have occurred in the notifications and documents made by FPS and by hydro power corporations. The underestimations have included different kinds of understatements of the impacts of the FPSs project plans and underestimations of the corporations' project plans. One practical issue in the underestimation is the previously mentioned undersized economic compensations for herders that have lost their pastures and villages.

⁶ For example Frank, A., G. (1969) *Capitalism and Underdevelopment in Latin America*. Historical Studies of Chile and Brazil, Penguin Books Ltd, New York; and Galtung, J. (1971) *A Structural Theory of Imperialism*. *Journal of Peace Research*. Vol. 8, (2)1971, pp. 81-117.

⁷ Pohjanpalo, O.: Pekkarinen kannattaa yhä Vuotoksen rakentamista. *Helsingin sanomat*, 3.10.2008. Helsinki, Finland.

Underestimation of environmental impacts has continued until recent history. For example, in 1995 the FPS announced that “present-day forest cuttings do not threat conditions of reindeer herding in any way and because of that there is no reason to limit cuttings in the Lappi RHC area.” (Magga 2003, chap. 3.3, transl. J. L.). Yet the impacts of intensive forestry are indisputable as we have pointed out earlier. Another crucial aspect to consider are the combined effects of different kinds of apparently small effects. It is easy to argue in political discussions that some new innovation has relatively small environmental impacts, but for example in reindeer herding, several small innovations together can force significant rearrangements in the livelihood.

5.1.3 Erroneous assumptions

One common denominator of the shifts between sustainability phases are the erroneous – typically strongly positive – assumptions of the upcoming change. Of course, it is easier politically to push through reforms that are expected to have positive implications than reforms that have questionable or negative implications. Signs of this kind of political argumentation are easy to find from the recent environmental history of Lapland.

For example it was forecast before the increased use of machines in forestry that mechanization does not decrease employment in the forestry sector (Massa 1983, 98). This assumption has been proven false. Also it was assumed in the 1950's that reservoir construction would prevent the depopulation of sparsely inhabited regions (Massa 1983, 124). What happened in reality was the opposite as people resettled predominantly only to the Vuotso village.

Erroneous assumptions can be ecological too. *Helsingin sanomat*⁸ wrote on 8.10.2007 about unexpected changes in the renewal process of the forests in the Lappi RHC area. Forest did not start to grow again in the area where large-scale cuttings were carried out in the 1970's. The reason for this is a sum of many things. Wide areas were prone to storms which destroyed seed trees. There were also mould problems, and solar radiation caused unexpected effects. The longer it takes for forests to start growing again, the more unlikely regrowth is. This is an illustrative example of the unexpected impacts of forest cutting.

5.2 Historical analogue indicators

We have argued that in some cases path-dependent politics precede shifts between sustainability phases. We have also pointed out that strong political support pushed forward both historical shifts, reservoir construction and intensive forestry. Today we can see lots of political action around climate change. We have also shown that political discussion concerning climate change is comparable to discussions that preceded earlier shifts. Furthermore, the environmental implications of historical shifts are comparable to the possible implications of climate change. We conclude this paper by introducing practical applications of our research by discussing the usefulness of our results in local environmental administration.

The historical shifts we have described have included surprising events, such as unexpected ecological effects, and complexity, such as the combined large effects of apparently small individual effects. These are also typical characteristics of climate change. How could a policy-maker practitioner at the local level cope with the reality of changing circumstances that are full of complexity and surprise both in terms of policy and in physical conditions? We propose historical analogue indicators.

A historical analogue indicator is a signal of historical analogies as identified through common denominators between present and historical situations. With historical analogue indicators the policy-maker practitioner can distinguish the critical aspects of environmental policy. The policy-maker practitioner should try to observe what issues in the regulation coming from higher

8 Mainio, T.: Metsä ei kasvanut vaaroille avohakkuun jälkeen. *Helsingin sanomat* 8.10.2007. Helsinki, Finland.

levels of administration or in the feedback she receives from the field have – according to her “historically enlightened” understanding – some reference to center versus periphery confrontation, underestimation or erroneous assumptions. In other words, the policy-maker practitioner evaluates if the new climate policy related regulations are based on relevant information from the local point of view.

If the policy-maker practitioner observes signs of center versus periphery confrontation, underestimation or erroneous assumptions in regulation that guides her work, she can send a reasoned message back to the higher level of administration, indicating that their policy is not based on relevant information from the local point of view. The same evaluation method works as a self-critique as well: if the policy-maker practitioner receives feedback from the field saying that the practiced policy contains signs of center versus periphery confrontation, underestimation or erroneous assumptions, then the policy must be changed. In these kinds of situations the policy-maker’s professional position expands in both directions in administration with the help of historical analogue indicators.

Our research shows that center versus periphery confrontation, underestimation of the effects of a phenomenon and erroneous assumptions are well-reasoned indicators of effectiveness of climate policy in Nordic peripheries. We believe that the indicators are usable in many different environments but we also encourage experts to create their own, place specific historical analogue indicators with the approach we have introduced in this paper. We emphasize that historical analogue indicators are knowledge-based tools for the policy anticipation phase. They are not meant to be used as an “everyday indicator” in environmental administration but rather as tools to be introduced when planning long term strategies for local adaptation to climate change.

References

Literature

- Aikio, P. (1977) Saamelaisen ekosysteemin murtuminen Lapin paliskunnassa. Suomen luonto. Vol. 36, pp. 72-77.
- Anderies, J. M., M. A. Janssen, and E. Ostrom (2004) A framework to analyze the robustness of social ecological systems from an institutional perspective. *Ecology and Society*. Vol. 9(1): 18.
- Barabási, A.-L. (2002) *Linked: How Everything Is Connected to Everything Else and What It Means for Business, Science, and Everyday Life*. Mass.: Perseus, Cambridge, UK.
- Berkes, F., J. Colding, and C. Folke (Eds.) 2003 *Navigating Social ecological Systems: Building Resilience for Complexity and Change*. Cambridge University Press, Cambridge, UK.
- Dyke, C. (2006) *Primer: On Thinking Dynamically about the Human Ecological Condition*. In Haila, Y., and C. Dyke (Eds.) 2006 *How Nature Speaks? The Dynamics of the Human Ecological Condition* [Appendix]. Duke University Press, Durham and London.
- Haila, Y., and C. Dyke (Eds.) 2006 *How Nature Speaks? The Dynamics of the Human Ecological Condition*. Duke University Press, Durham and London.
- Haila, Y., and C. Dyke (2006) Introduction: What to Say about Nature’s “Speech”. In Haila, Y., and C. Dyke (Eds.) 2006 *How Nature Speaks? The Dynamics of the Human Ecological Condition*. Duke University Press, Durham and London.
- Hukkinen, J. (2003) Sustainability indicators for anticipating the fickleness of human-environmental interaction. *Clean Technologies and Environmental Policy*. Vol. 5(2003), pp. 200-208.
- Hukkinen, J. (2008) *Sustainability networks: Cognitive Tools for Experts Collaboration in Social-Ecological Systems*. Routledge, London, UK.
- Jääskö, O. (2003) *Ympäristöpaineiden vaikutukset Paadarin – Muotkatunturin paliskunnan*

- poronhoitoon. In Heikkinen, H., H. Magga, S. Nevalainen, and O. Jääskö (Eds.) 2003 *Kuuluuko sääsken ääni taivaaseen? Poromiesten analyysi poronhoidon murroksista Suomen Lapissa 1900-luvulla* (Is the Mosquito Heard in Heaven? Reindeer Herders' Analysis of Disruptions in Reindeer Management in Lapland, Finland in the 1900's) in Finnish. Technology, Society, Environment. Vol. 3/2003. Espoo: Helsinki University of Technology Laboratory of Environmental Protection.
- Kay, A. (2003) Path-dependence and the CAP. *Journal of European Public Policy*. Vol. 10(3), pp. 405-420.
- Kitti, H., N. Gunsley, and B. C. Forbes (2006) Defining the Quality of Reindeer Pastures: The Perspectives of Sámi Reindeer Herders. In Forbes, B. C., M. Bølter, L. Müller-Wille, J. Hukkinen, F. Müller, N. Gunsley and Y. Konstantinov (Eds.) 2006 *Reindeer Management in Northern Europe: Linking Practical and Scientific Knowledge in Social-ecological Systems*. Ecological Studies 184. Springer-Verlag, Berlin, Heidelberg.
- Lenstra, M. (1973) Een onderzoek naar de levensomstandigheden van de rendierhoudere in Sodankylän Lapin Paliskunta en naar de mogelijke gevolgen voor hen door de sanleg van de waterreservoirs Lokka en Porttipahta. Licenciante thesis. Instituut voor Cultere en Sosciale Antropologie. Nijmegen, Neatherlands.
- Levänen, J. (2008) Climate change scenarios and indicators in Lapland, Finland: Understanding a global phenomenon in a local context. Master's thesis. Helsinki University of Technology, Espoo, Finland.
- Magga, H. (2003) Poronhoidon menetykset ja sopeuttaminen suuriin ympäristömuutoksiin Lapin paliskunnassa 1950-luvulta lähtien. In Heikkinen, H., H. Magga, S. Nevalainen, and O. Jääskö (Eds.) 2003: *Kuuluuko sääsken ääni taivaaseen? Poromiesten analyysi poronhoidon murroksista Suomen Lapissa 1900-luvulla* (Is the Mosquito Heard in Heaven? Reindeer Herders' Analysis of Disruptions in Reindeer Management in Lapland, Finland in the 1900's) in Finnish. Technology, Society, Environment. Vol. 3/2003. Espoo: Helsinki University of Technology Laboratory of Environmental Protection.
- Magga, H. (2005) Vapaasti laiduntava poronhoito ja muu maankäyttö. Seminar paper. Seminar in Kansallismuseo, Helsinki, Finland 26.1.2005.
(Online:<<http://weblog.greenpeace.org/metsa/archives/Kansallismuseoseminaari260105HM.pdf>> accessed 14 February 2009).
- Massa, I. (1983) Ihminen ja Lapin luonto. *Transactions of the Finnish Anthropological Society*. No. 12.
- Maxwell, J. (1996) Social dimensions of economic growth. Eric John Hanson Memorial Lecture Series. Vol. 8. University of Alberta.
- Mizruchi, M., S. (1992) *The Structure of Corporate Political Action*. Harvard University Press, Cambridge, Mass.
- Moody, J. and D. R. White (2003) Structural Cohesion and Embeddedness: A Hierarchical Concept of Social Groups. *American Sociological Review*. Vol. 68(1), pp. 103-127.
- Müller-Wille, L., J. Hukkinen, F. Müller, M. Bølter and B. C. Forbes 2006 Synthesis: Environmental and Sociopolitical Conditions for Modern Reindeer Management in Europe's North. In Forbes, B. C., M. Bølter, L. Müller-Wille, J. Hukkinen, F. Müller, N. Gunsley, Y. Konstantinov (Eds.) 2006 *Reindeer Management in Northernmost Europe: Linking Practical and Scientific Knowledge in Social-ecological Systems*. Ecological Studies 184. Springer-Verlag, Berlin, Heidelberg.
- Oppenheimer, M., B. C. O'Neill, M. Webster, and S. Agrawala (2007) Climate Change: The Limits of Consensus. *Science*. Vol. 317, No. 5844, pp. 1505-1506.
- Putnam, R., D. (2000) *Bowling Alone: The Collapse and Revival of American Community*. Simon and Schuster, New York, USA.
- Sara, M. N. (1994) The Pastures (in Sámi). In Eira N. I. (Ed.) *Being with reindeer*. DAT, Kautokeino, Norway.
- Scapple, K. (1998) Is Consensus Necessary for Effective Environmental Treaties? *The Journal of Environment and Development*. Vol. 7, No. 4, pp. 364-386.
- Scheffer, M., S. Carpenter, J. A. Foley, C. Folke, and B. Walker (2001) Catastrophic shifts in

ecosystems. Nature. Vol. 413, 11.
Sotarauta, M. and K. Viljamaa (Eds.) 2003 Tulkintoja kaupunkiseutujen kehityksestä ja kehittämisestä. Tekniikan akateemisten liitto TEK ry, Tampere, Finland.
Toiviainen, P. (2007) Ilmastonmuutos. Nyt. Kustannusosakeyhtiö Otava, Keuruu, Finland.

Internet sources

Poronet – Porotalouden tietoverkko <<http://www.paliskunnat.fi>>, accessed 20 October 2008.
Saami Parliament <<http://www.samediggi.fi>>, accessed 10 March 2009.

Decision processes, communication and democracy: The aluminium smelter project in Greenland

Klaus Georg Hansen,
Freia Lund Sørensen and
Steen R. Jeppson

Preface

This report is forms part of the research project Knowledge-based tools for the sustainable governance of energy and climate adaptation in the Nordic periphery (K-Based).

From its initiation, the Greenlandic contribution to the Nordic project has been implemented as a team-based project including Klaus Georg Hansen, Freia Lund Sørensen and Steen R. Jeppson, in which each of the team members have had specific tasks to complete. Klaus has managed the project and has had overall responsibility for the Greenlandic segment of the Nordic project. Amongst other things, this has included responsibility for organising the project, securing project progress and maintaining contact with the other Nordic partners in the overall project. In addition, Klaus held a seminar in Sisimiut during the spring of 2008 in which all the Nordic project partners participated. Freia's role in the project team has been to provide assistance with regard to the project's design and organisation, preparing data concerning the aluminium project process and contributing practical and methodological instructions for Steen. Steen's task has been, in cooperation with Klaus and Freia, to identify basic project material; primarily newspaper articles. Steen was also responsible for evaluating the contents of all the articles included in the project.

The second and third phases of the project have taken longer than it was expected. A significant factor in this regard is the fact that the organisational structure within which the project was carried out, i.e. the Greenland Home Rule Government's central administration, is not geared to taking on projects of this nature. It was only because there was access to the granted project funds that it was possible to dedicate a significant proportion of Steen's working hours to the project. The project funds granted have been insufficient to ensure that Klaus or Freia could dedicate themselves to the project and this has had a significant impact on project progress – or lack of progress – particularly in the project's final phase.

The Greenland Team wish to thank Rasmus Ole Rasmussen for the outstanding cooperation we have had during the K-based project. In continuation of this cooperation an extended edition of the report will be published in a joint publication: "Rasmus Ole Rasmussen og Klaus Georg Hansen (red): Demokratisering af planlægningsprocesser som en udfordring i Vestnorden. Case vedvarende energi og storskala industriprojekter. NORS Forsknings-rapporter, Roskilde Universitet". The publication will be available during the fall of 2009.

1. Introduction

Compared to the other Nordic countries, Greenland's democracy is a young one. This results in a number of specific challenges in the relation between the administrative and political decision making processes on the one hand, and public debate on the other. This is not a specifically Greenlandic issue. The potential for opposition between public decision making processes and public debate exists in all counties. What is a particularly Greenlandic issue, however, is the fact that strong traditions relating to information exchange in this area have yet to be established.

In the Greenlandic parliamentary elections held on 2 June 2009, this opposition was a central element in the election campaign. Public dissatisfaction with the lack of clarity in administrative and political decision making processes would seem to have been a significant factor influencing the result of an election in which, for the first time in the Greenland Home Rule Government's 30 year history, Greenland's social democratic party, Siumut, was not the largest party and could therefore not appoint the Greenlandic Prime Minister. For the first time in Greenland's history, the upcoming parliamentary term will see Siumut sitting on the opposition benches.

The party which won the election was elected on a promise to reassess many of the current administrative and political decision making processes. In other words, it would appear that there exists a widely held desire to overhaul some of the more ingrained decision making processes which have been built up during the 30 year history of the Greenlandic Home Rule Government. The timing of this change has an almost symbolic feel to it, as from the 21 June 2009 the framework under which the Greenlandic Home Rule Government operates will be replaced by a revised agreement with Denmark.

1.1 The Project

In this context the most pressing need that this project addresses is to reflect in a more systematic fashion on some of the administrative and political decision making processes which have been practised up till now. In this relation, this Nordic project relating to knowledge-based decision making tools is both highly topical and a relevant scientific analysis framework in connection with the planned revision of the administrative and political decision making processes.

The Greenlandic contribution to this Nordic project consists of a survey of public communication in connection with the establishment of an aluminium furnace in Greenland. This survey takes the form of an analysis of the communicative initiatives and discussions which have arisen in the public sphere since the project began in 2006, including decisions made by public bodies and the rationale on which these decisions were based in relation to the proposed construction of an aluminium furnace in Greenland.

The aim of this analysis is partly to identify the relation, in terms of the times at which they occur, between decision taking and public debate, and partly to identify the stated opinions of the various parties as expressed in the public sphere.

The theoretical basis for this analysis includes theories relating to communication, citizenship and discourses. The project's framework was not sufficient, however, for us to present the theoretical background on which our analysis is based.

Because of the project's relatively modest scope, the primary focus of our methodology has been an analysis of the two national Greenlandic newspapers. Relevant articles have been identified and analysed on the basis of a template (see Appendix 1).

Considered in relation to our method, the results we have achieved indicate that limiting the scope of our analysis to newspapers *is* a limitation, as public communication has also taken place via other media – primarily radio and television. Notwithstanding this it remains the case that 226 datasets were identified and analysed. This relatively high figure is in itself an indication that genuine public debate has occurred. It is possible, using the analysis framework which we have employed, to generate interesting cross tabulations. Our method has also, however, proved limited in some respects, for example in relation to the generation of a thorough stakeholder analysis.

Our analysis indicates that during the period in question (almost three years) levels of public debate relating to the aluminium furnace have gradually risen. A large number of stakeholders have been represented in this debate. In general, however, it would seem that public discussion has been displaced, as it were, as has occurred after administrative and internal political decision making processes have taken place. Considered in relation to the process' democratic character this is, of course, unfortunate.

Analysis also shows that a wide range of opinions have been expressed. There are thus marked differences between the opinions expressed by the various stakeholder groupings. In general terms it is clear that there are groups whose expressed attitude is mostly positive, and groups whose expressed attitude is mostly negative.

The project's aim has been, given the analysis performed and results thereby generated, and based on the concept of knowledge-based decision making tools, to present a model for a potential re-structuring of the information flow in relation to significant political decision making processes; thereby furthering the democratic process.

This aim has been partially achieved. It is unfortunately the case, however, that it has not been possible to carry out a discourse analysis as we had originally intended. This is primarily due to the fact that the data collection process proved more time consuming than anticipated; meaning that the available resources have not been sufficient to cover the planned discourse analysis.

The model employed for a knowledge-based decision tool has focused primarily, therefore, on issues relating to the timing of the three central discussion, analysis and decision making processes – i.e.: public debate, administrative assessment and political decision making.

1.2 Objective

There exist many individual decision making processes suitable for analysis but carrying out such a broad analysis would be far too extensive a project. Our initial objective, therefore, was to limit the scope of the decision making process under consideration in a suitable way. Limiting the project's scope to the decision making process surrounding the proposed aluminium furnace, was an obvious choice. This process has been ongoing since the start of 2006, and is likely to continue for many years to come. If it is implemented, the project will be by far the largest in Greenland's history, and because of its enormous scale it has been the focus of intense public interest.

Our survey is focused on knowledge-based decision making tools in the energy and climatic adaptation areas. We understand the term "knowledge-based decision making tools" as encompassing both the collection of factual and scientific knowledge in support of a decision and the holding of genuine, public and democratic debate relating to the decisions under consideration.

We find that a crucial factor for knowledge-based decision making tools is a description of a number of guidelines and principles relating to the structuring of a process which facilitates constructive public discussion during the decision making phase between the major stakeholders.

Our method takes its point of departure in a mapping of the various communicating parties and their expressed opinions. Our analysis will concentrate on assessing to what extent stakeholders, including the public, interact in both time and space.

The aluminium furnace project is thus a highly suitable subject for our analysis as it is both possible to assess the project's formal development over time and to find suitable discursive material relating to the project in the public sphere.

This objective of our analysis can thus be formally stated in the following terms:

Through a mapping of the aluminium project's formal development and a survey of the accompanying public debate relating to the project, we will carry out an analysis, firstly of the of the actual relation in time between decision and public debate, and thereafter of the various stakeholders' expressed opinions as evident in the public sphere. Finally, and on the basis of the concept of knowledge-based decision making tools, we will present a model for the potential structuring of such processes.

Both our analysis and the model are focused on one part of our understanding of the concept of knowledge-based decision making tools; i.e. a genuine, public and democratic debate relating to the measures under consideration.

This report assumes that genuine public debate relating to undertakings of so extensive societal importance as the aluminium furnace project should take place in advance of any political decisions.

1.3 Theoretical Framework and Model

Fundamentally, our project is about describing paths of communication, citizen participation and power relations. In each of these areas we have undertaken some basic theoretical considerations. In relation to communication paths we have assessed communication theories; in respect of citizen participation we have turned to theories of citizenship; and discourse analysis has formed the theoretical background to our consideration of power relations.

Our communication theoretical basis is "The Lasswell Formula" as formulated by sociologist Harold Dwinght Lasswell in 1948:

"A convenient way to describe an act of communication is to answer the following questions: Who says what in which channel to whom with what effect?" (Lasswell 1948).

<i>Part of the Formula</i>	Who?	Says what?	In which channel?	To whom?	With what effect?
<i>Element in focus</i>	Sender	Message	Medium	Receiver	Effect
<i>Types of analysis to use</i>	Institution and control analysis	Text and contents analysis	Media analysis	Reception analysis	Effect analysis

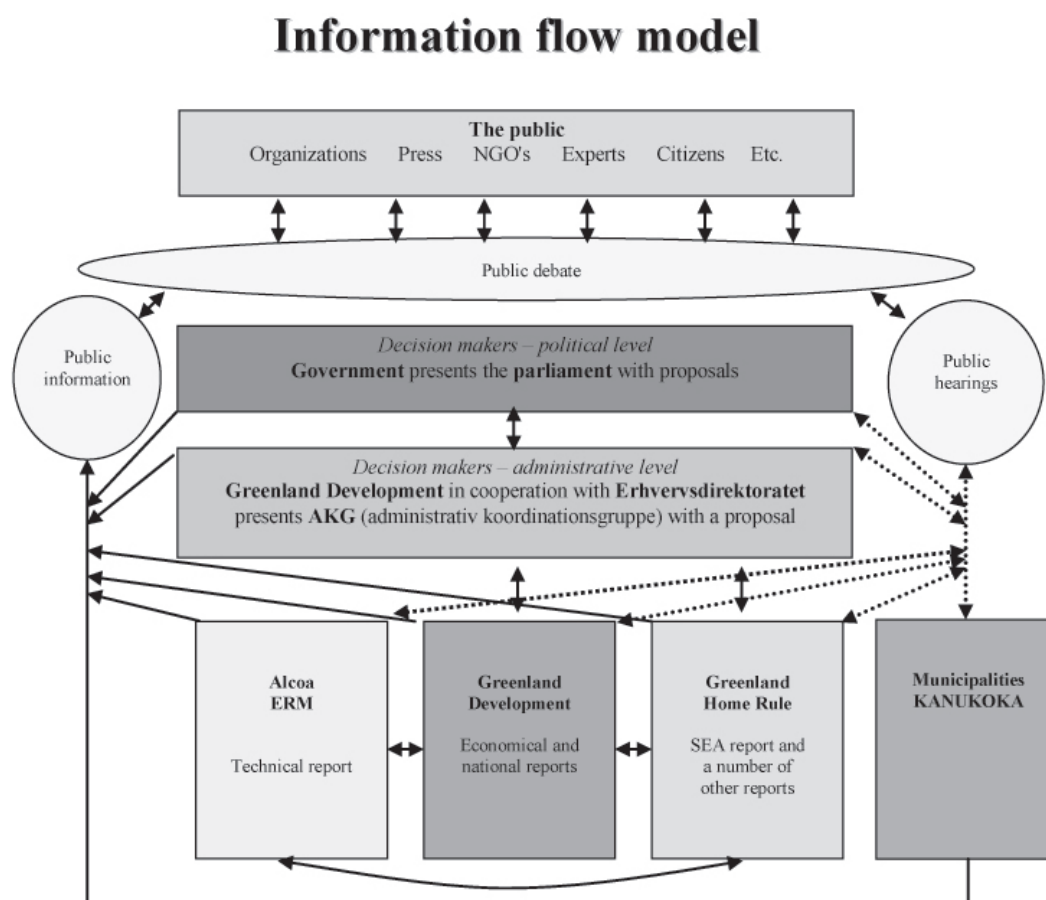
In his article, Lasswell operated with a division of the verbal model into five groups. This division gives a clearer understanding of each section of the formula:

Figure 1. The Lasswell Formula (Lasswell 1948,37).

A discussion of all five elements of the communicative process here would be too extensive for incorporation in this project. We refer instead to a previous discussion in "Communication and Information; technical quantity and quality" (Hansen 2004). We here highlight only some few significant parameters. Our project is particularly focused on an analysis of the first two elements, i.e. Sender and Message.

The second focus of our attention is citizen participation. Our primary source of inspiration in this regard is Jørgen Goul Andersen's discussion of the term 'citizenship'. Andersen proposes three dimensions to citizenship: rights, participation and identities in relation to the individual citizen's commitment (Andersen 2002). This citizenship-based approach is designed to help us outline an objective for the condition of a democracy. This can be achieved by assessing the population's opportunities to participate in and influence the process in question as well as assessing whether particular groups have, in reality, been excluded from public debate. Andersen demonstrates that what is of crucial importance is not whether people in fact participate, but whether they feel themselves cut off from the possibility of participation (Andersen 2002,170-171).

When a situation arises in which there is an expressed desire on the part of one or more groups of stakeholders to participate in a decision making process, but where it is not possible for them to



participate, a situation of democratic deficit can be said to have arisen. "The expression 'democratic deficit' is used loosely to identify decision procedures with insufficient democratic control" (Mandag Morgen 2002).

Figure 2. Model detailing the most significant parties to the communicative process and communication channels in connection with the various aluminium project discussions, analysis and decision making processes. (The authors' own model).

The reasons for which participation in a particular decision making process may not be possible are many and varied. It may, for example, be a result of the fact that the decision making process takes place in a language which the stakeholders do not speak, or that a particular decision making process doesn't take place in the public domain.

Power relations are the third element which we will consider from a theoretical standpoint. Of particular importance to us in this regard are the works of Norman Fairclough (1941-) especially his

critical discourse analysis (2001). Fairclough does not consider his critical discourse analysis to be neutral; rather he sees it as an expression of a critical, analytic approach to communication. It is also an expression of a critical approach that engages with social and societal change, where the attempt is made to describe and identify the discursive practice's effect on the maintenance of unequal power relations. One of Fairclough's central concepts is 'discourse order', which describes the competition existing between different discourses trying to fill out the same terrain, and which, as such, thus come to place themselves between the discourse itself and the discursive field (Tønder 2000).

The nature of the framework under which this project has been undertaken has not allowed us, however, to provide a genuine theoretical background for the analysis carried out. These theoretical considerations are, therefore, only implicit in our analysis.

Partially on the basis of these theoretical considerations, we have established the following model for the flow of information in the case in question – see figure 2 below. The model serves as our point of departure in designing the project's analytical framework.

The model identifies the most significant parties to the communicative process in the public domain. We have found it important to identify all the various parties which we feel play an active and independent role in the process. First and foremost, this involves the political and central administrative level. We have then identified the parties who have been active. We are, of course, aware that Alcoa are not a part of The Greenland Home Rule Government but we feel that it is important that Alcoa are included in the model as an independent party.

1.4 Approach

The project has consisted of three phases. The first phase lasted from the project's start to the summer of 2008 where the project's design was determined jointly by the team. The Sisimiut seminar acted as an excellent catalyst in this regard. The second phase of the project lasted until January 2009, and encompassed the collection of project data consisting in the identification and evaluation of articles. The third phase of the project culminated in June 2009. During this phase, the collected data was analysed and the report written.

Significant methodological considerations relating to the project have been concentrated in the areas of project design and data selection. The basic premiss on the basis of which the project was designed was that the project be based on as simple and transparent a model as possible. From the point of its initiation, the project has been defined as an empirical project. The framework within which the project was carried out, in particular budgetary constraints and the organisational culture the project had to contend with, made it clear to us that it would not be possible for us to incorporate theoretical considerations. The project's theoretical platform is, therefore, of a limited character and includes only general considerations relating to knowledge-based decision making processes, communication, empowerment and popular democratic principles.

Our data selection criteria were focused on securing as much material as possible from the two national newspapers *Atuagagdliutit* (AG) and *Sermitsiaq*. In order to be as comprehensive as possible and to trace developments over time we decided to include material dating right back to the start of 2006. The data collection period culminates in November 2008, meaning that we have almost 3 years worth of material to work with. Our aim has been as a bare minimum to register all the articles in the two national newspapers that relate to the aluminium project. Two methods were used for this registration process: searching the newspapers' online databases using keywords, and manually leafing through all newspapers in their entirety. We have also included articles from the Danish press, but because of the sheer volume of material to be sifted through we have based our selection on existing indexes. In addition, other sources which have provided a specific treatment of the subject in question have been included. This has resulted in a total of 226 individual raw

data items. Each of these has been analysed and indexed on the basis of the same template (see the overview in Appendix 1).

The data thus recovered has been subjected to analysis using selected cross tabulations giving rise to the data set analysed in this report. There are two main trends to this analysis. The first was to establish when public debate has taken place in relation to when the administrative and political decision making process occurred. The second was to determine which opinions were expressed in the texts and other raw data which were the subject of analysis. It would have been interesting to combine these two different analyses so as to determine which opinions were expressed by whom and at which point in the process, but, given the amount of data involved and the resources available this was not practically possible. It has not been our expectation that we would be able to generate sufficient levels of data to be able to produce statistically valid conclusions relating to which opinions have been expressed when. Clearly, such an analysis could also have been carried out on a purely qualitative basis but given the constraints imposed by the project's framework this has not been possible.

2. The Aluminium Project

As far as Greenland was concerned, the aluminium project as currently proposed had its genesis in the beginning of 2006, at which time Alcoa, an American aluminium company, contacted the Greenlandic authorities. Alcoa wished to initiate preliminary surveys whose object was to assess the potential for establishing an aluminium furnace in the central segment of West Greenland in the area between Sisimiut to the North and Nuuk to the South.

To describe the entire aluminium project in all its details would exceed the scope of this report. As mentioned previously, the aluminium project is potentially the most extensive of its type ever to be undertaken in Greenland. In the following presentation it will be sufficient in the first instance to record the most significant project milestones:

Spring 2006	First enquiry by Alcoa.
July 2006	Joint Action Plan (JAP) with Alcoa.
April 2007	First open political decision regarding the plans (Go on).
May 2007	Memorandum of Understanding (MoU) with Alcoa.
May 2008	Open political decision on placement (Maniitsoq).
2010	Open political decision on ownership (partner/concession).
2010	Final political discussion on project (start/not start).
2016	Earliest possible commencement of production - if project approved.

The Greenland Home Rule Government have undertaken a number of significant administrative initiatives during the project phase which have resulted in the creation of both significant independent actors, as well as principles and a framework which have impacted significantly to the project process. The most important of these initiatives are detailed in the following:

Greenland Development A/S

Greenland Development A/S was formally incorporated on the 1 November 2006 as a wholly owned subsidiary of Greenland Tourism and Business Council. In June 2007, the Government of Greenland decided to convert Greenland Development A/S (GD) to a public limited company under the auspices of the Government of Greenland. In early versions of the corporation's articles of assembly its purpose was described as to "work to advance the interests of the aluminium industry in Greenland". The scope of this stipulation was extended following the most recent revision of the corporations articles of assembly on 17 March 2009. GD's tasks include undertaking contact to

Alcoa on behalf of the Greenland Home Rule Government. GD has also produced a number of surveys and reviews primarily in the financial and socio-economic areas.

The Administrative Coordination Group

The Administrative Coordination Group (ACG [in Danish AKG]) was established in August 2007. ACG replaced 'the administrative working group' which was established at the end of 2006. Initially ACG consisted of a few key directors in the Greenlandic central administration. Its composition has been altered on several occasions and it has also been expanded. An example of this is the fact that organisational change from directorates to departments has influenced the composition of ACG such that it is now primarily Permanent Secretaries who sit on the ACG. ACG has overall coordinatory responsibility for Greenland's central administration's participation in the aluminium project. ACG are serviced by the Department for Business and Minerals.

Strategic Environmental Assessment

A Strategic Environmental Assessment (SEA) with accompanying organisation was established in April 2007. Prior to the SEA, the Infrastructure, Environment and Nature working group (IEN working group [in Danish IMN]) performed a screening and subsequently recommended a SEA. SEA has been through several organisational restructurings. The first SEA draft (SEA2007) was published in December 2007. The revised SEA (SEA2008) was published in February 2008. It is expected that a final SEA (SEA2009) will be completed in the autumn of 2009. During the course of the SEA a number of surveys have been completed and seminars and public meetings have been held.

Mobility Survey

A coordinated mobility survey was initiated in August 2008. A number of governmental bodies participated, as did external experts. During the spring of 2009 a number of surveys were carried out whose purpose was to map the population's mobility. It is anticipated that these surveys will be published in the autumn of 2009.

Working Group for a New Residential District in Maniitsoq

In September 2008 ACG formed an interdepartmental working group which drew members from across the public sector, with equal numbers from the central administration and the local authority (Qeqqate Kommunia) in which the aluminium furnace will be located. Qeqqata Kommunia is itself the result of a recent merger of two smaller administrative units: Maniitsoq Kommune and Sisimiut Kommune. The working group's task was to provide coordination of the analysis of investment requirements, burden and task distribution and infrastructure, housing and planning requirements.

Additional governmental working groups have performed further analyses in relation to the aluminium project. These surveys will not be considered separately.

Alcoa

The aluminium project's genesis consisted of a request on the part of Alcoa, and it is therefore appropriate to include a brief description of the company here. The following description was authored by the company:

Alcoa is the world leader in the production and management of primary aluminium, fabricated aluminium and alumina combined, through its active and growing participation in all major aspects of the industry. Alcoa serves the aerospace, automotive, packaging, building and construction, commercial transportation and industrial markets, bringing design, engineering, production and other capabilities of Alcoa's businesses to customers. In addition to aluminium products and components including flat-rolled products, hard alloy extrusions, and forgings, Alcoa also markets Alcoa® wheels, fastening systems, precision and investment castings, and building systems. The Company has 97,000 employees in 34 countries and has been named one of the top most sustainable corporations in the world at the World Economic Forum in Davos, Switzerland. More information can be found at www.alcoa.com (Alcoa 2009).

As of June 2009 the newly elected government will take a decision as to their policy with regard to the development of the aluminium furnace project. Administrators are working on the assumption that the project will continue and that political decisions will be taken with regard to a number of issues of a principle character at parliamentary assemblies in 2010. Amongst these issues is the question of whether Nukissiorfiit (Greenland's publicly owned utility company) should be converted to a PLC, what ownership structure is best suited to the proposed industrial water power stations (which, it is expected, will produce up to 15 times the energy currently used across Greenland) and whether or not the aluminium project should in fact be implemented.

If the aluminium project is given the green light and is located in the Maniitsoq area as proposed, this will, of course, have significant consequences - both for the areas from which manpower resources will inevitably be drawn, and for the area in which the aluminium furnace will be constructed, i.e. Maniitsoq.

For the majority of the first half of the 20th Century, Maniitsoq was the largest town in Greenland. This was primarily attributable to extensive local cod fishery. Towards the end of the last century development occurred primarily in other Greenlandic towns. Today Maniitsoq is the sixth largest town in Greenland.

Opinion in Maniitsoq is that the question of the location of the aluminium furnace will determine whether or not the town will survive. If the furnace is not located in Maniitsoq then the expectation is that it will only be a matter of time before the town will experience a significant fall in population levels. During the past 3 decades population levels have developed as follows:

1980:	3,008 residents in Maniitsoq
1990:	3,135 residents in Maniitsoq
2000:	2,929 residents in Maniitsoq
2007:	2,842 residents in Maniitsoq

From 1990, where resident figures peaked, to 2007 the town's population has declined by almost 10 %.

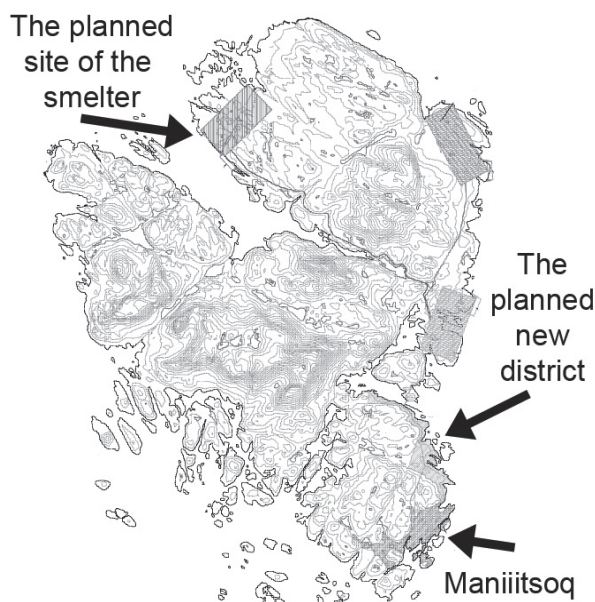


Figure 3: Map of Maniitsoq Island including the location of the existing town, the new district and the aluminium furnace. The furnace is located about 12 km from the town.

The most recent evaluations of the direct and indirect effects on Maniitsoq population levels of the construction of the aluminium furnace are that these will rise by approximately 2,000 individuals. This figure represents the anticipated permanent migration to the area. During the five years in

which the furnace and accompanying infrastructure are under construction approximately 4,000 construction workers will move to the area. It is anticipated that it will be necessary to recruit these workers from abroad, and that they will live in temporary accommodation areas with limited contact to Maniitsoq's residents.

Irrespective of whether the temporary influx of construction workers has a significant impact on the population of Maniitsoq, the town will experience significant changes when the furnace enters operation. The town's prosperity will be totally dependent on the furnace, and there will no longer be a valid financial case for locating a fish processing factory in the area. It is also to be expected that Maniitsoq will come to acquire a number of the other characteristics typical of industrial towns.

It is an open question as to whether the current population of Maniitsoq and migrants to the area will be able to cope with these changes. Little genuine debate has taken place concerning the fundamental changes that Maniitsoq will face in the coming 10 year period if the project is implemented as planned.

2.1 The Administrative and Political Decision Making Processes

As already mentioned, a number of administrative and political decisions have already been taken in relation to the aluminium project. Given the scale of the project (it involves potential investment of the order of 20 billion DKK) it is only appropriate that administrative and political decisions are kept confidential. It is not realistic to expect the same degree of public access to agreements and decisions as would be the case for projects on a smaller scale, which would also typically be covered by planning legislation. This is not the case for the aluminium furnace project.

Even though aspects of the agreement must of necessity be kept confidential this is not to say that the process itself should be kept confidential. The same degree of secrecy is not appropriate to the timing and subject matter of administrative and political decisions.

Typically an individual decision making process takes place as follows: a political statement is issued requiring the assessment or advancement of a given subject area /process. This political statements may take the form of a coalition agreement or parliamentary memorandum. Such political statements are typically loosely formulated. The following "Memorandum Relating to Energy Intensive Industry" (Greenlandic Parliament 2007) which was voted through by the parliament and authored by the government includes the following statement:

"... it [should] also be decided what degree of societal and environmental evaluation it will be necessary to carry out. It is advisable that a regional strategic environmental assessment be carried out in the region between Nuuk and Sisimiut ..." (Landstinget 2007,13).

On the basis of, in this instance parliamentary, backing for a government proposal, the administrative wheels begin to turn and existing knowledge relating to the issue in question is collated and assessed in order to determine whether it will be necessary to carry out additional research in the area in question. In our example, on the initiative of two members of the government, a person was appointed with responsibility for ensuring that the review was carried out and funds were approved for this purpose.

The next step is that the member of the administration with responsibility for the task in question prepares a draft proposal which is often approved in principle at the political level before being sent to internal or external consultation. When a consultation round has been carried out a revised draft is submitted. With regard to the strategic environmental assessment, political approval was secured in principle in October 2007. Internal consultations were held during November 2007, and a

process of public consultation took place between December 2007 and January 2008, with the final proposal being prepared for political approval in February 2008.

The revised draft is then presented to the government, which may have delegated responsibility for the project to an individual member of the government. If the matter in question is of significant import it may be the case that the government can or must submit the proposal to the parliament which then takes the final political decision. In many cases, however, it is the government that takes the final decision. The strategic environmental assessment was included in the total package of background material on which the parliament based its decision of May 2008 regarding the locating of the aluminium furnace in the Maniitsoq area.

There are, of course, innumerable possible variations of this process, and there are a number of factors which have not been included in this overview. In many cases, projects which have been under preparation in the administrative machinery for some time only become public when they are presented to parliament. In the best cases an issue can become public knowledge long before it reaches parliament. This occurs in the instance that a case is taken up at an initial seminar or similar where stakeholders and the public are provided with insight into a particular case. The public were first involved in an organised fashion in the strategic environmental assessment process at a series of open meetings in August 2007.

As mentioned above, a hearing can be made public by ensuring the involvement of stakeholders, including the press. This inclusion of the public, as broadly understood, does not occur in all cases, nor is it necessary in all cases as many cases have little societal impact. In these instances there is no need to introduce wide-reaching democratic initiatives. In some instances it can become apparent under a hearing that insight into significant factors is lacking and in these instances seminars or similar may be held during the course of the administrative process. In our example, towards the end of 2007 it was the opinion of the responsible person within the central administration that there were significant gaps in the knowledge available. A seminar was therefore held in mid January 2008 within the scope of the strategic environmental assessment and was attended by invited Canadian and Scandinavian experts.

There are also instances, however, in which, notwithstanding the fact that a proposal has significant societal consequences, the wider public are not included in the consultation process prior to the finished proposal being presented to the parliament for ratification. In such instances it is our opinion that the decision making process has suffered from a democratic deficit.

2.2 The Process Involved in Determining the Furnace's Location

During its spring session in 2008 the parliament took its most tangible decision yet in relation to the aluminium project. A government proposal was set out which required parliamentary approval. Before the proposal was considered by parliament several months of administrative work had gone into refining it as is evident from the following overview of the political and administrative process:

January 2008	Final material is collected by the administration.
February (start) 2008	Final draft prepared.
February (start) 2008	Draft presented and approved internally.
Mid-February 2008	Confidential memorandum issued for ACG hearing round.
Mid-February 2008	ACG meeting and final approval of draft.
18 February 2008	Parliamentary seminar concerning the aluminium project.
21 February 2008	Governmental decision in relation to the proposal (the executive authority).
21 February 2008	Press meeting upon publication of the proposal.
25 February 2008	Delivery to parliament (the legislative authority).

The government's bill was included as item 83 in the parliament's spring session and was given the following title: "Proposed parliamentary decision relating to the location of the aluminium furnace and decision in principle vis a vis preferred ownership and financing model if at some future time the construction of a water power plant based aluminium manufacturing facility in Greenland is approved". The bill's first reading was on 14 March 2008 and its second reading was on 7 May 2008. A majority of the parliament voted for the bill and it was passed into law.

The decision making process described here is just one of a number relating to the aluminium project. It is also one of the most significant to date. This process will, therefore, also be included in our analysis in the following paragraphs.

3. Public Debate

Public debate in Greenland is very different to public debate in the rest of Scandinavia; for one thing the media landscape is very different in Greenland. There are, for example, no daily newspapers. There are two national papers one of which comes out once a week and one twice a week. There is only one national TV station and one national radio channel. Internet use is widespread but is paid for by volume, and, amongst other things, this has a negative effect on news searches and information retrieval. There is a free press, but it functions only partially as a true fourth estate providing professional, in-depth, critical journalism.

The population of Greenland currently numbers some 56,000 individuals. Population levels have been stable for a number of years. Approximately 50 % of the population has a formal qualification that goes beyond their standard schooling, which percentage is lower than in the rest of Scandinavia. It is estimated that roughly 50 % of the population speak Greenlandic as their first or only language, 25 % speak Danish as their first or only language and 25 % speak both languages with equal fluency.

Cultural factors are also significant. There exists a different debating culture in Greenland to that found in the rest of Scandinavia. Young Greenlanders are still brought up to discuss things in an indirect fashion. Debates often take place with only indirect references to the essence of the matter under discussion or take place in an abstract third-person form (one, it is said that, some etc.). This doesn't make a debate less efficient, but the direct form of debating itself is not a traditional way of addressing conflicts in Greenland and it is to a certain extent the case that a particularly Greenlandic indirect form of debating has developed. A further significant cultural factor is the widespread clan consciousness. In relation to debates this means, amongst other things, that whilst issues may be the subject of lively debate in the private sphere (e.g. close family) in public the stage is left to a particular group of individuals. These are typically politicians, representatives of various organisations and persons with a university education.

It is on this basis that public debate in the traditional mass media currently takes place in Greenland. This is worth remembering when considering the whats, whos and whys of a particular public debate.

As stated above, we feel that knowledge-based decision making tools should always incorporate genuine public and democratic debate relating to the matters under consideration. It is this aspect of knowledge-based decision making tools which is the focus of our analysis. In the following two sections of this report we will first analyse the scheduling aspect of this issue, and thereafter turn our attention to issues relating to the content of debate.

3.1 Analysis of the Timing of Debates

In our analysis we compare the timing of public debates to the timing of administrative and political decision making processes.

Our analysis will uncover the relation between the time at which articles or other material relating to a particular issue are published and the time at which decisions relating to this issue are taken. This section of our analysis makes no assessment of the contents of these articles, only their timing and number.

Our point of departure is this: for a genuine public and democratic debate to have taken place concerning decisions that have been under consideration the majority of articles and other material relating to those decisions should have been published before the administrative and political decisions were taken.

Figure 4 illustrates the timing of all registered articles and other material. It is evident that the project has attracted higher levels of attention for each year that passes; fewest in 2006 and most in 2008.

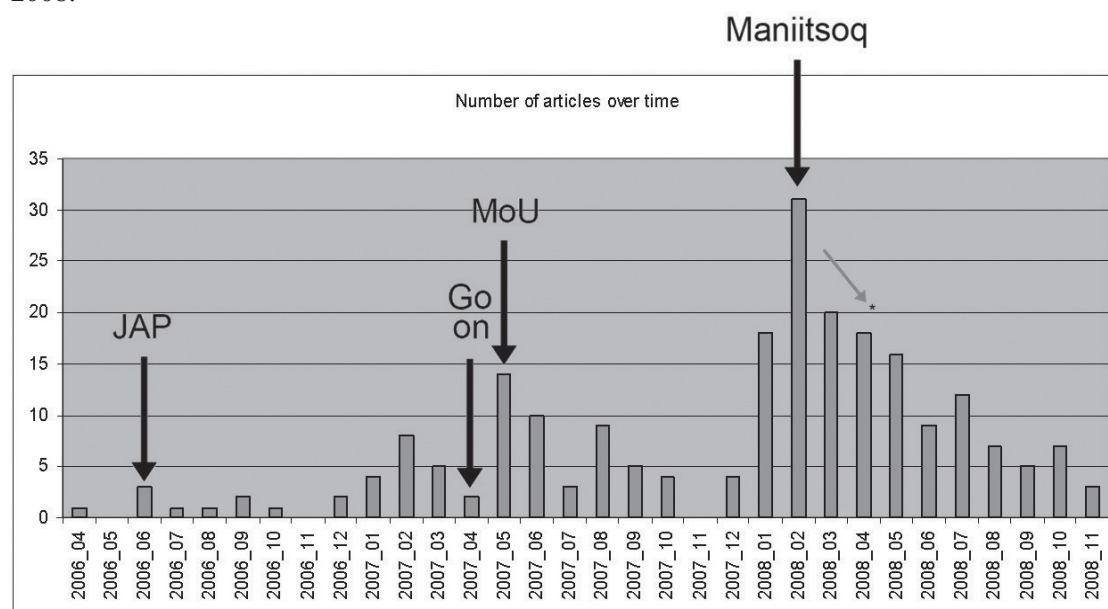


Figure 4. Distribution of articles over time. A total of 225 articles were considered.

If one looks more closely at the distribution of articles there are clear variations in the spread of articles across the year. It is obvious that a large amount of communication has been associated with the four public milestones which the project has crossed hitherto (see the overview in section 2.0).

In July 2006 the first agreement between the Greenland Home Rule Government and Alcoa was signed. It took the form of a so-called Joint Action Plan (JAP). This appeared to provoke a reaction in the public sphere, though it was a very slight reaction. In February 2007 communication levels increased again. February was also a hectic month for administrators. Amongst other things the parliament was informed of the status of the aluminium project and three working groups which had operated across the various directorates delivered their reports to The Administrative Working Group. Not much of this was reported or commented on in public at the time. Media attention was taken up with the visit of Norsk Hydro Aluminium to Nuuk which in January 2007 also entered into a JAP with the Greenland Home Rule Government. Up to May 2007 Norsk Hydro and Alcoa competed on the right to enter into a MoU with the Greenland Home Rule Government. A competition which, as we now know, Alcoa won.

On the 27 April 2007 the government bill: “Memorandum Relating to Energy Intensive Industry” (FM 07/49) (Greenlandic Parliament 2007) was debated in parliament and voted through. On 23 May 2007 the government issued a press release indicating that on 25 May 2007 the Greenland Home Rule Government would enter into a MoU with Alcoa. These two May milestones aroused a good deal of media interest as is evident from Figure 4.

The slight increase in activity in August 2007 can be ascribed to the fact that SEA, the local authorities and Alcoa held joint open meetings in Nuuk, Maniitsoq and Sisimiut. Approximately 200 people attended each of these meetings. This generated a certain amount of brief interest in the media but did not give rise to a broad-based popular debate during the following months, which had otherwise been in particular SEA’s intention as it had been hoped that these public meetings would kick start a debate as to the content of the SEA.

The next serious activity arose in January and February 2008. During January fresh public meetings were held in the three towns, plus an open seminar on regional development was organised by SEA. In February the government published its preferred location for an eventual aluminium furnace: Maniitsoq. The grey arrow in Figure 4 shows the period from the publishing of the government’s recommendation to parliamentary acceptance of this recommendation. One would imagine that a significant level of debate would have been evident during this period, but this does not seem to have been the case.

Mapping these events and milestones in relation to levels of public debate shows clearly that public communication first occur concurrent with or slightly after a milestone is reached at which political decisions are reached. As previously described prior to these political decisions an administrative and political decision making process has taken place. It does not appear to be the case that any significant public debate of these issues has taken place during this period.

As has been mentioned previously, not all decisions lend themselves to public discussion. We live in a representative democracy and it is the function of politicians to take some of these decisions on our behalf. However, though this remains the case, it is still true that the process itself should be the object of a degree of public debate. On the basis of the material here analysed this does not seem to have been the case.

Taken as a whole it would therefore appear that considered from the standpoint of knowledge-based decision making processes, the total process surrounding the aluminium project from its start in the beginning of 2006 up to the end of 2008 has suffered from a democratic deficit.

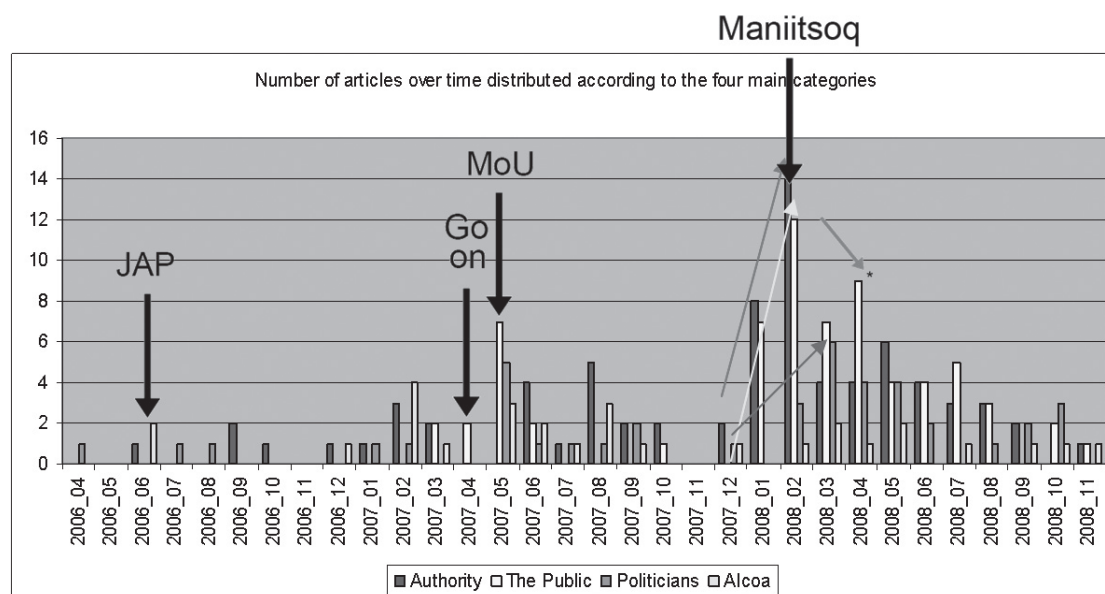
We have also analysed our material to determine the sender of each individual contribution to the public debate. This is illustrated in Figure 5, where senders have been divided into four categories: Authorities, The Public, Politicians and Alcoa.

During the JAP in June 2006 and Norsk Hydro’s visit during February 2007 it would appear that it is primarily Alcoa, that was active in communicating their message. Alcoa have maintained a low but consistent level of information provision throughout the period analysed.

During April and May 2007 it would appear that it was primarily the public (i.e. the press and citizens) who were active. It is interesting to note that the material under analysis records no public activity of note for the entirety of the autumn of 2007. This serves to underline the lack of public debate which attempts were made to reignite during August 2007.

During the period from December 2007 to February / March 2008 all three categories of Greenlandic stakeholders show increasing levels of activity. There seems to be a certain inter-relation between authorities and the public while the number of articles attributable to politicians peaks a month later without ever reaching a significant level. The three increases are marked by red, yellow and blue arrows respectively.

Seen at the general level it is clear that the contributions analysed come from various categories of senders, and that is, of course, in itself positive. If the majority of contributions were attributable to one particular grouping this would have been disturbing. It is a common feature of all the



contributions that they lag behind the administrative and executive decision making process.

Figure 5. Number of articles over time distributed according to the four main categories of sender. Total number of articles: 214.

3.2 Analysis of Debate Content

In the second section of the analysis we assess the opinions expressed in the texts and other material under analysis. The opinions which are ascribed to the individual groups of stakeholders are based on an assessment on our part. We have attempted to ensure that this assessment is as objective as possible. Opinion evaluations occur in accordance with the instructions included in Appendix 1.

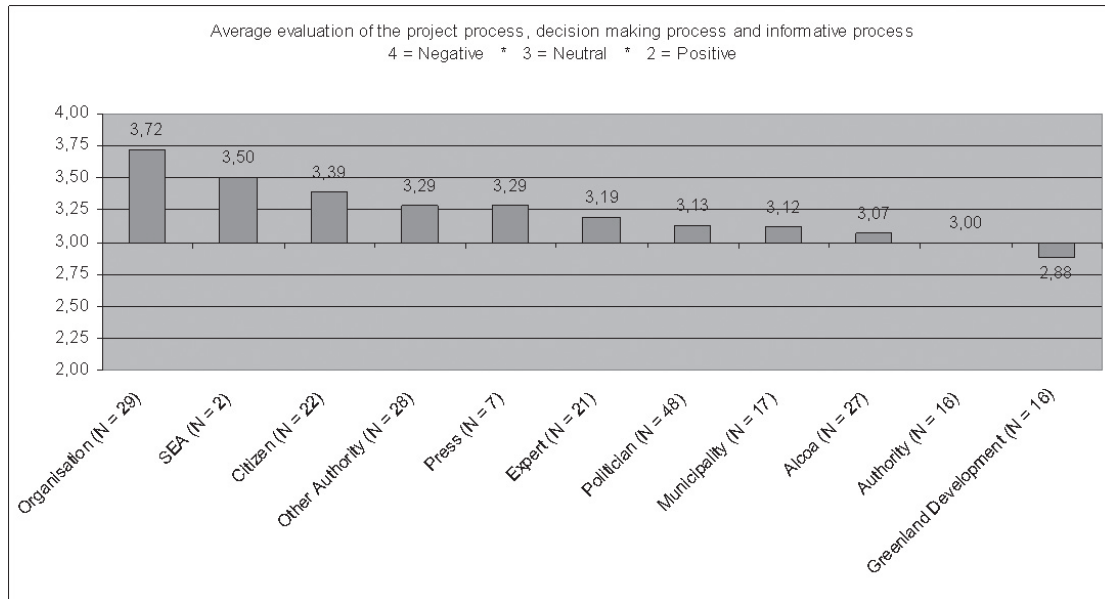
Only the themes which the individual stakeholders have touched on in the texts analysed are included in our data set; meaning that if a stakeholder hasn't mentioned a particular theme then this opinion will not have been registered.

In the analysis we assess which opinions are expressed within two general categories: the aluminium project's processes, and selected societal issues.

3.2.1 Opinions Relating to the Aluminium Project's Processes

The first of the two general areas to be assessed is those opinions which relate to the aluminium project's processes. This includes opinions in relation to the project process, decision making process and informative process. The three processes are registered independently but there are too few opinions expressed in our material for it to make sense to separate them. For this reason, the three categories have been united.

What is immediately evident from Figure 6 is that of the eleven groups considered nine have a negative opinion of aluminium project processes. Authorities maintain a neutral standpoint and only Greenland Development A/S consistently expresses a positive attitude to aluminium project processes. A total of 233 opinions expressed also indicate that this is a subject which has been of



importance to many stakeholders.

Figure 6. Average evaluation of the aluminium project's project process, decision making process and informative process by stakeholder group. Total N= 233.

There should not, of course, be accorded too great a significance to the various degrees of positive or negative opinions. However, it is interesting to note that the 'organisation' group has been particularly negative in its assessment of aluminium project processes.

It has not been possible within the constraints of this project to extend our analysis to an evaluation of what these positive and negative opinions have been expressed in regard to.

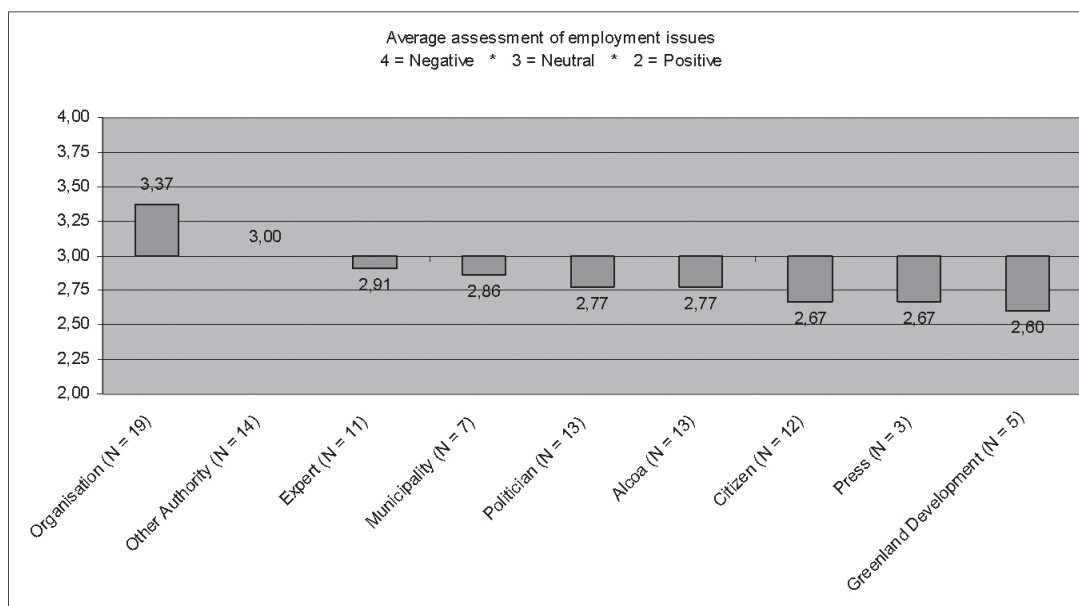
3.2.2 Opinions Relating to Selected Societal Issues

The second general subject area to be the subject of analysis are opinions expressed in relation to societal issues. This analysis is more extensive than the above which related to opinions expressed concerning aluminium project processes.

Our analysis starts with an assessment of opinions expressed in relation to nine separate themes. These results will then be commented on. The nine separate themes are as follows: employment, training, health, finances, independence, regionalism, the environment, CO2 and cultural and historical issues.

Employment

With a total of 97 expressed opinions, employment is an issue which has attracted a relatively high degree of attention. The figures in Figure 7 indicate that the majority of the opinions expressed in this regard have been positive. It is only 'organisations' which have a negative opinion of this issue, and the

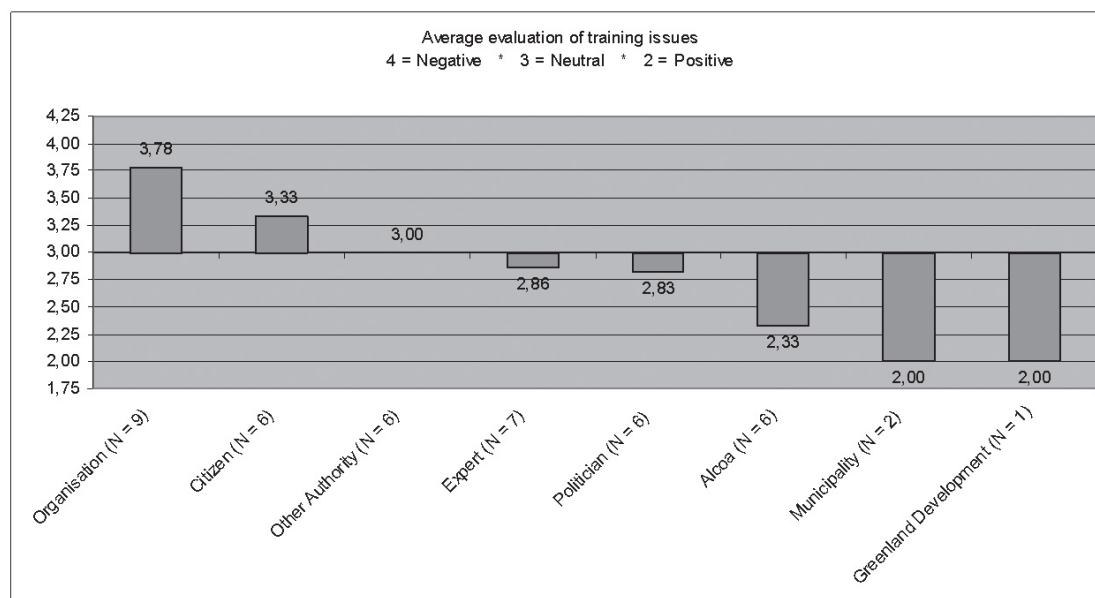


opinions of The Association of Greenlandic Employers have a marked influence in this regard.

Figure 7. Average assessment of the employment related effects of the aluminium project distributed by stakeholder group. Total N = 97.

Training

This theme covers opinions expressed in relation to effects on training. Figure 8 indicates, amongst other things, that of all the analyses presented, the issue of training is the most divisive. There are 1.78 'opinion points' between the most positive (local authorities and GD) and the most negative (organisations). Only 43 opinions were expressed in relation to this area, however, meaning that it



is not a subject which has been particularly significant.

Figure 8. Average evaluation of the effect on training of the aluminium project distributed by stakeholder grouping. Total N = 43.

Social and Health

The social health issue has not attracted significant attention in public debate. Only 25 expressed opinions were registered. Furthermore, the majority of these opinions have been neutral. This may be a reflection of the fact that this is one of the areas in which knowledge is scarce. Large sums

of money are currently being used to collect additional information such that it will be possible, in some year's time, to arrive at an assessment of the likely consequences for public health of the aluminium furnace development.

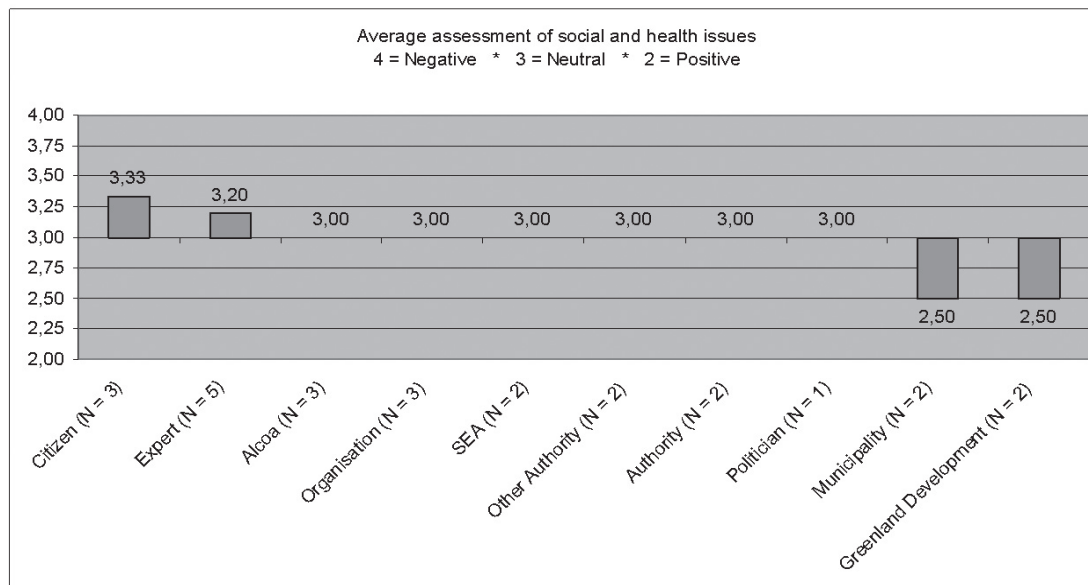


Figure 9. Average assessment of the consequences for public health of the aluminium project by stakeholder groups. Total N = 25.

Finances

The likely financial effects of the proposed development are an issue which has attracted a good deal of attention. A total of 96 expressed opinions have been registered. Seen from a Greenlandic standpoint, Alcoa have maintained a neutral attitude to financial issues. Both GD and local authorities have been consistently positive in their attitude to the financial consequences of the proposed aluminium furnace. At the other end of the spectrum it is worth noting that SEA's attitude is negative. Only one recorded opinion was expressed by SEA. Organisations, the general public and the press have all expressed negative opinions in this regard.

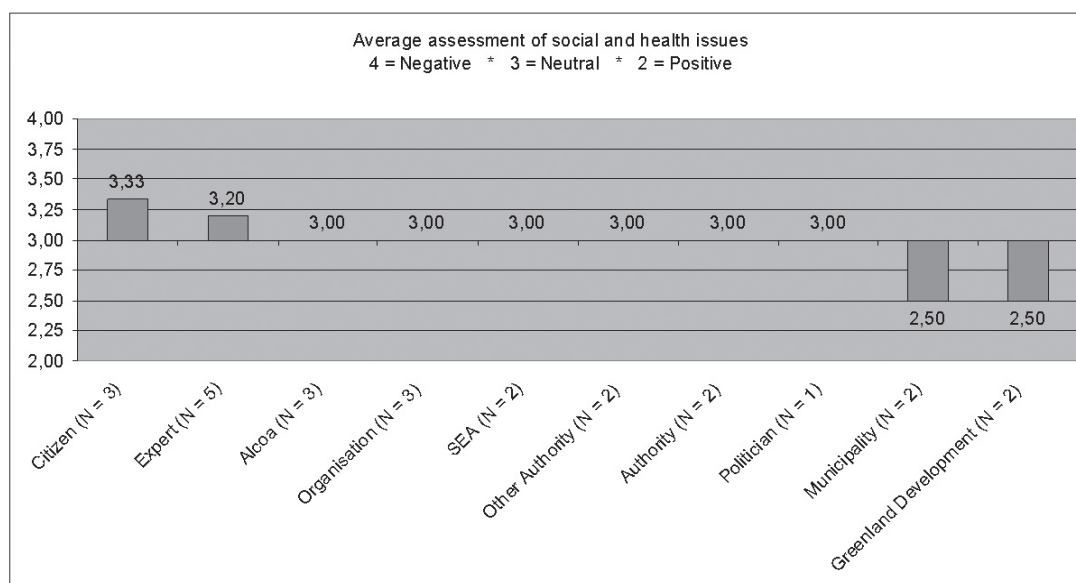
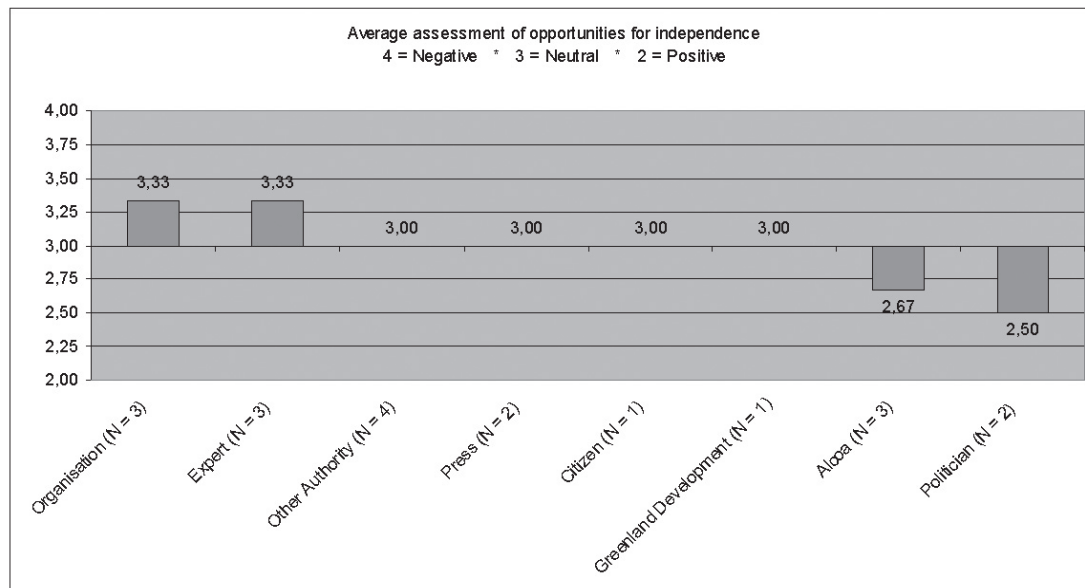


Figure 10. Average assessment of the financial effects of the aluminium project by stakeholder group. Total N = 96.

Independence

The issue of independence is not one which has enjoyed a prominent place in public debates in relation to the proposed aluminium furnace. Only 19 opinions were registered in this area. Figure 11 indicates that the general opinion with regard to this question is a positive one. In other words, it is the general opinion that the potential for independence will increase if a furnace is established. Interestingly, it is



politicians and Alcoa who are positive in this regard while the sum of expert opinion is negative. This is also the issue which the most groups have expressed a neutral opinion in relation to.

Figure 11. Average assessment of the possibility for increased independence as a consequence of the aluminium project by stakeholder group. Total N = 19.

Regional

The following data is of particular interest. Opinions expressed with regard to the issue of the effects of the aluminium furnace project at the regional level are unusually negative. Our analysis of this theme relies on very small quantities of data. In the same way that SEA had a very negative assessment of the likely financial consequences of the establishment of an aluminium furnace; it is noticeable that Alcoa have a very negative evaluation of this issue. No assessment has been made of what this attitude is founded on. A more specific textual analysis of the text in question could have revealed the context in which this information was expressed.

A total of 27 registered opinions indicate that this theme has not attracted significant attention in public debate. It has been a generally accepted truism that an aluminium furnace would benefit the region surrounding Maniitsoq, but that it may have a negative effect on the other regions in Greenland. It is likely that it is this issue which the majority of the recorded opinions have been expressed in relation to. The regional issue has been one of the themes which SEA have addressed and one would have expected them to have registered a number of opinions in this regard, however, only one neutral opinion was recorded.

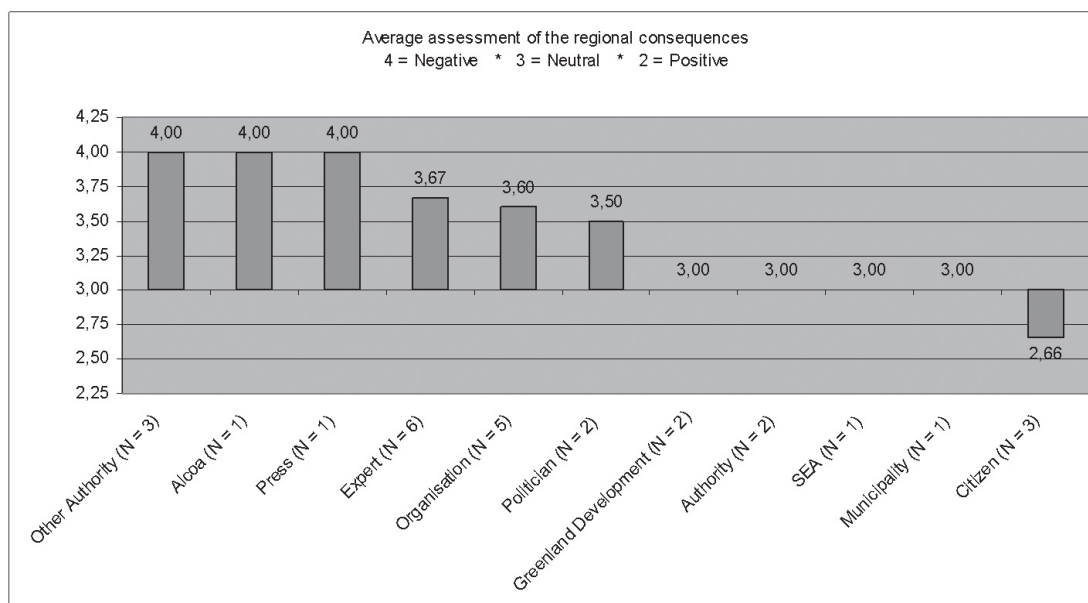


Figure 12. Average assessment of the regional consequences of the aluminium project by stakeholder groups. Total N = 27.

The Environment

The question of whether the construction and operation of an aluminium furnace would have a negative effect on the environment is one of the issues which has attracted most interest. Our analysis has identified 84 expressed opinions. It is an issue which has proved particularly interesting for citizens and experts, and there seems to be - on a cautious assessment - general concern about this issue amongst contributors to the debate.

As is characteristic of many of the issues analysed here, Alcoa, Local Authorities and Greenland Development have expressed positive opinions in relation to the environmental consequences of the aluminium furnace project.

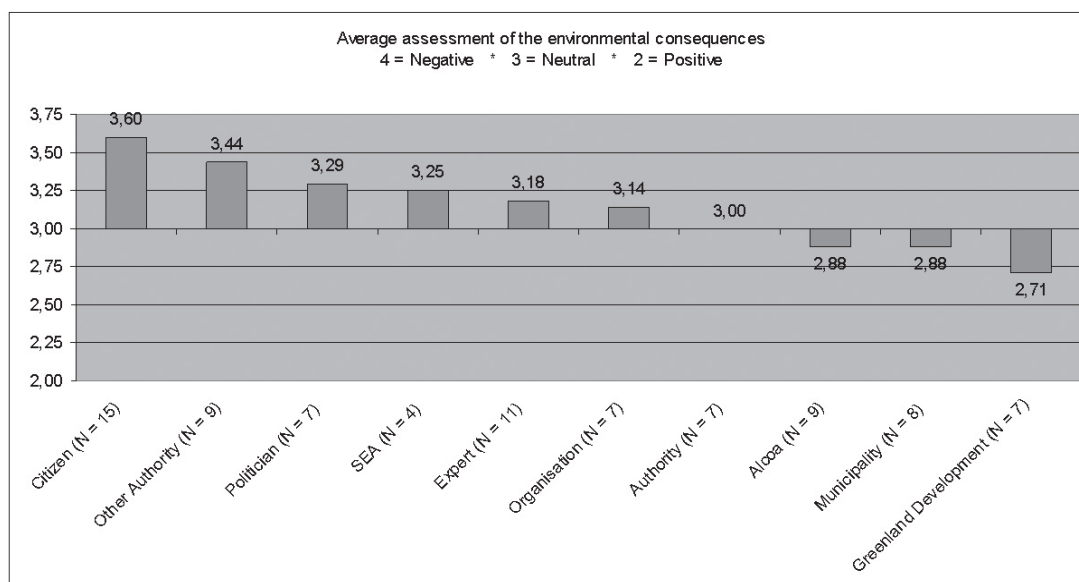


Figure 13. Average assessment of the environmental consequences of the aluminium project by stakeholder groups. Total N = 84.

CO2

It is interesting to note in regard to discussion of the issue of CO₂ emissions that it is clearly in this area that the majority of positive opinions have been expressed. Given the fact that it is an established fact that the CO₂ emissions attributable to an aluminium furnace will, roughly speaking, double total Greenlandic CO₂ emissions it might seem peculiar that this issue scores so highly. It is highly probable that opinions with respect to this issue have assessed the total global impact rather than focusing on Greenland alone. It is a generally held opinion in Greenland that siting an aluminium furnace in Greenland would lead to lower total emissions than if the furnace was located elsewhere in the world. Interestingly it would appear that it is this view which is the focus of disagreements in the ongoing negotiations between Greenland and Denmark concerning the climatic summit to be held in Copenhagen in December 2009.

The most critical group in relation to the CO₂ issue are members of the public who are the only group to express a generally negative opinion. At the other end of the scale are the press, which, together with GD, experts and local authorities have shown an exceptionally positive attitude in relation to the CO₂ issue.

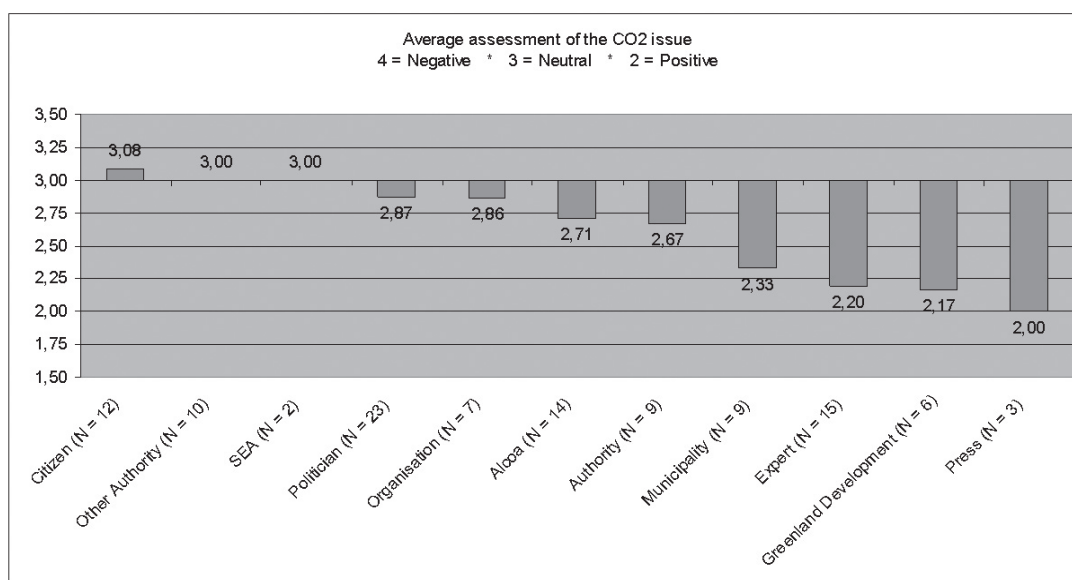


Figure 14. Average assessment of the effect on CO₂ emissions of the construction and operation of an aluminium furnace by stakeholder group. Total N = 110.

Cultural and Historical Issues

The topic which has attracted the fewest comments is the issue of the consequences the project will entail for the island's current culture and cultural history. This is a topic which has attracted significant interest in the process of assessing the aluminium project. For three years now, archaeological and cultural-historical assessments have taken place in the areas in Greenland's interior which are most likely to be affected when artificial lakes are created to service the enormous water power stations. Many of the opinions expressed are neutral though GD and the organisations have expressed generally positive opinions. This is one of the few topics which has attracted a generally positive response from the organisations.

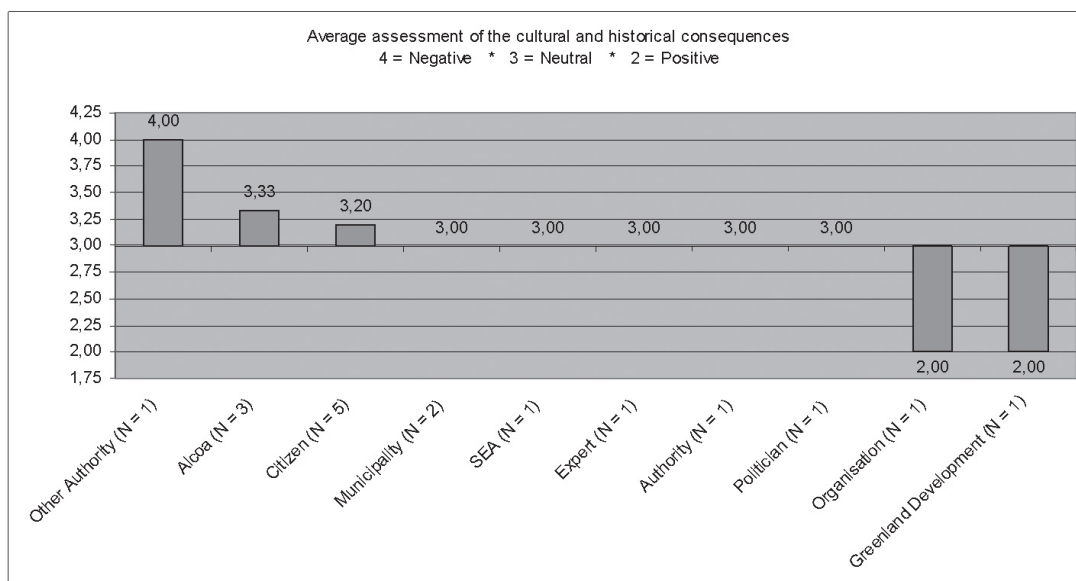


Figure 15. Average assessment of the cultural and historical consequences of the aluminium project by stakeholder group. Total N = 17.

Assessment of Societal Issues Generally

In the above analysis, registered societal issues are analysed independently. This has given a clear indication of which group of stakeholders have expressed a generally positive attitude and which a negative attitude in relation to the individual topics. In itself, this provides an interesting insight into the attitudes of the individual groups of stakeholders in relation to the various topics.

The collected information can also be presented in another way. By combining all the expressed opinions from each of the eleven stakeholder groupings it is possible to gain an insight into which of these groups of stakeholders have, generally speaking, expressed the most positive attitudes and which have been negative.

In the 'authority' category no less than 80 of the expressed opinions have been neutral. This is to the authority's credit. Authority is also the only group which considered generally maintains a neutral standpoint. The most negative groups of stakeholders, in rank order, are 'organisation,' SEA and the general public. At the other end of the spectrum, Greenland Development, municipality and Alcoa have been the most positive. In a number of debates which have taken place in public it has been these two blocks of stakeholders which have opposed each other with respect to the various aspects of the aluminium project. In this sense, the survey merely serves to underline the fact that there are clear conflicts of interest between the various groupings.

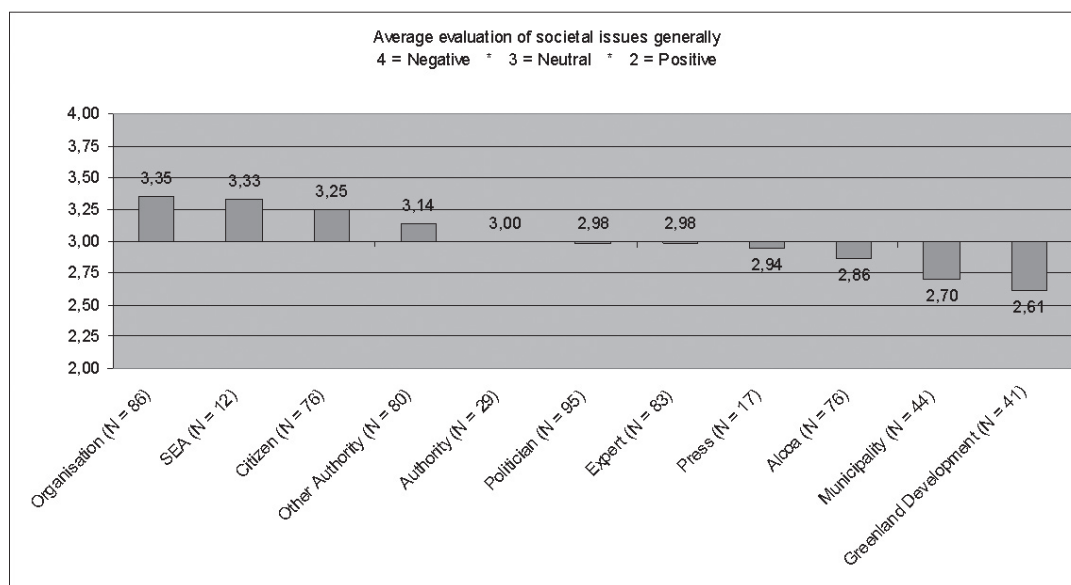


Figure 16. Average evaluation of aluminium project societal issues generally by stakeholder grouping. Total N = 639.

3.2.3 Total Analysed Topics

In the foregoing section of this paper a total of thirteen different topics have been the subject of analysis. The total average opinion for each group of stakeholders is evident from Figure 17.

It is worthy of note that of the thirteen themes assessed only two have produced a generally positive reaction. This is the case, perhaps unsurprisingly, for the issues of CO₂ and unemployment. Issues relating to the discussion of CO₂ have been discussed above. The generally positive attitude to the employment issue is more than likely a reflection of the fact that it is anticipated that the aluminium furnace will provide direct employment for about 500 people, making it a very significant employer by Greenlandic standards.

At the other end of the spectrum, attitudes towards regional issues are clearly the most negative of those assessed. The three different aspects of the project process also reflect a generally negative attitude. If any lesson can be learned for the further development of the process it is that the individuals responsible should focus on those areas in which there is a generally negative attitude to the project.

In the final section of this paper we present a model for knowledge-based decision making tools which constitutes our recommendation for how negative attitudes to the project process itself can best be avoided in future projects.

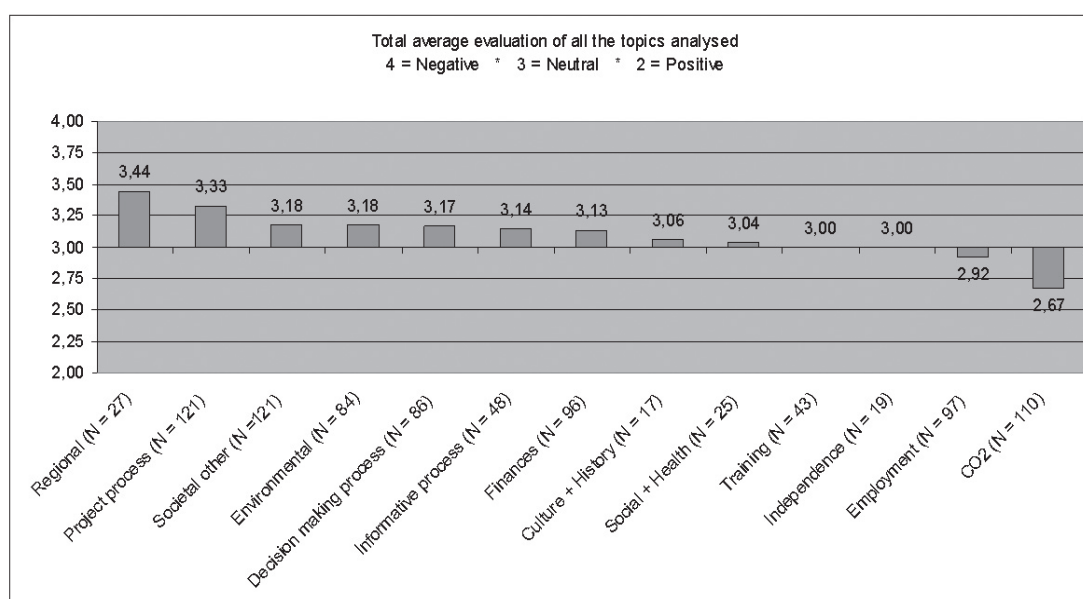


Figure 17. Total average evaluation of all the topics analysed. Total N = 639.

3.2.4 Total Stakeholders Analysed

Some additional comments are appropriate in relation to the groups of stakeholders analysed. Figure 18 indicates that there is a wide spread in relation to the number of opinions the groups analysed have contributed.

Politicians	143
Organisations	115
Other Authority	108
Experts	104
Alcoa	103
Citizens	98
Local Authorities	61
Greenland Development	57
Authorities	45
The Press	24
SEA	14

Figure 18. Total number of opinions expressed for each of the assessed groups of stakeholders.

It is clear from the above figures that politicians have given widespread expression to their opinions with 143 statements of opinion. A total of five other groups have contributed to the debate with between 98 and 115 statements of opinion. This is the case for organisations, citizens, experts and Alcoa. Three groups have given expression to their opinion between 45 and 61 times, these being the municipality, GD and authority.

The groups who have contributed least are the press with 24 and SEA with only 14 expressions of opinion. The lack of participation in the public debate is surprising, particularly as one would expect the press to contribute critical journalism, and because SEA have, supposedly, made a priority of entering into a process of dialogue with citizens. This dialogue has not been particularly evident in the press.

4. Conclusion – Democratic Deficit and Discourse Analysis

An analysis of the timing of the debates which have taken place during the past three years indicates clearly that debate flourishes after significant decision making processes have been completed at the administrative and political level.

In addition, it would appear that no active debate has taken place in those periods during which information has been made publicly available and various groups of stakeholders have had an opportunity to express their opinions. This is evident in the spring of 2007, where at public meetings held in August an attempt was made to initiate public debate. It is also evident in the period from February 2008, during which the government (the executive authority) published its bill suggesting a preferred placement of the aluminium furnace, to May 2008, when the Parliament (the legislative authority) passed the bill into law.

On this basis it is evident that there are indicators which suggest that there exists a democratic deficit in relation to the timing of significant administrative and internal political decisions on the one hand, and public debate on the other.

As mentioned previously, the expression ‘democratic deficit’ is used here to characterise decision procedures with insufficient mechanisms to ensure democratic control. Our focus is here directed only toward the conditions enjoyed by mechanisms for democratic control of the process. We vouch no opinion whatsoever as to the content of these decision making processes.

It is our assessment that a democratic deficit is evident in these cases. It is also our opinion that the difficult conditions under which mechanisms for democratic control operated can primarily be ascribed to a lack of public information regarding which decision making processes had been initiated at which times. Decision making processes were first made public after administrative and internal decisions had been taken.

When these decision making processes occur without democratic control, i.e. without a public debate concerning the processes in question, the risk is that the necessary insight into how political decisions are actually arrived at is lacking. In other words, it is the decision making process qua process for which democratic control is lacking.

In reality, the public have no way of knowing which aspects of the decision making process are delegated to which external partners by the administrative system. This is, of course, potentially problematic in relation to a project in which the stakes are so high. We are not asserting that any actual delegation of the decision making process to external partners has in fact taken place, but rather that, because the necessary control of the democratic process has been lacking, the risk is that doubts will begin to surface in connection with particular issues.

In terms of the content of the analysed debates, no democratic deficit has been identified. This is true both with respect to attitudes regarding the aluminium project’s processes and attitudes to societal issues relevant in relation to the aluminium project.

It is evident from the, in some areas, very open differences of opinion that we have registered that in our survey that a relatively open debate has been possible in which the various groups of stakeholders have expressed their opinion. It is further evident from the high number of op-eds and reader’s letters that it has been possible for the general public to contribute their opinion should they wish to do so. The survey indicates, furthermore, that if articles and other material are distributed according to the stakeholder group that authored them all groups are well represented.

No precise analysis has been performed but a rough qualitative run through of the data registered points to the fact that a number of the individuals who have contributed to public debate have made a significant number of contributions. This means that participation in public debate is not as broad as the number of articles under consideration would seem to suggest. This may be because, as we have previously mentioned, large sections of the population are reluctant to participate in public debate. This may in turn be because they allow others to speak on their behalf, in the sense that these social groups may ally themselves with an individual who already takes part in public debate. Whether this is in fact the case is not something which this survey has attempted to assess.

If the constraints of this project had allowed it, a thorough discourse analysis relating to the material collected would have been a natural extension of the work presented here. A discourse analysis would have allowed us to identify the various discourses (i.e. opinions) expressed in the debate surrounding the aluminium project.

Such a discourse analysis would, at best, have been able to identify fundamental opinions with respect to the project as a whole. It can not be excluded that an analysis could identify a discourse that the decision making must be open and inclusive and also identify a discourse that the decision making must be closed and exclusionary. It is conceivable that the debate features a discourse which holds that the aluminium project must be implemented, and a discourse that holds that it is necessary to assess whether the aluminium project should be implemented. A theme which the analysis in this project has not touched on is the various opinions expressed with regard to which ownership model is most appropriate to the extensive industrial power stations which will be required to power the furnace. It is conceivable that there exists a discourse which sees Greenlandic ownership in a positive light and a further discourse which is of the opposite opinion.

It is important to identify the differences between discourses that exist between stakeholders, but no such analysis has formally taken place in relation to the aluminium project. Given this, and the democratic deficit that has been identified with regard to administrative and internal decision making processes, it may be advisable to call a halt and re-think the framework employed with respect to some of the decision making processes involved in this extensive industrial project.

5. A Model for Knowledge-Based Decision Making Processes

On the basis of the above considerations we feel that we are in a position to identify the elements which could be improved in the democratic decision making process relating to projects such as the aluminium furnace project. For us, this entails the devising of a suitable model for knowledge-based decision making processes. That a decision making process is characterised as "knowledge-based" entails, as far as we are concerned, that factual and scientific knowledge is gathered to support the decision making process and that a genuine public and democratic debate takes place with regard to the decisions under consideration.

As previously mentioned, we here concentrate our efforts on the second of these two parameters, which is why it is also this aspect we focus on in our model for knowledge-based decision making processes. The first parameter has been included in our model, but only in general terms (see "collection of factual information") in association with the administrative processing of the decision making process.

Our model for knowledge-based decision making processes is a four stage process model, the four stages being as follows:

- The executive authorities administrative system.
- The executive authority / internal political stages.
- The legislative authority / external political stages.
- The public domain.

It is the communicative processes which take place between these various process stages which are key to our interest in the project. Communication between the administrative system and the executive authority is at the heart of a political decision making process. This process has been highlighted in the model with blue horizontal arrows. All significant decisions which the executive authority wishes to see implemented have to be submitted to the legislative authority. Communication between the executive and legislative authorities is marked by horizontal red arrows. The fourth stage of the model is the public domain. Communication between the public domain and the model's other stages is indicated by green horizontal arrows.

One could say that it is characteristic of a number of the decision making processes described in our analysis that the early communication processes (those at the base of our model) have been weak or have been lacking altogether. The most significant aspect of our model is therefore a concentration on and strengthening of the early communicative processes in the decision process. By strengthening these aspects of the decision making process, the necessary democratic control over these processes will also be strengthened.

It is especially the element of the model relating to 'Early dialogue between the executive authority and the legislative authority' and that relating to 'Early involvement of stakeholders' that, as far as we can see, are important in relation to a strengthening of democratic potential if this is desired. By strengthening these two elements in the model the opportunity for participation will be strengthened, and thereby the potential will exist for increased public participation leading to a strengthening of the democratic aspects of the process.

The forming of a new coalition government in June 2009 follows on the epoch-making election result of the 2 June. For the first time in the history of the Greenland Home Rule Government Siumut will not participate in government, which has resulted in some very interesting developments in Greenlandic parliamentarianism. During the election campaign the government then in office

was the subject of repeated attacks across a broad front because of perceived nepotism and secretive government practises. The opposition as was indicated that it was their intention to alter these practises if they were elected, which of course they now have been.

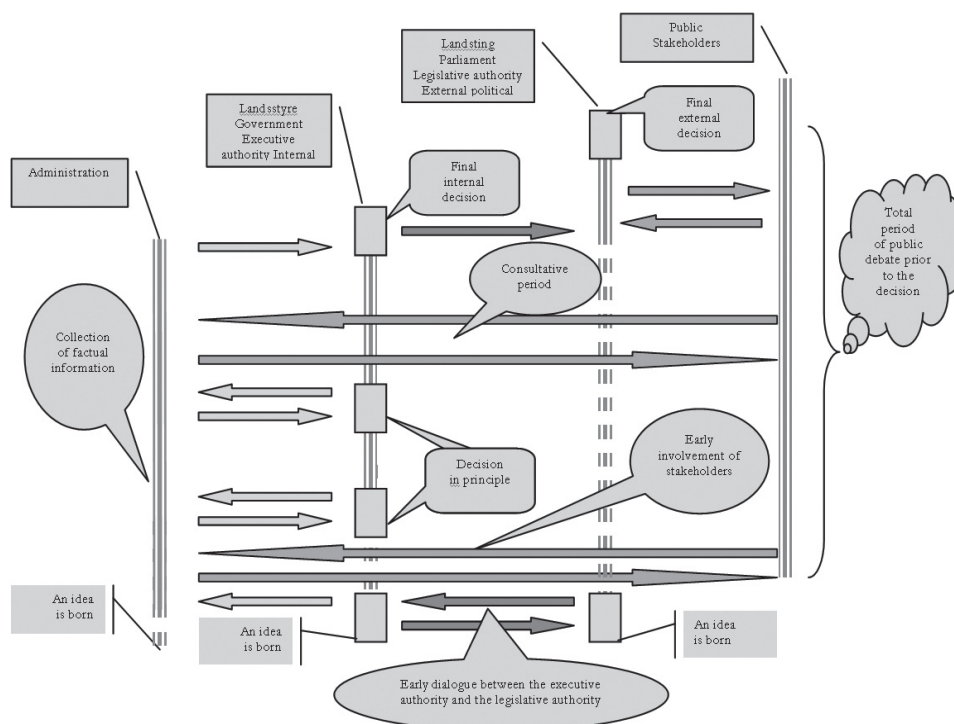


Figure 19. Four stage model for knowledge-based decision making process. (The authors' own work).

In this connection it was very interesting to note that one of the first actions of the new government has been to initiate activity to strengthen early stage communication between the executive and legislative authority. The government has introduced, as something new in Greenlandic politics, coordinatory committees consisting of three highly-placed government politicians and three highly-placed politicians from the governing parties' parliamentary groups. The declared intent of these measures is to ensure a significant improvement in the communication between these political bodies at an earlier stage in the process.

Since 2007 the central administration has been through extensive organisational changes. One of these changes has been the adoption of a more project-oriented working practise. This is a process which is gradually beginning to take shape. For example, in mid-June 2009, a report was published detailing aspects of the existing project organisation. This analysis concluded that the central administration's performance in relation to performing stakeholder analyses and including stakeholders in decision making processes has been very poor (Munck 2009). This is precisely the same conclusion that our analysis has reached.

In our opinion it is thus of crucial importance to the democratic process that focus is directed to that aspect of our model entitled "Early involvement of stakeholders".

In this area some interesting projects have been initiated by the central administration since, in connection with the added focus on project work, it has been decided that a project management model called PRINCE2 will be utilised. One of the areas identified as of significant importance by PRINCE 2 for successful projects is the early inclusion of stakeholders (PRINCE2 2007).

There are thus a number of factors that indicate that the development of the administrative and political situation in Greenland has reached a stage where it is ripe for the inclusion of knowledge-based decision making models such as that described in this report in the coming year's political and administrative work.

6. Discussion

In conclusion we wish to include some considerations relating to the model and the rest of Scandinavia especially the Scandinavian periphery. It is our opinion, that there are at least two areas in which the situation in Greenland is comparable to that in the rest of the Scandinavian periphery.

Greenland is characterised in some areas by a markedly reserved form of public debate. The reasons for this are, in our opinion, to be found in the specific cultural traditions relating to the exchange of opinions, and, in the sparsely populated regions of Scandinavia, the characteristic reserve which, by outsiders, is often mistaken for indifference.

Furthermore, the peripheral and sparsely populated areas of Scandinavia, including Greenland, are generally characterised by a lack of strong NGOs or a truly critical and independent press which can provide the sort of democratic criticism necessary and expected from the fourth estate in the local public arena in which locally rooted debates often take place in relation to local political decisions.

References

- Alcoa (2009) http://www.alcoa.com/brazil/en/news/releases/2009_01_26.asp?initSection=1. Published: January 26, 2009
- Andersen, J. G. (2002) Medborgerskab og politisk deltagelse. In Albæk, E., P. M. Christiansen and B. Møller (red.) *Demokratisk set*. Århus: Aarhus Universitetsforlag. pp 162-179.
- Fairclough, N. (2008) *Kritisk diskursanalyse*. Hans Reitzels Forlag, København (Original in English 2001).
- Hansen, K. G. (2004) *Communication and information; technical quantity and quality*. Working paper No 183, NORS Paper No 60. NORS. Roskilde: Geography, Roskilde University.
- Landsstyret (2007) *Redegørelse om energiintensiv industri*. Grønlands Landsstyre. (FM 07/49).
- Mandag, M. (2002) *Demokrati i Europa: Baggrund og fakta*. http://www.europadag.dk/demokrati_bag.asp
- Munck, K. (2009) *Projektarbejde I Hjemmestyret, undersøgelser og anbefalinger*. Mundtlig fremlæggelse i Lederforum. 15. juni 2009.
- PRINCE2 (2007) *PRINCE2 – Projektledelse med succes!* London. The Stationery Office.
- Tønder, Lars (2000). 'Diskursteori i Danmark'. In Politiske Studier. Nr. 8, november 2000.

The proposed ALCOA aluminium smelter in Greenland: A case study report

Peter Schmitt, Stefanie Lange,
Richard Langlais

Preface

You have to know what you're doing to survive beyond the villages and towns of Greenland. Once you get out the door, it starts. You can freeze, you can get lost, you can fall through the ice on the lakes and sea and you can fall into holes where there's no ice at all anymore, when you hadn't noticed you'd wandered onto a snow-covered glacier. You need to know what you're doing, and if you don't, you soon find that out. You'll probably starve to death or perish in an avalanche . . . if you don't know what you're doing, that is.

When the Home Rule government of Greenland and the American-based ALCOA Inc agreed to enter a process of deliberation and negotiation about the possibility of building a world-class aluminium smelter, they began a long journey into finding out what they didn't know. The Home Rule government knows how to help its citizens survive in the demanding climate and geography of its country, while ALCOA knows more than anyone else could ever know about everything you can, and can't do, with and to and around aluminium. Greenland is one of the keys to understanding global climate change and ALCOA is an expert on world resource markets. When ALCOA came to Greenland, however, it wasn't much like what they expected, and the Home Rule government, for its part, had to stop and catch its breath a few times in the rarified air of global finance that ALCOA is so used to moving in. Both see a path where their counterpart can help them survive into the future. Each can guide the other to achieving its aims, if they can only learn what the other already knows. It's not easy breaking your paradigm or mainstreaming your Gulfstream, but there are ways to getting there and these two partners seem well on the way past the beginning of their now shared journey.

When we tried to think of how we could study the interaction of different knowledge-based tools in the Nordic periphery, the case of the Greenland aluminium smelter proposal appeared to be perfect for our aims. The rough and beautiful land- and sea- and ice-scapes provide a clear background field against which the strategies and plans and policies of the world of human beings stands clear for what it is, a sustained effort to find a sustainable road into the future. That the ages-old knowledge of their aboriginal roots still has a place in the Greenland of today appears to be a strength in the world of engineering, hydro-electricity and venture capital. It seemed to us that both ALCOA and the Home Rule government represented forms of knowledge that the other needed, and how they would deal with that difference has remained a stimulating question, an appropriate field of enquiry.

In keeping with the spirit of this knowledge-sharing activity, our respondents must be thanked for their patience in enduring our interviews, both in Greenland and by phone, occasionally from the other side of the world. Numerous organizations were of superb assistance, but above all, we must thank the Nordic Council of Ministers for having funded this work via its Nordic Research Programme. At Nordregio, Johanna Roto must be thanked for having produced our maps, while Asli Tepecik Dis, a Masters student at Stockholm University, deserves our gratitude for having helped us as part of her internship at Nordregio.

1. Introduction

With regard to knowledge-based tools for sustainable governance of energy and climate adaptation, Greenland is an important object of study for several reasons. Because of the enormous quantities of ancient fresh water still locked in its continental ice cap, Greenland is a thankful example when illustrating the causes and impacts of global climate change, especially with regard to the role of the Arctic. As the ice cap melts due to increasing average temperatures—a clear impact of climate change—the resulting melt-water in turn affects the temperature and content of the world's oceans, which then adds to further change. As ever more recent studies are published, the rate of that change is shown to be proceeding at rates even more rapid than those anticipated in the most recent overviews of the Intergovernmental Panel on Climate Change, or IPCC, as it is most commonly known.

In the realms of politics and economics, the current post-colonial situation of the Greenland Home Rule government (established in 1979) vis-à-vis Denmark has several relevant aspects. Among them is the fact that it is the first and, so far, only territory to have ever left the European Union (then the European Community), which it did voluntarily in 1985, while Denmark remained. Its relation to the Kingdom of Denmark retains interest for other nations in similar situations, either historical or on-going. Most recently for Greenland, its process of political devolution from Denmark was expressed in a non-binding national referendum, held on 25 November 2008. A desire for further discussions of increased autonomy was approved by approximately 75% of those who voted.

By definition, however, complete autonomy requires both political and economic independence. A number of factors have relevance for Greenland's potential viability. Oil and mineral exploration are considered to be increasingly promising, especially since global warming implies greater access to whatever deposits, currently under the edges of the ice cap, that might be waiting to be discovered as the thinner, coastal ice recedes. By the same token, increasing run-off of melt-water will only add to the present almost completely undeveloped hydro-electric generating capacity throughout Greenland. These considerable potentials invite questions of how they can best be utilized. Since aluminium production is heavily dependent on electricity, the construction of aluminium smelter(s) provides a possibility for exporting electricity (in the form of aluminium); it also presents an inviting prospect for those who would encourage increasing industrial development as a road to increased autonomy for Greenland.

Since the construction of a “world-class aluminium smelter” (as it is typically referred to), with its attendant hydropower generation facilities and infrastructure, is such an enormous undertaking anywhere in the world, almost always of mega-project scale, the fact that Greenland and ALCOA Inc.—known more commonly as just “ALCOA”—are in advanced stages of negotiations for the construction of such a complex makes it a suitable case for study in the present project. With its concern for learning more about how different kinds of knowledge-based tools are used for sustainable governance of energy and climate adaptation in the Nordic periphery, the case of the planning process around the proposal to construct an aluminium smelter in Greenland is highly appropriate. As far as our study has been able to ascertain, that process appears to have begun in 2006, with contacts between ALCOA and the Greenland Home Rule government; this study therefore covers the three years between 2006 and 2008. At time of writing, a final decision about the location of the smelter has already been made, and those involved must still find answers to numerous questions, solve some considerable problems and undertake a number of further investigations before the construction can be considered to have commenced.

1.1 Methodological considerations and key results

The objective is to provide a description of knowledge-based tools that focus on the policy planning phase, using the example of the current situation in the Alcoa/Greenland megaproject case. We investigate how knowledge is obtained, applied and communicated within the megaproject's planning process. Knowledge is naturally embodied in people's minds and thus is to some degree mobile. This commonplace is useful to recall because it strengthens the notion that place matters. With regard to Greenland, what are the relevant institutions, and more precisely, who are the individual experts? Are they totally Greenland-based or are they (and their knowledge) imported? To explore this further we need to distinguish between those forms of knowledge that can be easily codified (e.g. information to the municipalities about how the planning process is intended to take place) and so-called tacit knowledge, which is bounded to the knowledge carrier and difficult to transfer (e.g. expert's knowledge of impacts caused by aluminium smelters in arctic-peripheral locations). In regional development planning, this distinction is critical, as it centralizes the question of how far local/regional communities are able to organize and finally institutionalize learning processes and thus shape and foster their regional development path (cf. the discussion on learning regions by e.g. Hassink, 2001). Such 'theoretical concepts' and their 'normative transformation' are often discussed and empirically verified using the well-known examples in southern California or southeast England. But what is the situation with regard to a peripheral-arctic environment (and its specific geo-political, historical and socio-cultural setting) with an assumedly low critical mass of available knowledge carriers in relation to such a highly 'knowledge-loaded' mega-project? Having asked this, we argue that the applicability of our findings and their compilation in knowledge-based tools rests upon the critical reconstruction of the planning process around this mega-project (cf. case study report). We therefore propose the ensuing checklist of practical tools. Our study reveals that not all of its elements were covered in an appropriate manner by the planners in the case.

Knowledge-intensive Megaproject Planning in specific arctic-peripheral environments; checklist:

- screen who identifies sources of knowledge that inform the stakeholders concerned
- identify the sources of knowledge used to explore any issues/impacts related to the project
- assess how such kinds of knowledge were used in the past
- explore how local knowledge management system can be incorporated in specific governance configuration established for the megaproject. What kinds of networks/coalitions are needed?
- identify cornerstones (of this governance configuration) with regard to the flow of knowledge (acquisition>application>dissemination). Who are the powerful institutions/actors?
- identify and inform who decides which kinds of knowledge are valuable. Which kinds are thought of as less important? How will decision-making process(es) be designed?
- investigate what kinds of knowledge can be localized and exploited in the home region. What other kinds need to be imported from other regions (e.g. experts and their tacit knowledge)?
- analyze how a local knowledge management system can assure that different kinds of knowledge are communicated to the public and stakeholders in an effective way.
- assess how a local knowledge management system can assure that different kinds of knowledge are being maintained and institutionalized so that they contribute to and help organize the permanent absorption of (new) knowledge in this respect so that it contributes to a localizable learning process within a specific community?

We consider use of the above checklist to be an indispensable pre-condition for implementing megaprojects in arctic-peripheral environments and their specific settings. Here the role of knowledge and the complex interplay between localized sorts and sources of knowledge and non-localizable ones (those which have to be imported) is of great importance—since there is the risk that such projects will only be governed by the functional logic of global footloose investors and a certain

policy elite in the region at hand (here: Greenland). A local knowledge management system should ensure not only the incorporation of all sorts of Greenlandic expertise, but also maintain and further develop the specific lessons learned (here: learning by doing, learning by interacting etc.). In the long-run such a system could contribute to the endogenous development capacity of such specific peripheral environments and in a sense to their capacity to shape their own regional development path—against the background of the specific geo-political context of Greenland and its enormous energy resource potential. The concrete application of such a checklist would require and perhaps even challenge some specific ‘organizing resources’ (here e.g. by the Greenland Home Rule). We would argue, however, that such an investment is worthwhile in the long-run as it can help to better facilitate such complex and extremely knowledge-based planning processes. In addition it can help to improve the assessment of the potential environmental, social and economic impacts of such megaprojects and, finally, to make the whole process more transparent.

1.2 Approach

The following is a description of the analytical approach, focusing on micro-level actor network analysis, and used to study the Alcoa Greenland case. The case of ALCOA/Greenland is typical of a situation that is suited for this approach. As a focus of research it is explicitly and implicitly interdisciplinary in nature. The approach is question-driven—often a hallmark of interdisciplinary research (Klein, 1996)—and uses actor-network-theory in its most methodological sense, as a sociology of associations (Latour, 2006). Its theoretical aspect, classically speaking, claims that our notions of sociological concepts are rediscovered and re-represented as we follow and describe the actors themselves, as they move through their actions and interactions, as strings of mediators, thereby constituting actor-networks. Speaking with Latour (*ibid.*), our task is to “deploy actors as networks of mediators”; as such, they are “the social.” By following the actors in the ALCOA/Greenland case, we create the social that is relevant for understanding that complex of interactions.

The very idea of “the social” itself exists in the configuration and description of the actor-network: materially, spatially, temporally and abstractly; it lasts as long as the actor-network has meaning for the actors. In other words, the performance of a study based on actor-network-theory, by virtue of its intricate and thick description, seeks to expose as much as it can of the complex interactions between actors so that they are clearly discernible, so that as much knowledge as possible can be gathered, inscribed and preserved, until the extent of the enquiry suffices (Law, 2004; Latour, 2005; Langlais, 2006). Actor-network discovery, elucidation and translation has been performed by following as many of the relevant actors as possible. In-depth interviews (recorded, where possible), text analysis (reports, public records, policy statements, decision documents, etc.), participant observation at meetings of various kinds, group discussions (an element of action research), thick description and archival searches have been used. As such, this has, by definition, been eminently suitable as an integrative approach for a process of interdisciplinary teamwork (Lattuca, 2001).

Conflicting understandings and knowledge of the scientific “story” of climate change may be recruited for a variety of political ends. By studying the micro-level in Greenland, we address whether there is something different about climate change in aboriginally-informed knowledge tools, in what way that may be so, and how that is being transformed into effective social change. The local appears in some cases to be superseding the national, and the relative weights of different jurisdictions are in flux. The degree to which this is applicable indicates the manner, directions and speed with which planners, stakeholders and decision-makers are expected to (re)act. Who is doing what? Are any of their actions especially innovative when considered from an international perspective? Do they demonstrate that they understand the scientific “story” and knowledge about climate change in different ways? As programmatic responses proceed, are specific spatial and regional development impacts (changes in employment, mobility, etc.) generated that can be of concern in Greenland? How does that feed back to the municipalities who have been bidding for the ALCOA Greenland smelter project? Can planners cope with the need to develop 100-year plans that can cope with the smelter project? It appears that the relations of power and the space for change are being re-arranged.

Some of the literature has been helpful in pointing the way to answers. Hukkinen (1999) shows how planning officials are co-opted in making sustainability-related decisions, even when they “know better.” Dolšák and Ostrom (2003) open the way for management of global-scale resources at local, human ecological levels in terms of trust, social capital and common property. Detailed resolution of such processes of political ecology and the role of power in local-level sustainability policy and decision-making is found in Flyvbjerg (1998) and, with regard to reflexive governance, in the anthology by Voss, et al. (2006). Lundqvist and Biel’s (2007) work, on interaction between national and local governments in climate change programs, is instructive how empowerment and envisioning are crucial for disadvantaged communities in setting ecological sustainability aims, and how imperatives of national and international security clash with those aims at local levels, including where aboriginal peoples are in the majority (e.g., Heikkinen, et al., 2003; Langlais, 1995; 1999; 1999b).

2. An annotated chronology

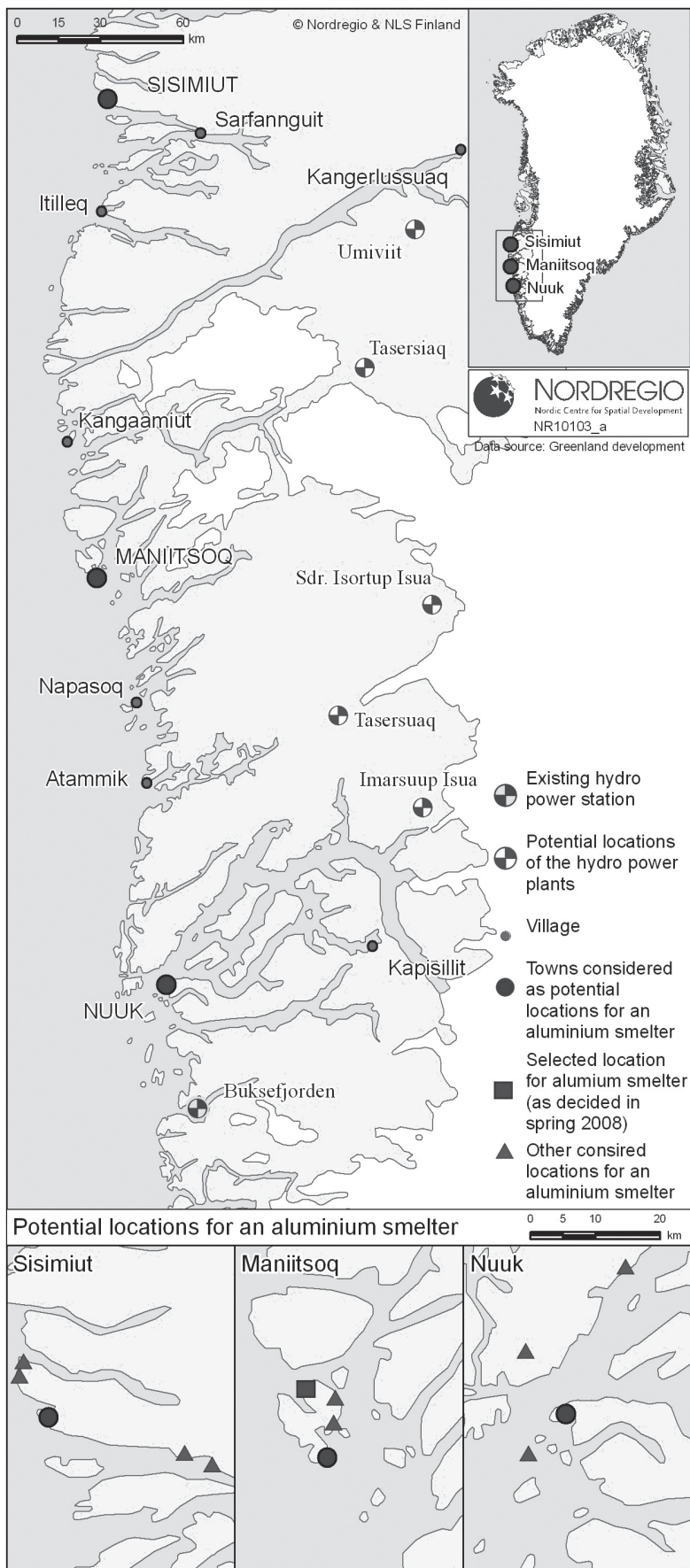
The following chronology is the result of our investigations, based on our interviews with respondents, as well as on published and archival material. The capital letters in parentheses represent the various respondents. In order to avoid tedium as much as possible, we have avoided overly using such phrases as, “it was mentioned,” “the respondent said that,” and so on. Consequently, the text is a composite of the material that was collected, and the most verifiable chronology that we have been able to produce to date. Figure 1 (p. 17) presents a graduated timeline of the most important phases of the chronology.

Although we found that the first idea for developing Greenland’s hydropower potentials in combination with the construction of an aluminium smelter emerged in the 1970s, this has not been investigated further (C, I) at this time. In 2006, the project idea started to become more concrete when an initial contact was made between ALCOA Inc. (or ALCOA, and earlier, until 1999, known as the Aluminum Company of America) and Greenland. The question of who actually made the first contact must remain open, even if there is evidence that supports each of several views regarding the answer. According to most of the respondents who actually live and work in Greenland, ALCOA contacted the Home Rule government to express interest in investing in Greenland (C, L, D, E, B). One respondent indicated that the Joint Committee between the United States and Greenland—a platform where American and Greenlandic stakeholders meet—had been crucial for instigating the project (B). The respondents from ALCOA, however, recalled that the Home Rule government had sent an inquiry announcing interest in developing Greenlandic hydro-power potentials.

The Home Rule government also contacted Norsk Hydro, a Norwegian company that, among other things, produces aluminium. The Home Rule government, however, made an arrangement with ALCOA and decided to work further with them. This happened at a rather early stage in the process (May 2006), even though the exact date is not clearly stated. In any event, the decision was made by the Home Rule government without involving other stakeholders or giving any justification at that time (I, L, R, B).

In Autumn 2006, the Home Rule government established the Greenland Development Agency, as a company, for dealing solely with the smelter project and for managing the contact with ALCOA. Although the Greenland Development Agency’s formal role is promoted as being the link between ALCOA, the Home Rule government, the municipalities and, thus, the public, its actual performance has not always been perceived in accordance with the formal description. At the same time as it can be considered as having executed its primary mandate effectively, since the proposal is going ahead, it has also been criticized as being less than communicative and unable to receive criticism (I, N, C, K, J).

Map 1: Potential locations for an aluminum smelter



The Home Rule government and the Greenland Development Agency organized a seminar in Nuuk, in November 2006, to inform three selected municipalities (Nuuk, Sisimiut and Maniitsoq) what their task would be in the ensuing process. The three municipalities had been pre-selected in the previous months according to their location with regard to potential hydro power development (D). Having then been pre-selected, their proposals were then to be subjected to a selection process that would result in the choice of a site for ALCOA's consideration. At the November seminar, they were requested to send in their proposals for being host sites of the eventual smelter/hydro power mega-project by 15 February 2007. Their proposals should each designate three feasible smelter sites within the area of their municipalities; their proposals would have a dual role, since they should be simultaneously framed as applications for hosting the actual aluminium smelter. Additionally, representatives of the municipalities were invited to participate in a trip to Iceland in January 2007, to visit the ALCOA smelter there. When that trip was completed, a series of public meetings were held in each municipality, for the purpose of informing the inhabitants and asking for their input on the matter. As it happened, employees from ALCOA also joined those meetings (A, Q, D).

Several points of criticism have been raised by the respondents regarding this latter part of the process. Firstly, the time-frame set by the Home Rule government has been perceived as too tight for being able to thoroughly investigate the sites and the potential impacts on them and their surroundings. It was mentioned, secondly, that the timing chosen for this type of task was inappropriate, since at that time of year the sites are covered by ice and snow and the weather conditions are unfavourable for thorough investigations (I, H). As respondents whose roles were more from the point of view of observers indicated, the municipalities ended up being in competitive positions against each other, rather than of asking critical questions or supporting each other in finding the most appropriate site (L, Q). (This begs the question of, "Appropriate for whom?" of course.)

All of the applications were sent to the Greenland Development Agency, as instructed. The Agency then translated them from Danish into English and forwarded them to ALCOA (I).

During the same period (Spring 2007), NIRAS—a Danish consulting engineering company—began analysing the eventual socio-economic impacts of the aluminium smelter project. Their report was provided to the Home Rule government to function as a background paper for their process of coming to a decision on whether to go ahead with the project or not.

A "Strategic Environmental Assessment" (SEA) was carried out; this was mentioned by those respondents who had either been involved in it, or who simply "knew that something was going on." The way in which environmental impacts were investigated, however, was not perceived as being sufficient. Some respondents indicated that there was a lack of sufficient information, especially regarding eventual emissions (CO₂) from a smelter and the possible consequences of damming Greenland's largest lake for the purpose of producing hydro power (J, G, Q, H, E). Even though the project proposal is huge in scale and in its probable impact on Greenland, there have been few activities carried out by NGOs in relation to environmental issues.

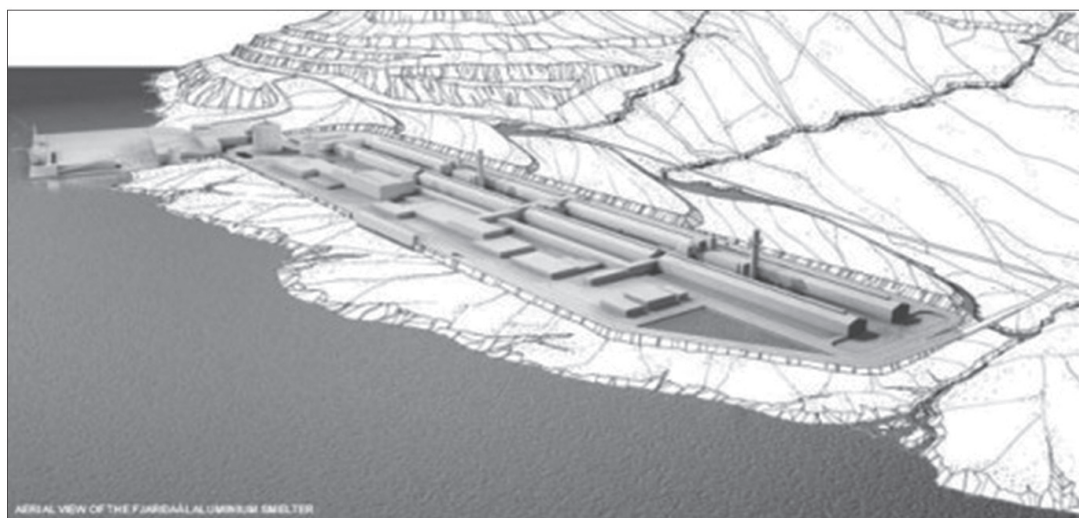
The Greenland National Museum and Archives, in parallel, had been observing the application process from the perspective of archaeological and cultural heritage matters, and were to conduct field work, during the summer of 2007, which would investigate the selected smelter sites and lakes. The results of that work would not be available to the selection process until well after the completion and submission of the municipalities' proposals.

Representatives of ALCOA came to Greenland during the summer of 2007 and, together with staff from Greenland Development and the Home Rule government, visited all three municipalities for the purpose of gathering more information about the sites. For stakeholders in the municipalities, this was a welcome opportunity for providing valuable information and posing important questions to ALCOA (I).

In March/April 2008, announcements were made that Maniitsoq was the municipality that had been chosen as the one where the aluminum smelter would be placed. The decision was made according to a calculation of which site would have the lowest construction costs; that decision was perceived by many of the respondents as being rather fast and rationalistic, and in spite of the potential social or environmental impacts on the area (N, B, H, D, G, J). The decision process was not public and its deliberations and details have subsequently not (yet) been published. Neither the inhabitants of, nor the stakeholders in, any of the municipalities were able to follow the process as well as they might have wished, and for most of them, the choice of Maniitsoq was surprising. Two main views emerged among the respondents; one, that the decision was actually made by ALCOA and the Home Rule government simply accepted it (I, H, D, G), or, two, that ALCOA gave a recommendation, but that the actual choice was finally decided by the parliament (A, E).

Picture 1: Smelter site in Maniitsoq municipality (project model).

Sources: SIKUnews (2008).



Immediately after the decision by the parliament, the Home Rule government decided to go ahead with the project and allocated 17 million DKK, for further investigations. Consequently, NIRAS started a deep revision of its report on socio-economic impacts. In this connection, the respondents were mostly concerned, or worried, about the financial model, which still has to be negotiated between ALCOA and Greenland (either a partnership, or concession, model); and about the question of how to compensate for the lack of a qualified labour force (J, G, C, R, B, M, D, N).

Some reflections on the present situation

Depending on the financial model eventually chosen, Greenland will invest between 10 and 20 billion DKK; either model is nevertheless perceived as entailing a huge sum, which is on a scale that can compare with between ten and twenty years of its annual total Gross Domestic Product (GDP), respectively. Several of the respondents were critical about the risk that Greenland will take by investing in one single mega-project, in the sense of “putting all of one’s eggs in one basket,” primarily since funding is urgently needed in other fields e.g. for hospitals, schools and transport infrastructure (R, B, I, P).

Up to 5500 workers will be required for the construction phase, for both the hydropower plant and the aluminium plant, for at least two years. Afterwards, 400-800 qualified workers will be needed to run and maintain the smelter (NIRAS 2007). Maniitsoq has about 5000 inhabitants, living in a situation that is, by normal European standards, isolated, i.e. there is no road connection to any other city. ALCOA prefers to rely on the local labour force as much as possible, but the

hunters and fishermen have collectively expressed the opinion that they are hardly interested in swapping their more flexible working conditions for a structured work place in an industrial facility. Furthermore, even if the aluminium smelter actually does end up becoming attractive to Greenlandic workers, the national labour market would be drained. As a result, as the situation appears now, a considerable number will have to be hired abroad. The respondents were mainly apprehensive about the eventual emergence of societal and cultural problems (e.g. the ratio of men to women, integration issues, emergence of ghettos, and so on), none of which they feel have been properly discussed or investigated yet. Due to Maniitsoq's unique characteristics, more commonly applicable regional policy tools and practical values from, for example, Iceland, or Norway, cannot be applied (Gloersen 2008).

The planning process itself is being developed in parallel with the mega-project; in other words, the planning procedure and the tools to be used have not been prepared in advance. The Greenland experience in planning that has been gained locally, and that is based on mineral and oil exploration projects of comparable scale, is not being adopted (N, C, P, R, O). In general, the process until now has been described as evolving "very fast" (I, B, N, D, P, Q, R, E) although pressure from ALCOA has not been perceived so far, and is not considered to be the rationale for the haste that is being experienced (N, A, K).

A relation between the project and the debate on independence from Denmark was often emphasized by the respondents (N, C, I, L, P, R, B, M, D, E), based on either a conviction or an assumption that the aluminium smelter will be a fundamental economic tool for national development. A final decision between ALCOA and the Greenland Home Rule government is expected to be announced in the autumn of 2009.

1970s	First interest in developing hydro power potentials
2006	
Feb. 2006	First contact between ALCOA and Greenland
May 2006	Agreement between Home Rule government and ALCOA
Autumn 2006	Establishment of Greenland Development Agency
Nov. 2006	Seminar in Nuuk, with all three selected municipalities
Dec. 2006	Invitation to municipalities to travel to Iceland to visit the ALCOA Fjarðaál smelter
Jan. 2007	Trip to Iceland, and public meetings in the three Greenland municipalities
15. Feb. 2007	Deadline for the proposals for the smelter site
Feb./March 2007	
	NIRAS works on socio-economic analysis
Summer 2007	ALCOA visit municipalities / Greenland National Museum and Archives works with archeological field work
April 2008	Final decision on Maniitsoq as the smelter site
Spring 2008	Decision by Greenland Home Rule to go further with the project
Autumn 2009	Anticipated decision between ALCOA and Greenland Home Rule

Figure 1: Chronology of events, compiled according to the respondents' interviews.

3. Knowledge tools in action

Shaping the base – about the acquisition of knowledge

“One of the local fishermen said you should also have a look at this particular site. It turned out that this one became one of our best locations for the smelter.” (H).

The above statement is emblematic for the acquisition of knowledge around this highly complex mega-project. The criss-cross analysis that we performed on the data we collected from our interviews reveals that a systematic procedure to obtain all relevant sources related to the mega-project has not taken place.

This observation comprises two dimensions: at first there is the acquisition of professional expert knowledge to be mentioned. There is a broad consensus among most of the respondents that the existing institutions that might be able to enlarge the knowledge-base regarding this project on Greenland (such as for example BMP, Avataq, Saving Iceland) have not been exploited to the maximum nor, at the very least for acquiring some further expertise from abroad (B, E, R). Also, some of the basic data and information that are required to fully assess the project's scale and scope are missing (A).

Secondly, a criticism that has been voiced is that the available information about the project has been kept in a short form by the two main players (Greenland Development Agency and ALCOA), which has in return restricted the responsive capacity by other institutions and stakeholders (B, I, P, R, E). On the other hand, at least regarding the hydro power potentials, as well as for mineral, oil and gas explorations, a broad base of knowledge has been developed as a result of other proposals (G, R).

In addition, it has been emphasized by the majority of the respondents that most of the required knowledge is per se not available in Greenland (e.g. C, K). This means, in return, that knowledge needs to be imported—or in other terms—that the specific persons carrying such specific tacit knowledge have to be identified and, finally, ways have to be found to codify their specific knowledge so that it is accessible for other stakeholders. Also, the investor among our respondents confirmed that this project requires an extreme learning process in Greenland, which includes as well “to learn how such peripheral countries conduct such planning exercises” (A). On the other hand, it has been put forward that several local stakeholders do have vastly superior knowledge of the local environment and of the diverse sites within the—from a European perspective—extremely large areas that are covered by the three selected municipalities that were potentially foreseen as locations for the aluminium smelter (J, C). Another item is the uniqueness of the project as such. Even the potential investor, ALCOA, has admitted that experiences from other so-called “first green projects” (e.g. from Iceland), even if they are helpful, are still significantly different in approach and situation from what awaits in Greenland (A).

The management of knowledge in a historic perspective

With regard to the general status of knowledge and experience in Greenland with regard to mega-projects, the lack of having secured the flow of knowledge through time was critically expressed by a large range of respondents. The maintenance of such specific knowledge is rather weak due to the fact that specifically Danes do hold superior responsible positions in politics and administration, but usually stay in their positions in Greenland for only a couple of years. This can be problematic in two ways: firstly, when they arrive in Greenland they do not have a thorough understanding of the Greenlandic society. Secondly, they take their specific knowledge, gained through their stay and work in Greenland, with them when they move back to Denmark (B, M). In other terms, it remains difficult to maintain institutional learning processes and to develop a kind of tailor-made institutional culture for Greenland.

A non-transparent intra-regional knowledge transfer

Apart from the obvious drivers of the project (ALCOA and the Greenland Development Agency), there is a broad consensus among the respondents that the flow and the transparency of knowledge about and around the project have not been handled in a satisfying manner. An example is the role of the Greenland Development Agency in the planning process, which is rather blurred for many Greenlanders and even for most of the key institutions that have been interviewed (E). Another example is the information flow between Greenland's Home Rule and the civil local society in Greenland, which was felt to be insufficient (G, H, I, M). Unsurprisingly, the knowledge and information transfer between the two parties, those that have initiated the project (ALCOA and Greenland Development Agency) and those that are directly concerned (e.g. the municipalities), was reflected differently (A, I, P). Regarding the latter party, it was felt that the process has been largely a closed-shop (B, G, I, N, P). Besides this feeling of exclusion, it has been experienced as difficult to get the required data and information from the responsible Greenlandic planning authority. This situation led to mistrust against this institution, so that some local institutional stakeholders were left to contact ALCOA directly in order to get solid information. They felt that ALCOA has endeavored to inform them correspondingly (E, H, I, P). Even staff close to the planning process within the Greenland Home Rule government confided that the Greenland Development Agency does not provide them with all the information that might be related to the project (B). It has even been stated that they have not delivered more information than one could get from ALCOA's homepage, with an unsurprisingly dominant focus only on the positive effects of the project (E). Another example of a criticism related to exclusiveness is that a considerable part of the codified knowledge and even public meetings have not been translated into Greenlandic (Q). Apparently direct personal knowledge transfer during both closed and public meetings was very much restricted by the particular language capabilities of the persons on both sides of the table, namely the "experts," represented by the responsible planners and potential investors, and the "public," since English, Danish and Greenlandic were all being used in the same settings at the same time (M).

Such, for the most part, blurred regional knowledge transfer leads to a dead-end, since it has also been difficult for the local media to report in a corresponding manner on the planning process as well as on the project and its potential implications as such. In connection to this, it is interesting to notice that a handful of stakeholders have expressed their critical reflections on the project via newspaper articles (Barfoed 2007, Klesit 2008, Myrup 2008) and received responses in the same way (Drechsel 2008 responding on Myrup 2008). This in turn has provoked an occasional reply by the Greenland Development Agency, so that some crucial issues related to the scope of the project (e.g. How many lakes are being used for the two new hydro power stations that are needed for the energy supply of the smelter?) have been released to the public. Informing the public only in this vein has even reinforced the level of suspicion about there being a hidden political agenda (D, E).

About the sharing of knowledge with local stakeholders

The critique discussed above, regarding the non-transparent intra-regional knowledge transfer, makes it comprehensible why it was felt that it also hampered the sharing of knowledge with local stakeholders. Even though a great interest has been shown by the Greenlandic inhabitants—in particular regarding the environmental impacts of the project (D, G, I)—it has been indicated by numerous respondents that it was difficult, if not impossible, to organize a thorough participation process locally. In principle, two main reasons have been brought forward: the first regards the general haste that appears to have characterized the process. Specifically, the responsible stakeholders in the municipalities criticised the tight agenda that was set by the Greenland Development Agency (H, I, R). Secondly, numerous respondents had the impression that some specific sorts of knowledge were either not provided by the drivers of the project or were not accessible for them (I, J, G). It was also perceived, however, that the spatial planning section responsible for the environmental impact assessment study in the Home Rule followed a difficult strategy, as they have were active in thoroughly informing the public at least about those aspects of the project they were designated as being responsible for (M, N). Though their engagement could not compensate for the general observation by almost all respondents (apart from the main promoter of the project, of course)

that a clear master plan of the planning process and its design have not been communicated to the concerned stakeholders (e.g. E, H, I, K, N). The process so far has been reflected as being rather chaotic and driven mostly in an incremental manner (e.g. H, K). Also corresponding to that picture is the way in which the public meetings were organized, since the promoters of the mega-project informed instead about things that they did not know the answers to at that time, instead of assisting in highlighting the question of which burning issues might (or should) be discussed (N) at the meetings.

4. Discussion

About the governance of knowledge

When analysing the perception of the flows and accessibility of knowledge related to this mega-project, it became obvious that the Home Rule Government and in particular the one-purpose company, the Greenland Development Agency (which was created for and dedicated solely to this particular mega-project), have an extremely central role in this respect (besides that of the potential investor, ALCOA). The close connection and control between the Greenland Development Agency and the cabinet was considered by respondents as being peculiar, or even suspicious, as it seems to bypass the required comprehensive public information procedures (I). What completes this impression is the fact that the director (and most of his staff—whom were characterised as lacking the experience for handling projects of such mega-scale (E))—is a former member of the Home Rule Government, and is the direct contact person for ALCOA. It has also been anticipated that the Greenland Development Agency prefers to shape a pure Greenlandic project, since most of the staff members are Greenlanders with a strong interest in using this project as a powerful tool in striving for more independence from Denmark. Unsurprisingly, this certain constellation, a so-called “one door principle” (E), was criticised by numerous respondents, since it gives too much power to the national level and too little to the stakeholders who are concerned with their local perspective. On the other hand, there were doubts about whether the local civil servants are prepared to deal with a global player such as ALCOA (P). Another engaged stakeholder merely reported that he often just tries to get in contact with ALCOA directly, but they have told him that they are not allowed to speak with him. It is assumed that this prohibition has been stipulated by either the Home Rule Government, or by the Greenland Development Agency (D).

In connection with this it was noted by various respondents that the “size” of this project goes far beyond normal Greenlandic standards. This challenges in particular the formal existing decision-making structure, which is apparently not prepared to handle such mega-projects either (B, H, K, M, R). What would be needed is an enormous foresight process, since this project not only concerns a particular municipality, but will have a significant influence on Greenland’s future development path (N).

Localising global projects - about the specific role of the municipalities

As indicated earlier, the municipalities put forth the criticism that only a minimum of information has been delivered to them (G, H, K). This puts, in turn, the responsible stakeholders from the municipalities under pressure to inform the public correctly on the scope and potential impacts of the planned mega-project (I). On the other hand, the Home Rule government has had the rather difficult task of keeping the competition fair and not to treating one of the municipalities preferentially. This was expressed through the phenomenon of being able to see the municipalities competing in the media by “bad-mouthing against each other” (L).

The three municipalities each proposed three sites for the smelter, as instructed. ALCOA assessed those and made cost estimates. In that evaluation, it emerged that the cheapest alternative would be one of the locations in Maniitsoq, basically because of its greater proximity to the two planned

hydro power stations that are required for running the smelter (Map 1). That site was then proposed by ALCOA as the site for the smelter, which was in turn finally accepted by the Greenland Home Rule and later on by the Greenlandic Parliament (A, D).

From the different interviews, one receives the impression that the cost-efficiency argument has been, somewhat unsurprisingly, the strongest one, when weighted against others (e.g. B, N, R). In the end, some further arguments, some of them not very convincing for experts, have been brought forward to verify the decision of this particular site, in this by far smallest community of the three applicants. One such argument relates to the idea that the smelter could foster a more polycentric development on Greenland. This assumed strategy has evoked the feeling that only costs-benefits rationales were taken into consideration and other arguments and impacts on the environment, labour market etc. were just placed in a nice packaging (N). Even after the selected location has been confirmed by the parliament, there is obviously a strong need in Maniitsoq among the responsible stakeholders to get more involved in the process. They are apparently still looking towards Nuuk, to the Home Rule government and to Greenland Development, as they are desperately waiting for further information, time lines and details on the project. Apparently there is still a feeling of being excluded from the process and therefore the responsible stakeholders in Maniitsoq have proposed many times that Greenland Development should set up an office in their town in order to improve the communication on the project (L).

The construction of knowledge related to the scale and scope of the project

Different aspects and impacts, which have been addressed by the respondents, are related to this mega-project. They cover socio-cultural, socio-economic, environmental and rather (geo-) political issues. It has not been our intention to collect those in order to get an idea of the pattern of opinions among the interviewed stakeholders and finally to assess those. Rather we wanted to explore what issues are perceived as being important when looking at the dimension of the project for a lightly-populated country such as Greenland.

It must be mentioned that the smelter project would be implemented in a small town with about 2,800 inhabitants. It has been argued that there is obviously a low level of willingness among people living in Greenland to embark on a new vocational education in order to work in the smelter. Thus, a large amount of the required workforce, about 3000 workers in the construction phase and even more in the operation phase, have to be imported from other countries—even though ALCAO reassures that it is always their strategy to use local labour within a so-called “green field activity.” This would have tremendous implications for the local community in Maniitsoq, because all workers have to live there, since it is impossible to commute from other towns. Due to the isolated labour market situation in Greenland, the project would induce strong efforts to integrate a few thousand foreign workers in such a small community. Another concern related to it is the gender dimension, since it can be assumed that to work in the smelter is more attractive to men, which would even aggravate the current gender imbalance in Greenland in general and in Maniitsoq in particular. Another risk that has been expressed is that such workers might only stay temporarily in Maniitsoq, which would probably imply a low willingness to integrate with the local society and to learn either Greenlandic or Danish (B, D, J, N, R, M).

Looking at pure economic impacts, a kind of helplessness could be recognised among the respondents. It is obviously rather difficult in that situation to obtain proper empirical data to feed some economic models. This might explain as well why very different figures circulate within the public debate. Another critical point in the discussion is the ownership of the project, about whether it should be owned totally by ALCAO, with its taking all the risk, but having at the same time all the decision-making power, or whether one-half should be owned by the Greenlandic society (C, I, J, R). This question is naturally of strategic and long-lasting importance and connected to the question of independence and sovereignty (B, C, D, E, M, P).

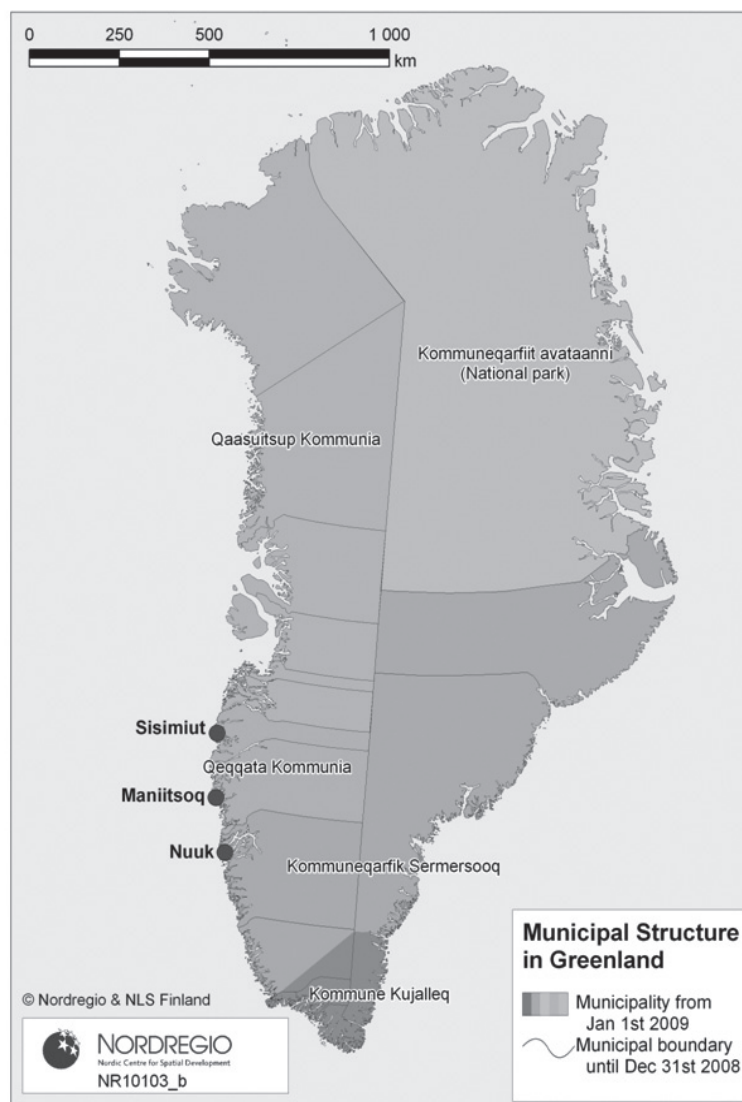
Regarding the environmental impacts of the project, it is striking that the arguments are at best focused on CO₂ emissions, but not that much on other harmful substances related to the smelter. Consequently, it has been observed that ALCOA has not had to deal with as many critical questions in Greenland as they are obviously used to in connection with such mega-projects elsewhere (E, H, M). Here again it has been admitted that some important knowledge is missing or at least not accessible (J, G). However, only very few respondents brought up the contradictoriness in the fact that the country that is probably most jeopardised by climate change is about to more than double its current CO₂ emissions once the smelter is in operation. A few respondents have even relativised this by mentioning that the required power will be provided by clean energy (the two hydro power stations)—even though this will have irreversible consequences on the geological and geographical realities (Q).

The geo-political aspects imply in fact two dimensions. There are on the one hand some assumptions that the general agreement between Greenland and the USA, certified in 2004, has had meant that, in the end, ALCOA, as an American company, has been the only potential investor in this respect. Some earlier negotiations with the Norwegian based company Norsk Hydro were put on ice once ALCOA signalled a degree of interest (J, P). In addition, it has been flagged, as mentioned above, that this mega-project is an important step in underlining Greenland's aspirations to become more independent from Denmark, which has in turn been recently confirmed (in Nov. 2008) by a referendum. Therefore, the question of the ownership of the project is more than tricky. If ALCOA would become the only owner, Greenland would get into a new kind of dependency—now with a global company—with a functional logic to exploit potentially profitable markets at best. A shared ownership would not hide the fact that the Greenlandic part would still be financed for the most part with Danish money. In a broader perspective, it has been argued that this project could be one important cornerstone towards an industrial shift in Greenland, catalyzing the country's preparedness for new kinds of industries.

It appears that specifically Maniitsoq and Sisimiut have been very engaged in delivering sufficient information to ALCOA on their chosen sites. It was felt that this project might cause numerous positive spill-over effects—specifically state-run investments in infrastructures—such as a connecting road from Sisimiut to the international airport Kangerlussuaq farther inland from the open sea (I, K, M). A delicate side-effect is that Greenland has simultaneously initiated a municipal reform. From 1 January 2009, the country has been divided into only four large municipalities, which means that Maniitsoq and Sisimiut will be merged together into a new one called Qeqqata, which also incorporates Kangerlussuaq (see Map 2).

Besides the tight deadlines for providing information on potential sites, it was felt by the responsible stakeholders from the municipalities that the upswing in activity with regard to the planning of the mega-project took place at the completely wrong time of year. It was winter and there was consequently lots of snow covering the terrain, which made it almost impossible to perform some of the in-situ investigations (H). Another critique has been that once the municipalities submitted their reports and material they were decoupled from the process. Even though they assumed such a procedure in advance, the way in which the rest of the process would take place was not spelled out to them (D, H). In other terms, they have been kept in uncertainty over the further planning and evaluation process even though at least one municipality insisted in having direct communication with ALCOA (H).

Map 2: Municipal structure in Greenland.



Another point of suspicion about the final selection was that one of the responsible ministers (the one for Business and Trade) is from Maniitsoq, which might, as the thinking went, have played a role in the final outcome. The chosen site is also quite isolated, which means that it is not visible from the city itself, which might have seen as having some psychological advantages regarding the unavoidable environmental effects, since it is out of sight (and “out of mind?”) of the daily focus of the local inhabitants (D).

On the other hand, it has been questioned whether Greenland should transform its enormous energy resources into aluminium at this time, since the on-going mineral, oil and gas explorations might in any event open up some promising future avenues for its development (I, P, R). The hydro power potentials will be there in the future, nonetheless, and therefore it has been argued that there is no longer any need for haste in defining solutions with the kind of rashness that has obviously been taking place in relation to the smelter project (H, N).

References

- ALCOA (2007) Project background.
http://www.alcoa.com/greenland/en/proposed_smelter/project_background.asp; 28.04.2009
- Bruun, H. (2007). Genomics and epistemic transformation in the production of knowledge: The bioinformatics challenge. In Glasner, P., P. Atkinson and H. Greenslade (Eds.) 2007 *New Genetics, New Social Formations. Genetics and Society* (Series editors Paul Atkinson, Ruth Chadwick, Peter Glaser, Brian Wynne). Routledge.
- Bruun, H. and R. Langlais (2003) On the embodied nature of action. *Acta Sociologica*, 46(1), 31-49.
- Bruun, H., R. Langlais and N. Janasik (2005) Knowledge networking: A conceptual framework and typology. *VEST: J. for Science & Technology Studies*, 18(3-4), 73-104.
- Bulkeley, H. (2006) A changing climate for spatial planning. *Planning Theory & Practice*, 7(2), 203-214.
- Bulkeley, H. and K. Kern (2006) Local government and the governing of climate change in Germany and the UK. *Urban Studies*, 43(12), 2237-2259.
- Bylund, J. R. (2006) *Planning, Projects, Practice*. Human Geography, Stockholm U.
- Cohen, M. J. (2006) Ecological modernization and its discontents: The American environmental movement's resistance to an innovation-driven future. *Futures*, 38, 528-47.
- Dietz, T., E. Ostrom and P. C. Stern (2003) The struggle to govern the commons. *Science*, 302, 1907-1912.
- Dolšák, N. and E. Ostrom (2003) *The Commons in the New Millennium*. MIT Press.
- Engel, K. H. (2006) Mitigating global climate change in the United States: a regional approach. *NYU Environmental Law Journal*, 14(1), 54-85.
- Feichtinger, J. and M. Pregernig (2005) Imagined citizens and participation: Local Agenda 21 in two communities in Sweden and Austria. *Local Environment*, 10(3), 229-242.
- Flyvbjerg, B. (1998) *Rationality and Power: Democracy in Practice*. U. Chicago P.
- Fudge, C. and J. Rowe (2001) Ecological modernisation as a framework for sustainable development: a case study in Sweden. *Environment and Planning A*, 33(9), 1527-1546.
- Gløersen, E. (2008) Aluminium smelter in Greenland. *Journal of Nordregio*. No. 1. March. Vol. 8. 2008, pp. 10-11.
- Greenland Home Rule (2007) *Strategic Environmental Assessment report*. Nuuk.
- Hammar, H. and S. C. Jagers (2007) Is there a trade-off between cost-effective climate policies and political legitimacy? In Lundqvist, L. J. and A. Biel (Eds.) 2007 *From Kyoto to the Town Hall: Making International and National Climate Policy Work at the Local Level*. Earthscan.
- Hassink, R. (2001) The learning region: A fuzzy concept or a sound theoretical basis for modern regional innovation policies? *Zeitschrift für Wirtschaftsgeographie*, 45, pp. 219-230.
- Heikkinen, H., H. Magga, S. Nevalainen and O. Jääskö (Eds.) 2003: *Kuuluuko sääskien ääni taivaaseen? Poromiesten analyysi poronhoidon murroksista Suomen Lapissa 1900-luvulla* (Is the Mosquito Heard in Heaven? Reindeer Herders' Analysis of Disruptions in Reindeer Management in Lapland, Finland in the 1900's) in Finnish. *Technology, Society, Environment*. Vol. 3/2003. Espoo: Helsinki University of Technology Laboratory of Environmental Protection.
- Hibbard, K. A., P. J. Crutzen, E. F. Lambin, D. M. Liverman, N. J. Mantua, J. R. McNeill, B. Messerli and W. Steffen. (2007) "Group report: Decadal-scale interactions of humans and the environment." In Costanza, R., L. J. Graumlich and W. Steffen (Eds.) 2007 *Sustainability or Collapse? Report of the 96th Dahlem Workshop on Integrated History and Future of People on Earth (IHOPE)*. Berlin, 12-17 June 2005. MIT Press/Dalhlem U. Press.
- Holliday, C. O., S. Schmidheiny and P. Watts (2002) *Walking the Talk: The Business Case for Sustainable Development*. Berrett-Koehler.
- Hukkinen, J. (2008) *Sustainability Networks: Cognitive Tools for Expert Collaboration in Social-Ecological Systems*. London: Routledge.
- Jensen, M. B. and F. L. Sørensen (2008) ALCOA – Et grønlandsk projekt? In *Tidsskriftet Grønland*, 2-3/2008.

- Klein, J. T. (1996) *Crossing Boundaries: Knowledge, Disciplinarity, and Interdisciplinarity*. University Press of Virginia.
- Langlais, R. (1995) *Reformulating Security*. Ph.D. diss. Human Ecology, Göteborg U.
- Langlais, R. (1999) Envisioning a sustainable Arctic. In H. Petersen and B. Poppel (Eds.) *Dependency, Autonomy, Sustainability in the Arctic*, 65-77. Ashgate.
- Langlais, R. (1999b) Securing relations and sustaining northern futures: The Kola Peninsula and the reformulating security discourse. In Wall, D. et al. (Eds.) *Securing Northern Futures*, 29-35. Canadian Circumpolar Institute.
- Langlais, R. (2006) Reassembling the social: A review. *Science Studies*, 19(1), 93-95.
- Langlais, R. and H. Bruun (1999) The human dimensions of interdisciplinarity. In Turunen, M. et al. (Eds.) *A Terrestrial Transect for Scandinavia/Northern Europe*, 227-235. Ecosystems Research Report 31. European Commission.
- Langlais, R., P. Francke, J. Nilsson and F. Ernborg (2007) *Turning Point on Climate Change? Emergent Municipal Response in Sweden: Pilot Study*. Nordregio Working Paper 2007: 3. 40pp.
- Latour, B. (2005) *Reassembling the Social*. Oxford.
- Lattuca, L. R. (2001) *Creating Interdisciplinarity: Interdisciplinary Research and Teaching Among College and University Faculty*. Vanderbilt University Press.
- Law, J. (2004) *After Method: Mess in Social Science Research*. Routledge.
- Lundqvist, L. J. and A. Biel (Eds.) 2007 *From Kyoto to the Town Hall: Making International and National Climate Policy Work at the Local Level*. Earthscan.
- Nilsson, M. and K. Eckerberg (Eds.) 2007 *Environmental Policy Integration in Practice: Shaping Institutions for Learning*. Earthscan.
- NIRAS (2007) *Økonomiske konsekvenser af etablering af aluminiumsindustri i Grønland. Analyser af kapaciteten*. Nuuk.
- Olsen, K. H. (2006) National ownership in the implementation of global climate policy in Uganda. *Climate Policy*, 5(6), 599-612.
- Pierre, J. and B. G. Peters (2005) *Governing Complex Societies: Trajectories and Scenarios*. Palgrave.
- Rummukainen M., S. Bergström, G. Persson and E. Rensner (2005) *Anpassning till klimatförändringar [Adaptation to Climate Change]*. SMHI Serie RMK 106.
- Schmidt-Thomé, P. (2006) *Integration of Natural Hazards, Risk and Climate Change Into Spatial Planning Practices*. Geological Survey of Finland.
- Stern, N. (2006) *The Economics of Climate Change*. <http://www.hm-treasury.gov.uk>
- Sweden (2006) *Klimat- och sårbarhetsutredningen. Översvämningshot [Flood Threats]*. SOU 2006: 94.
- Tsing, A. L. (2005) *Friction: An Ethnography of Global Connection*. Princeton U. P.
- Voss, J.-P., D. Bauknecht and R. Kemp (2006) *Reflexive Governance for Sustainable Development*. Edward Elgar.
- Wilson, E. (2006) Adapting to climate change at the local level: The Spatial Planning Response. *Local Environment*, 11(6), 609-625.

Newspaper/internet articles

- Denmark.dk (2004) *History made in Southern Greenland*. 2004
www.denmark.dk/en/servicemenu/News/FocusOn/Archives2003-2004/HistoryMadeInSouthernGreenland.htm; 09.06.2008
- Drechsel, F. (2008) *Viden opnås gennem dialog – ikke spekulationer!*
http://www.aluminium.gl/content/dk/nyheder/viden_opnas_gennem_dialog_-_ikke_spekulationer; 28.04.2009
- Greenlandexpo (2007) *Signing of agreement between Government of Greenland and ALCOA Inc*. 26.05.2007
http://www.greenlandexpo.com/content/us/news_-_greenland_expo/signing_of_agreement_between_government_of_greenland; 28.04.2009

Greenland Government (2008) Aluminium smelter plant in Maniitsoq. 21.02.2008 http://www.aluminium.gl/content/us/news/aluminium_smelter_plant_in_maniitsoq; 28.04.2009

Kleist, K. (2008) IA: ALCOA-projektet er en 'ommer'. 04.08.2008 http://www.knr.gl/index.php?id=183&type=98&tx_ttnews%5Btt_news%5D=36566&cHash=08b83524a5; 28.04.2009

Myrup, M. (2008) Mens vi venter på ALCOA. http://www.aluminium.gl/content/dk/nyheder/mikkel_myrups_indlag_i_aviserne_mens_vi_venter_pa

Barfoed, P. (2007) Aluminium smelter located close to Nuuk. 07.10.2007 http://www.tenu.gl/downloads/alu_smelter_located_close_to_nuuk.pdf; 28.04.2009

Barfoed, P. (2007) The good, the bad and the ugly. 10.10.2007 http://www.tenu.gl/downloads/good_bad_ugly_english.pdf; 28.04.2009

U.S. Department of State (2005) Partnership with Greenland. Fact Sheet: The New Partnership between the United States, Greenland and Denmark. May 2005 <http://denmark.usembassy.gov/policy/issuesinfocus/greenland/factsheet2006.htm>; 28.04.2009

Saving Iceland (2007) Greenland to get Norsk Hydro smelter? 01.01.2007 <http://savingiceland.puscii.nl/?p=666&language=en>; 28.04.2009

Saving Iceland (2008) ALCOA divides and Rules Greenland. 11.01.2008 <http://savingiceland.puscii.nl/?p=1123&language=en>; 28.04.2009

SIKUnews (2008) Smelter a bad investment for Greenland. 15.04.2008 <http://www.sikunews.com/art.html?artid=4684&catid=6>; 28.04.2009

SIKUnews (2008) ALCOA: good for Greenland. 08.05.2008 <http://www.sikunews.com/art.html?artid=4827&catid=6>; 28.04.2009

SIKUnews (2008) Maniitsoq smelter will draw other industries to Greenland. 13.05.2008 <http://www.sikunews.com/art.html?artid=4853&catid=6>; 28.04.2009

List of Respondents

	Date and type of interview
A	09.06.2008, by telephone
B	20.11.2008, in person
C	30.05.2008, in person
D	13.05.2008, in person
E	24.06.2008, by telephone
F	23.02.2008, by mail
G	08.05.2008, in person
H	08.05.2008, in person
I	08.05.2008, in person
J	07.05.2008, in person
K	30.05.2008, by telephone
L	04.07.2008, by telephone
M	08.05.2008, in person
N	11.06.2008, in person
O	17.02.2009, by mail
P	23.10.2008, by telephone
Q	12.11.2008, by telephone
R	19.06.2008, by telephone

The identities of the respondents are considered to be confidential.

Transitions to sustainable energy systems in West Norden

Rasmus Ole Rasmussen

with contributions from

Borys Kharchuk, Steen Jeppson,
Stefanie Lange, Søren Bitsch, Karen Thronøe,
Emil Møller Rasmussen, Lene Rasmussen

Preface

This report is one among several connected to the research project Knowledge-based tools for the sustainable governance of energy and climate adaptation in the Nordic periphery (K-Base).

Our research group has tackled the task by drafting knowledge-based tools on the basis of five case studies: (1) Climate policy and reindeer management in Lapland, Finland, (2) Transitions to sustainable energy systems in West Norden, (3) Public information flow analysis of a proposal to construct an Alcoa aluminium smelter in Greenland, (4) Actor network analysis of Alcoa Greenland, (5) Climate policy in Swedish municipalities.

This publication constitutes the second of these five reports, and looks at the options and instruments available to local level practitioners and policy makers aiming to develop knowledge-based tools to assist in planning sustainably for climate change and changes in energy provision.

The focus is on the transitions to sustainable energy systems in West Norden and thus addresses the challenges and opportunities emergent in developing renewable energy production in peripheral and remote areas, islands and rural areas rich in natural resources. This, on one hand, increases the amount of clean, reliable energy available, it ensures provision of such energy in places where the cost of providing traditional energies is often very high and it creates employment opportunities in regions often experiencing high unemployment. On the otherhand, however, it at the same time is facing an accumulation of disadvantages due to problems relating to their remoteness, relative small size in the case of islands, their distance from economic and social centres, higher infrastructure costs, and, in some cases, harsh climatic conditions. Added to these geographical handicaps, the impact of globalisation on peripheral regions and sparsely populated areas is uneven, with the demographic transformations that are now impacting all Nordic regions often affecting them disproportionately.

The main parts of the report are the responsibilities of Rasmus Ole Rasmussen. Borys Kharchuk has provided the background materials and analysis of the general energy development trends of the Nordic Countries, while Søren Bitsch, Karen Thronøe, Emil Møller Rasmussen, Lene Rasmussen, Borys Kharchuk, Steen Jeppson, and Stefanie Lange have been in charge of most of the interviews.

In connection with the development of the project there has been a close, fruitful and productive cooperation with Klaus Georg Hansen and his project group on section 3 of the project about Public information flow analysis of a proposal to construct an Alcoa aluminium smelter in Greenland. As a result of this, the full reporting from these two research groups which include transcripts of interviews, detailed data analyses etc. have been published in a joint publication: "Rasmus Ole Rasmussen og Klaus Georg Hansen (red): Demokratisering af planlægningsprocesser som en udfordring i Vestnorden. Case vedvarende energi og storskala industriprojekter. NORS Forskningsrapporter, Roskilde Universitet". The Publication will be available during the fall of 2009.

1. Introduction

In the Nordic countries the most important energy sources in order of importance are oil, renewable energy sources (hydro-, geothermal and solar energy), nuclear power, and finally coal and gas. Taken as one unit the Nordic countries could produce all the energy needed to be self-sufficient while retaining a surplus for export.

In reality of course significant differences exist between the countries. Norway and to lesser degree Denmark are oil and gas exporters; Norway produces over 600% and Denmark more than 150% more energy than in needs for domestic use., Finland and Sweden, however, remain dependent on foreign imports of fossil fuels. Norway, Iceland and Sweden, generate a significant proportion of their electricity from hydropower. In Finland and particularly in Sweden nuclear power is a major source of energy while in Iceland geothermal energy production is a substantial contributor to the nation's energy supply.

Energy and climate change mitigation policies in the Nordic countries share similarities as well as displaying clear difference. This is so for many reasons, including, access to natural resources, industrial structure, political and cultural traditions and contexts, trading opportunities, public attitudes and the prevalence of joint and international agreements. While economic growth, employment and welfare remain the overriding policy targets in the Nordic countries, efficiency, security of supply and environmental protection remain the central policy concerns set for the energy sector.

The use of renewable energy sources has been fairly prevalent, in Finland and Sweden, for at least ten years, while over the same period Denmark has seen a remarkable improvement in its position through increasing the ratio between the electricity produced from renewable energy sources and the gross national electricity consumption from 5.8% in 1995 to 28.2% in 2005. More generally we can see that the use of renewable energy sources in heat generation has increased in the Nordic countries relatively more than in the other OECD countries.

While the development of renewable energy sources and technologies is one of the main energy policy challenges for the Nordic countries, with all Nordic countries stressing the importance of this issue, differences soon emerge in respect of the areas focused on, with these differences typically being associated with available energy resources, industrial development and available expertise, and the challenges and problems connected to energy supply in sparsely populated and remote areas which are often radically different from those faced by centrally located and densely populated areas.

Large scale solutions and mainstream technologies are often not appropriate for the remote regions, either because the production facilities required are not cost-effective and create over-capacity or because local connections to common backbone systems are limited with local energy systems often being characterized by island-type characteristics, i.e. lacking connections to other systems. In addition, many of the regions concerned are technologically challenged because of the harsh and varied natural conditions associated with renewable resource exploitation.

Developing renewable energy production in peripheral and remote areas, islands and rural areas rich in natural resources, on the other hand, can have a triple benefit. It increases the amount of clean, reliable energy available, it ensures provision of such energy in places where the cost of providing traditional energies is often very high and it creates employment opportunities in regions often experiencing high unemployment. A development strategy aiming at renewable solutions in peripheral communities emphasizes a number of general characteristics in relation to peripheral regions, namely, equity of access to infrastructures, services and economic development, which is one

of the foundations for sustainable development and for democracy. In addition, peripheral regions, sparsely populated areas and some mountainous zones and islands often face an accumulation of disadvantages due to problems relating to their remoteness, relative small size in the case of islands, their distance from economic and social centres, higher infrastructure costs, and, in some cases, harsh climatic conditions. Added to these geographical handicaps, the impact of globalisation on peripheral regions and sparsely populated areas is uneven, with the demographic transformations that are now impacting all Nordic regions often affecting them disproportionately.

Aiming to develop a coherent strategy for the integrated, regionally balanced development of all Nordic regions, Nordic Energy Cooperation aims at the development of technologies and means to oversee the creation of a sustainable energy system across the Nordic regions that is not connected to the main transmission lines and which is based, first and foremost on local initiatives and solutions.

It is one thing, to simply seek to present alternative technologies and solutions to existing systems, it is quite another, however, to actually implement such solutions which often require the need to lobby decentralized decision makers encouraging them to embrace new policy approaches when confronted with the choice of relying on well known 'top-down' systems or moving into alternatives, where the potentials as well as the consequences, are not yet clearly discernable

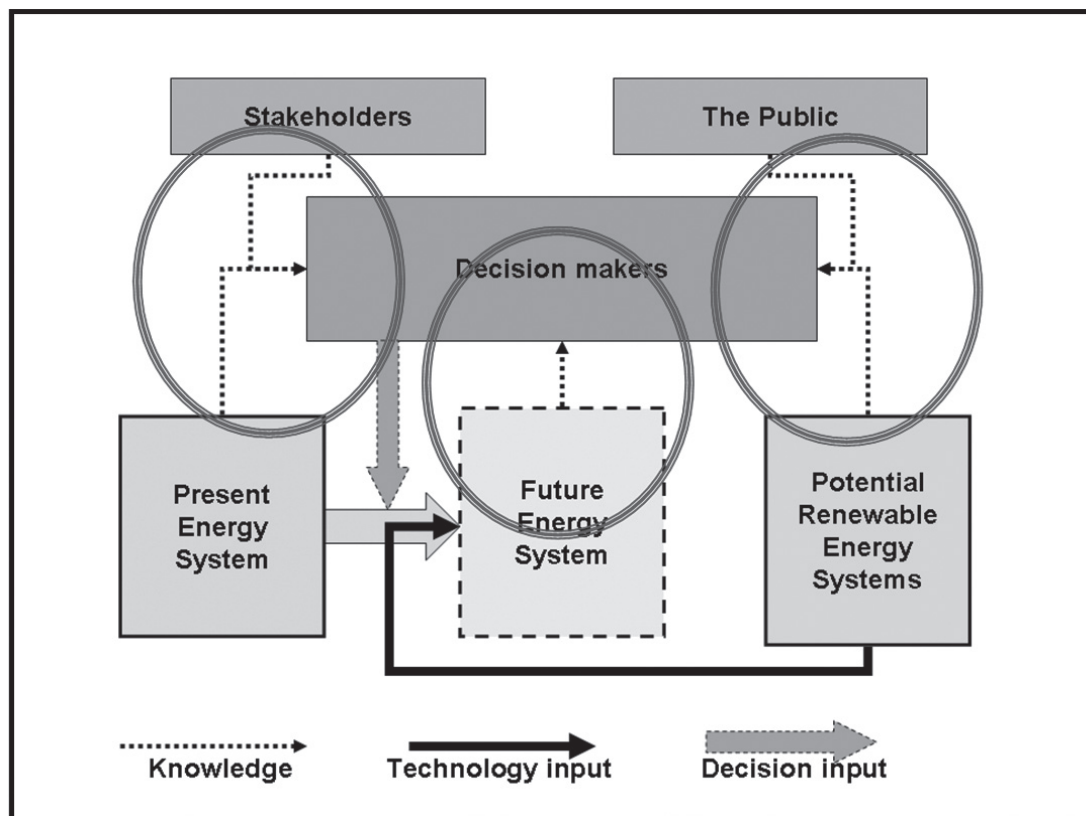


Figure 1: Outline of the problem field

1.1 The research question

It is this point that the current report takes as its point of departure, namely previewing the conditions for decision making in situations where many “unknowns” exist, and where knowledge-based tools designed to help in the decision making process could help to improve the knowledge base.

The situation is outlined in figure 1 above showing the process of transition from a present to a future energy system, under the influence of the overriding element of moving towards a renewable energy regime which contains numerous unknown elements. Three types of information flows are discernable:

- (i) Information in respect of the various technologies available (the black arrow),
- (ii) Different sub-systems of knowledge relating to the energy system sphere, but which also relate to the knowledge systems connected to both the stakeholders and the public sphere (the dotted arrows),
- (iii) Information flows of the decision makers (the red arrow).

Decisions will be taken within this multi-dimensional knowledge related system, and thus it is the purpose of this report to look into all three spheres in order to see how the interaction between existing and potential systems influences the decision takers particularly in whether they seek to take into consideration the various knowledge systems, and by identifying how different knowledge tools help in this process whether they provide a better basis for decision taking.

1.2 Research approach

Based on a general overview of the status of energy systems in the Nordic countries, the emphasis of the research undertaken here has been on the implications arising from the general development pattern on the energy situation in what is often characterized as “the Nordic periphery”, encompassing the northernmost regions of the Nordic countries and with a particular focus on the West Nordic regions:

- What are the general trends in the development characteristics of the energy sector in the Nordic countries.
- How are these trends mirrored or showing marked differences in the periphery?
- What policy measures were adopted?
- And how have the specific development conditions in the Nordic periphery influenced the character of these policy measures?

The empirical focus of this report is on two specific issues.: Firstly in relation to the capacity, characteristics of and changes in nordic energy systems. This part of the analysis was based on data from official documents, reports, statistical agencies, and personal contacts and interviews with 9 key persons in the national energy agencies. And secondly in relation to the local adjustments to these ongoing changes in the periphery, where the analysis was based on strategy and development documents as well as interviews with a total of 39 key managers and decision takers in the Nordic periphery and West Norden.

The theoretical focus of the project was on socio-technological transformation processes, from the micro level (individual actors), through the meso level (socio-technical regimes), to the macro level (socio-technical landscapes), emphasizing endogenous factors such as the use of technology roadmapping as a tool in adequate policy development.

The report's conclusions informed by the juxtaposition of the empirical analysis with the theoretical framework, point to two approaches which have been analyzed, applied and tested in connection with the project, thereby constituting a set of knowledge-based tools which can provide help in connection with future decision making.

2. Status and Characteristics of Energy System Development in the Nordic Countries

The starting point here is to determine the framework conditions of energy system development and the particular options available in the nordic periphery. The focus then is on the capacity and characteristics of the existing energy systems and their potential development. Even local development conditions are in many ways characterized by a reasonably high level of autonomy - a point which will be discussed later - the overall supply structure, being the outcome of long term strategies, has however resulted in marked differences between the nordic countries. Moreover, these structures constitute the backbone of the various national and regional supply systems.

To begin with then the main characteristics of, and changes in, the current energy systems and consumption patterns in the nordic countries will be outlined. This is followed by a presentation of the economic and political basis for these changes, highlighting some of the economic and political measures which have been taken in order to pursue the various national goals, followed by an attempt to outline the similarities and differences that emerge in policies and instruments. The sources for this part of the analysis include data gathered from official documents, reports and statistical agencies as well as the utilisation of a number of personal contacts and the conduction of interviews with 9 key persons in the national energy agencies.

Our analysis then turns to the specific characteristics of the West Norden region, on one hand by outlining the various energy systems characteristics and their supply patterns, and on the other, by means of a series of interviews with stakeholders and practitioners in the regions.

2.1 Energy consumption status

A key issue in contemporary discussions of energy consumption development is the question of the decoupling⁹ of economic development from energy consumption. In this context the Nordic economies are, in general, characterized by such developments. The energy intensity of the Nordic economies is diverse. The Nordic countries have in general become less energy intensive over the last ten years. Denmark is the most efficient energy user in the European Union while Iceland however remains a highly energy intensive economy. Iceland has however managed to preserve its intensity rate at approximately the same level of overall energy efficiency even though a number of highly energy intensive aluminium plants have come on line in recent years. Finland with its sizeable heavy industrial sector is also above the European average in energy intensive usage terms. The following graph show the overall trends in final or end-use energy consumption, i.e. the amount of energy that actually reaches final consumers in whatever form that may be such as petrol for motor vehicles, hot water in a district heating system, or electricity reaching the wall socket.

⁹ For a discussion of the concept of decoupling economic development, see for instance:

- Petri Tapio, 2005, Towards a theory of decoupling: degrees of decoupling in the EU and the case of road traffic in Finland between 1970 and 2001, Transport Policy, Volume 12, Issue 2, March 2005, Pages 137-151

- James A. Caporaso and David P. Levine, 1992, "The Theories of Political Economy". Cambridge University Press

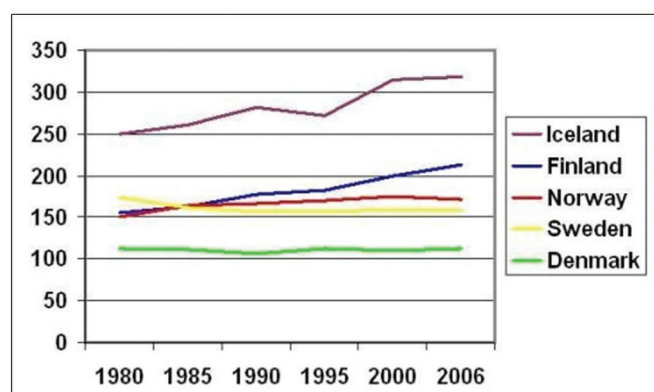


Figure 2: Final energy use per capita, 1980-2006, GJ¹⁰

The difference between this indicator and the primary energy supply¹¹ relates to the energy use and energy losses in conversion and distribution, e.g. in oil refineries, power plants and power lines.

While Denmark is unique among the Nordic countries and indeed among Western industrial countries more generally in respect of primary energy usage having a usage level which has remained virtually unchanged since the mid- 1970s, Denmark, Sweden and Norway are all in the situation where end-use energy consumption has been more or less stable for several decades.

Both Finland and Iceland, however, have experienced ongoing growth in final energy usage right up to the present. A number of factors may contribute to explaining these trends:

- Energy-intensive industries in Finland, Iceland and Norway are not only important but have also expanded significantly over the period, especially in Finland and Iceland.
- Sweden and Denmark have each for extended periods of time had in place robust policies to promote energy conservation which the others generally lacked. Norway, but not Finland or Iceland, significantly increased support for energy conservation after 2000.
- Denmark was hit hard by the oil crises of the 1970s due to the fact that its building stock was, in general, poorly insulated as compared to the other Nordic countries. As such, the country has subsequently benefited substantially from the introduction of tough insulation measures since the 1980s.
- Sweden was the most affluent of the Nordic countries until 1980, but has since experienced somewhat slower growth and been overtaken in terms of per capita GDP by Iceland, Norway and Denmark.

Energy consumption for transport has grown throughout the period in all five countries, and significantly faster than population. Consequently, this means that stationary energy consumption per capita has actually declined slightly in Denmark as well as Sweden, and grown only slightly in Norway. In Finland and Iceland, there has been growth across all major sectors.

¹⁰SusNordic Gateway, http://www.sum.uio.no/susnordic/comparative/energy_use.html

¹¹ Defined as Indigenous production + imports - exports - international marine bunkers ± stock changes (International Energy Agency).

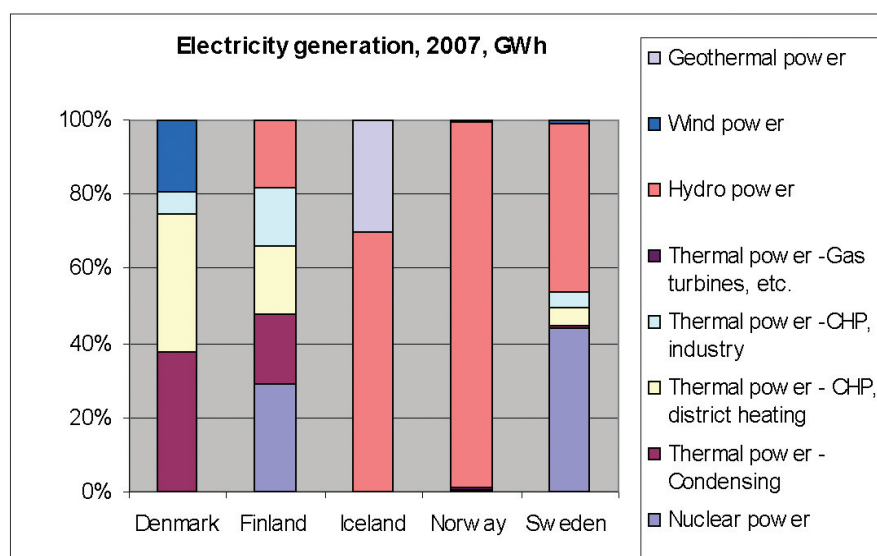


Figure 3: Electricity generation 2007 GWh in the Nordic Countries Distributed on power sources

Understanding changes in primary and final consumption in individual countries, is however quite complex. No two Nordic countries are even roughly similar in their energy supply structure. In Denmark, almost all electricity in 1980 was generated by coal-fired plants. As electricity has increased its share of stationary energy use and thermal electricity generation entails major losses, this would have led to an increase in primary consumption relative to final consumption if no other changes had intervened. Primary consumption has however been kept down partly through the expansion of wind power (replacing some thermal power), through the conversion of condensing power plants to CHP (thus reducing losses) and the substitution of their district heat for oil, and partly also through the replacement of older plants with new coal- or gas-fired plants with higher electrical efficiencies as well as the provision of district heat. In Sweden, the growth in primary energy use during the 1980s reflects the phasing in of nuclear power in that country, which previously relied mainly on hydropower. In other words, the difference between the trends for final and primary energy use is mainly made up by the waste heat of nuclear plants. In Norway, almost all electricity in the country itself (i.e. excluding oil and gas installations on the continental shelf) is generated from hydropower, and the share of electricity in final consumption has changed only marginally over the period. The significant growth in primary energy is largely due to the expansion of the offshore oil and gas sector, and the use of gas turbines to power its platforms. As an energy sector, the oil and gas industry does not count in final use of energy.

In Finland, primary energy use has grown slightly less than end use. Finland has a more varied mix of sources for electricity generation than any of the other countries, including hydro, thermal plants fired by coal, gas, peat and wood fuels and nuclear plants. The share of conventional and nuclear thermal plants has grown over the period – tending to push primary energy up more than end use – while increased plant efficiencies and CHP have had the opposite effect, though not as strongly as in Denmark. In Iceland, the spread between final and primary energy use is larger than in any of the other countries. This reflects the extensive use of geothermal energy for heating (with major losses in transmission) as well as electricity generation (at low theoretical efficiencies).

2.2 The energy development framework for the Nordic Countries

A common development characteristic of the energy sector across the Nordic countries can be seen in the move towards progressive deregulation towards market based trade in electricity, a successful

process that has received general political support from the national level. To make this happen, the electricity transmission systems between the countries involved have been made compatible through the definition of joint technical standards and the development of joint regulation frameworks. Consequently the power sector acts today as one integrated market with the transmission operation vertically separated in all the countries managed by independent regulated operators cooperating within the Nordel framework. This can even be viewed as generating a competitiveness advantage for the Nordic energy-intensive industry sectors.

Subsequent environmental concerns during the 1980s and 1990s promoted first a supplement to, and later the substitution of coal with renewable source of energy, mainly wind power in Denmark and district heating based on biomass in Sweden and Denmark. The use of new renewable energy sources in Finland and Norway was however modest during this period, with the exception of heat production for Finnish industries where biomass combustion emerged as an important energy source. In Finland and Sweden the forest-based energy systems also activated efforts to coordinate energy policy, environmental policy and various forms of industrial development, innovation, regional planning and regional development policies.

In the last two decades, development in the energy sector resulted in a progressive reduction of nuclear power capacity in Sweden while contrarily in Finland developments moved in the opposite direction as a new nuclear plant is projected to be operative at the turn of 2010-2011. Similarly the Swedish government agreed to do away with a ban on building new nuclear reactors as well as plans to phase out the country's existing nuclear plants by 2010. The government also proposed to build new reactors at Oskarshamn, Ringhals and Forsmark — the three sites in the country where reactors are already operating.¹²

This success in generating electrical and heat power from renewable sources in the Nordic countries has been based on various support schemes for these technologies such as: feed-in-tariffs -fixed price or premium- (Denmark), green certificates (Sweden), investment support (Finland, Norway and Sweden), tax incentives, taxation of fossil fuels in heat production (Finland, Sweden and Denmark), operational support (Sweden and Denmark), CO₂ emission trading and R&D support. Due to the abundance of, and easy access to, hydro and geothermal power in Iceland state subsidies or other support schemes for electricity generation have been indispensable for the deployment of these energy sources as at present over 99% of electricity production and over 70% of total energy production come from hydropower and geothermal energy.

Today all Nordic countries effectively face the same policy challenges by being committed to further reductions in greenhouse gas emissions and increases in their share of energy production from renewable sources. The choice to support a specific mix of renewables and their related support mechanism will however continue to be nationally based and mainly determined by accessibility to different natural resources, though differences in industry structure and energy consumption patterns also remain important here. As certain renewable energy sources have been exploited to the extent that further expansion potential is limited, such as for example the case of wind energy in Denmark or hydropower in Norway and Sweden, future developments in respect of renewable energy are expected to take new directions particularly in respect of the utilization of previously unexploited resources. This is already the case in Norway and Sweden where wind power appears to be the option with the most immediate potential for expansion. Offshore windmill parks in particular have in this respect become a topic of joint interest among the Nordic countries.

The production of renewable energy is closely related to domestic potentials. In order of importance Denmark produces renewable energy from municipal waste, biomass and wind power (together 97% of RES), Finland from biomass and hydro power (95%), Iceland from hydro and geothermal power (more than 70%), Norway from hydropower (98%) and Sweden from hydro

12 http://www.stratfor.com/memberships/131678/analysis/20090206_sweden_preparing_nuclear_power_boom

power and biomass (92%). Each of the Nordic countries has made considerable progress in the use of renewable sources of energy. On average the Nordic countries generate electricity from renewable sources at a level four times higher than the average level of the OECD countries and three times more in terms of heat power.

In the Nordic context there are a number of regionally specific and well known environmental technology clusters such as a wind energy cluster in Denmark, a geothermal cluster in Iceland (Rannís), as well as the Finnish bio-energy and forestry cluster. An important explanation for the good level of Finnish performance in bio-energy is its integration with the forest industry cluster. Forest industry complexes are energy self-sufficient. Through integration it has been possible to reduce operational and investment costs and thus generate beneficial economies of scale. The integration of the procurement of forest fuels with the procurement of forest industry feedstock has produced excellent result in this respects. Similar levels of potential exist also for agricultural crops and several sorts of biomass-based fuels which can be co-fired with coal or peat (TEKES). Such integration of fossil and biomass fuels has, in a transition period, been an important source of combined power for district heating plants in Denmark.

At the micro level a significant number of companies already exist across Norden with a particular focus on energy- and environment-related products and services. Some of those are globally recognized. *Forbes* magazine included in its 2008 list of the world's largest public companies 72 Nordic companies measured by sales, profits, assets and market value. Ten of those companies work with energy and environmental technologies. In the field of renewable energy companies like *Vesta* and *Renewable Energy Corporation ASA* are world leaders in their field¹³. *Innovest Strategic Value Advisors* provides a Global top 100 list of the most sustainable corporations in the world. In the 2008 list, there were 13 Nordic companies included of which five were from Finland, five were from Sweden and three from Denmark. In addition ten of those were also included in the *Forbes* list.

Lot of environmental work in the Nordic countries is done outside the company and state frames. There are a huge number of Nordic organisations and institutions playing an active role in environmental issues. Some of those are coping purely with environment, some also with other issues. As environmental policies were among the first cooperation areas in the Nordic countries, some of these organizations are even pre-runners in the world.

3. Energy systems in the Nordic Periphery

The second phase of the analysis was undertaken in relation to the local adjustments already undertaken in respect of these ongoing changes in the Nordic periphery. A key issue here is the level of regional autonomy and dependency in structuring regional and local energy systems, including an understanding of the local and regional responses to overall policies. In addition we seek to raise questions in relation to the initially rather limited responses to these challenges across the various peripheral regions while also raising the question of what has worked in terms of awareness raising in respect of workable alternatives.

3.1 Energy system characteristics

Seen from a top-down energy policy perspective, energy supply in and to the sparsely populated areas of the Nordic countries has to be environmentally friendly and based on renewable energy sources¹⁴. This, however, requires a change from an energy supply situation that in many local communities is

13 Scott DeCarlo: The World's Biggest Companies. Forbes Special Report.

http://www.forbes.com/2009/04/08/worlds-largest-companies-business-global-09-global_land.html. 14 Lemgart, Marie Louise et al. , 2004, "Muligheter for fornybare energisystemer og hydrogenteknologi i Vest-Norden - Energiplanlegging og systemstudier" - Fornybare energisystemer og hydrogenteknologi i Vest Norden (pdf-file).

mainly based on fossil fuels to one that is based on renewable energy sources. This objective however presents many challenges. Such a shift requires acknowledgement of the availability of renewable energy sources in the sparsely populated areas of the Nordic periphery at one and the same time presenting genuine possibilities while also acknowledging that a broad technological range of options exists with significant differences prevailing from one locality to another.

A significant player in this “game” is the Nordic Task Force for Renewable Energy in Sparsely Populated Areas, based on the Nordic Committee of Senior Officials under the Nordic Council of Ministers for Energy. The task force has members from the Nordic countries and also includes members from the self-governing Nordic territories, i.e. Greenland, the Faroe Islands and Åland. Its main focus is on finding suitable common solutions for a decentralised energy supply which could contribute a reduction in fossil fuel usage. Their goals are also quite clear when it comes to outlining joint solutions, as indicated above.

The reality, however, displays a rather more challenging – and also quite diverse – situation. Most parts of *Fenno-Scandia* are served by a backbone supply system, which in most cases will provide not only energy supply security while at the same time effectively preventing the evolution of local resource provision, either due to competition¹⁵ where the construction of usually smaller local energy systems cannot compete with the external large scale providers, or due to the influence of lobbying¹⁶, where again the large scale providers are creating problems for local initiatives by emphasizing the risk connected to smaller local systems that may be vulnerable to both technical and staff problems. Consequently, the challenge in these regions is NOT to become dependent on outside supply if the goal is to develop local renewable energy resources.

Other parts of the Nordic periphery are not connected to backbone systems at all and thus face the rather different challenge posed by insularity. Greenland represents an extreme case here as currently all towns and villages are served through individual systems. On the Faroe Islands the majority of the population is served by a common grid, nevertheless, the existence of no less than seven systems remains a challenge for other parts of the islands. The absence of a backbone grid system not only requires that a stand-alone system is put in place but also necessitates the requirement for a supplementary system as a back up.. Thus with the generally small size of such isolated settlements dependence on different types of systems has often been argued as being not only expensive, but also vulnerable to breakdown due to the need for different types of expertise as regards system maintenance.

As a consequence of this, the West Nordic countries and their sparsely populated regions in particular have limited experience in combining two or more renewable energy sources¹⁷. It is generally considered that while consumers are open to change the energy supply institutions are more hesitant¹⁸. This general perception is not however borne out on meeting with the energy planners in the regions in question. Often the customers themselves are considered the greatest obstacle to change, partly due to a lack of interest in the sources of energy, and partly also because of their fear of instability where small local providers take over the supply system¹⁹.

An overview of the potentials in respect of renewable resource exploitation has been developed, and listed in the table below. A general characteristic of the West Nordic countries is their potential access to a rather broad spectrum of exploitable renewable resources. Indeed, in some cases, quite substantial resources may be available. The problem may be that local needs only require a small scale plant, automatically raising the conflict over economies of scale between a small scale facility addressing local needs versus a large scale facility that may provide excess energy but at the same time also necessitating an answer to the question of how to make use of this energy. A further problem touched upon previously, is also central here, namely that of reducing the need for reserve and back-up capacity without jeopardizing the security of supply.

15 Interviews, 2, 54.

16 Interviews, 4, 44

17 Interviews, 1, 13, 18

18 Lemgart, op. cit.

19 Interviews, 8, 13, 36

Potential Renewable Energy Sources							
	Hydro power	Wind	Geo thermal	Tidal	Waves	Biomass/Waste	Sun
Northern Greenland	U	I	I	U	U	U	I/U
Mid Greenland	M	I/U	I	I	I	I	I/M
South Greenland	M	I/M	I	I	I/U	I	I/M
East Greenland	M/U	I	I	I	U	I	I
Faroe Islands	M	M	U	I	I/M	M	I/M
Iceland	M	I	M	I	U	M	M/U
Northern Norway	M	M	I	I	I	U	M/U
Western Norway	M	M	M	I	I	M	I/U
Eastern Norway	M	U	M	U	U	M	I/U

Table 1: Potential renewable energy resources in the North Atlantic / West Norden region ²⁰

U = Of no interest I = Of interest, but details missing M = Would be possible

The issue of knowledge dissimulation in respect of the various systems – the traditional diesel/oil based generators and the new technologies connected to renewable resource exploitation – however remains a significant challenge. Moreover it has often been emphasized that the expertise developed in connection with maintaining the traditional energy supply is quite different from that needed as regards renewable resources. This, however is contradicted by the fact that the last 5-10 years have shown increasing openness from educational institutions and innovation centers towards participation in research and development, providing training facilities for much more diverse technologies²¹.

3.1.1 Energy development framework for the sparsely populated areas

The questions raised above in connection with the Nordic countries are not however unique even in a broader European context. The question of developing alternatives for energy supply in sparsely populated areas is reflected in the recommendations brought forward by the Council of Europe's Chamber of Regions²². They stress that many peripheral and sparsely populated areas are rich in natural resources, and that resources such as bio-energy and hydroelectric energy are not only valuable for Europe in general, but that the developing of such resources offers opportunities for peripheral regions. Not only in order to change energy production and energy use practices with a view to reducing carbon dioxide emissions and to replacing depleting mineral-based energy sources, but in addition to promote the inclusion of indigenous, diversified renewable energy sources such as wind energy, biomass, hydro energy, geothermal and solar power in order to offer a safe and reliable future for European energy requirements. It is, moreover, continually emphasized how such energy sources have the three-fold benefit of being less destructive of the environment, reduce dependency on energy imports and improve security of supply. In addition this approach ensures "provision of energy in places where the cost of providing traditional energies is often very high and it creates employment opportunities in regions often experiencing high unemployment"²³.

As indicated above, the question of energy supply by means of local renewable resources does not only appear to be a means of ensuring access to energy, but in addition becomes a policy tool in relation to peripheral regions and the creation of equity of access to infrastructures, services and economic development. It is even suggested that "Some regions are home to native, traditional peoples and cultures which are an integral and precious part of our shared European heritage and civilisation"²⁴.

²⁰ Lemgart, op. Cit.

²¹ Lemgart, op. cit, and interviews 22, 32

²² 1. Debated and approved by the Chamber of Regions on 31 May 2007 and adopted by the Congress on 1 June 2007, 3rd Sitting, Document CPR(14)7REC, draft recommendation presented by I. Linge (Sweden, R, EPP/CD), rapporteur

²³ Chamber of Regions, op. cit.

²⁴ Chambers of Regions, op. cit.

In the Nordic setting context then obvious similarities emerge in relation to the sentiments expressed in statements made at the general European level. At the “programmatic level” similarities in targets can easily be identified, for instance when local actors from the Faeroe Islands, Greenland and Iceland, in co-operation with Nordic Energy Research in 2004, studied various alternatives for distributed energy production systems for scarcely populated areas. The study included a mapping of the current energy situation, a development of model tools for efficient and flexible analyses and finally, simulations to find suitable technical concepts and locations for possible future demonstration plants based on environmentally friendly energy production solutions. The study highlights hydrogen technology combined with wind power (especially in the Faeroe Islands) and solar power or small scale hydropower (especially in Greenland) as suitable energy solutions in isolated areas²⁵.

Similarly, joint projects within the Nordic Energy Research organization provide excellent studies on the technical and economic options relating to the introduction of renewable energy systems in sparsely populated areas. A key question seldom touched upon here however is how local and regional producers and agencies are involved in laying out strategies for future development, and what kind of networks have already been developed, including the question of what the main driving forces in respect of local adjustments to change have been.

When looking into strategy and development documents, and especially by means of interviewing regional and local authorities, it is possible to provide a more in-depth understanding of the options and adjustment processes which have been decisive in relation to the current structure, as well as determining the likely directions of future change.

3.1.2 Regional characteristics

West Norden and the sparsely populated regions in particular are characterized by being different from the rest of the Nordic countries and at the same time in many ways quite similar. The overall framework through the physical, infrastructural and demographic characteristics of the regions are quite similar, just as the institutional framework seems to have many joint characteristics. In order to compensate for the differences, however, it is generally perceived that the decision-makers at the national level have to comply with an energy strategy that gives special consideration to the island structure, the small scale installations and the small economies³⁰. What may be feasible and economically viable on a large scale may be a problem locally³¹ requiring special attention.

The supply network often impacts island communities directly and to a lesser extent the supply networks in the Nordic and other European countries connected through a backbone network³². Energy supply in the West Norden territories at the same time present a varied picture, which to some extent makes it difficult to exchange information and experiences both within and between the countries, thus rendering the strategic exchange of knowledge and experience difficult³³.

25 <http://www.nordicenergysolutions.org/performance-policy/nordic-cooperation/the-west-nordic-project>

26 <http://www.nordicenergy.net>

27 For instance:

- Juha Ruokonen, Gunnar Aronsen, Anna-Maija Turkama, Kristian Gautesen, Mats Nilsson, Juha Ollikainen and Atle Middtun, “Opportunities for harmonisation of instruments for the promotion of renewable energy in the Nordic countries”
- Ulleberg, Øystein, and Andreas Mørkved “Renewable energy and hydrogen system concepts for remote communities in the west Nordic region - the Nólsoy case study”, 978-82-7017-697-7
- Byrkjedal, Øyvind “Nanortalik A preliminary analysis of the wind measurements” –
- Strømmen, Kristian “Introduction of Renewable Energy Systems in Remote Communities in the Nordic Region - A Case Study of Nólsoy, The Faroe Islands” and Ulleberg, Øystein et al. “Renewable Energy System Concepts for Nólsoy, The Faroe Islands” - Renewable Energy System Concepts for Nólsoy, The Faroe Islands. Both 2006.

28 A total of 55 key managers and decision takers in the Nordic Sparsely Populated Areas and Westnorden have been made in connection with this project.

29 Interview 44

30 Interviews 3, 9, 14, 28, 44, 51

31 Interview 2

32 Interview 43

33 Interviews 22, 36, 53

A decentralized power supply in sparsely populated regions mainly based on renewable energy has to be able to use technical skills and 'know-how' across an array of quite different renewable energy sources and related technologies, and this might open up possibilities for much closer cooperation between both regions and countries³⁴. One significant problem here, however, is the fact that politicians often talk about cooperation and alternative energy sources before elections, but when elected they seldom follow up on their promises, often because the costs of moving from conventional energy sources to renewable energy may be a burden during the politician's political lifetime, while the potential benefits can only be reaped by future politicians. In consequence, "talking without acting"³⁵ is very common in relation to the provision of renewable energy systems.

3.1.3 Networks and knowledge exchange

The question of exchanging knowledge is both a biased and a complex one. On the one hand it is often experienced not to be a hindrance³⁶, because networks and cooperation activities between technical centers, educational institutions and innovation centers are usually accessible, open-minded and willing to entertain practical arrangements with planners, practitioners, communities and industry. Research and pilot projects are only undertaken quite sporadically, however, which seems to indicate that while the knowledge gained from these projects may, in the long run, be useful it is often not currently actionable.

It has been continuously emphasized that all the West Norden territories still lack information about the possibility of combining two or more renewable energy sources, and that the combination of a main and a supplementary source is still utilised to only a limited extent. As such, even though networking is occurring on a reasonable scale³⁸ resources are spread quite thinly³⁹ and often need someone to be in charge – organizing the joint activities that do take place⁴⁰. Powerful service centres do exist⁴¹ but often with only limited resources so the possibilities of exchanging knowledge vary, depending on the local organizations concerned and their commitment to actively promote knowledge sharing on a regular basis, and there are also those who complain about the limited options available⁴⁴. Getting involved in the exchange of knowledge and experiences is often a challenge for organizations who are not always competent in creating connections⁴⁵, as well as those quite frequent situations where the problem is a result of outsiders being responsible for the project development without generating internal experiences and leaving a positive footprint⁴⁶.

3.1.4 Interaction between the private/public spheres and the national/regional/local levels

Interaction requires acceptance of the different interests of private and public organisations and institutions, and energy supply businesses have to take into consideration their own ability and willingness to participate in an open dialogue with other partners⁴⁷.

³⁴ Interviews 6, 10, 53

³⁵ Interviews 17

³⁶ Interview 1

³⁷ Interview 15, 19, 32

³⁸ Interview 10

³⁹ Interview 9

⁴⁰ Interview 10

⁴¹ Interview 15

⁴² Interview 16

⁴³ Interview 30, 31

⁴⁴ Interview 34

⁴⁵ Interviews 43, 47

⁴⁶ Interview 36

⁴⁷ An interesting case here is the development of the alumina industry in Greenland where the company *Greenland Development* has been assigned competence for developing the project on behalf of Greenland Home Rule. During its first years of operation the company tried to prevent any public

⁴⁸ Interview 12

⁴⁹ Interview 13

Problems, of course, emerge in situations where NGO's, the public and the private sectors are each seen to be pulling in different directions⁴⁸, not least because a lot of resources are used on lobbying⁴⁹ which might have been used more productively, for instance in establishing common standards in order to provide for the establishment of a "common pool" of expertise and equipment.

There are only a few areas in which several countries each possess exactly the same competence with the smaller economies often being the most vulnerable. Interest in cooperating and in forming associations, partnerships, and similar common interest fora, is substantially higher in the North as compared to interest in the more southern regions. A further problem here however is the much more frequent North-South interaction than the East-West interaction actually needed for the West Nordic regions as a whole⁵⁰.

A further problem here relates to the fact that only some parts of the distribution net can be privatized⁵¹ and that the various Nordic countries display very different experiences in relation to the question of privatization or the delegation of responsibilities in respect of energy distribution⁵². This is not, however, considered a hindrance by everybody given the existence of several cases where distributed systems are already functioning under various types of ownership⁵³. Instead there are several mentions of how limited competition is becoming much more of a hindrance, while the issue of whether a system is public or private is not decisive once the activity has been established. In this context mention is also made of good experiences with the delegation of activities to small local companies within national settings, while only limited experience exists in relation to cross-border company delegation throughout Norden⁵⁴. Another point made in respect of arguing for greater local involvement in respect of small scale service companies is the fact that such services need to take into consideration the fact that distances are great and travel costs are high. Even where IT applications may be available to remotely steer, troubleshoot or even repair the technology, local involvement is still considered important, even where it results in less efficient processes, because the long term benefits are obvious⁵⁵.

3.1.5 Driving forces and the question of who is ready

The willingness of industry to take up the task has been indicated above as has the fact that divergent experiences exist within the public sphere. Several emphasise that consumers in general are ready to make the change away from fossil fuels and seek workable alternatives, including the promotion of fuel economy, while others stress that the general public remain hesitant, reluctant to give up the secure resources provided by the large scale external providers of energy. In essence then we have a mixed bag of experiences depending in the main on local differences and approaches.

In addition the role of EU policies in imposing new requirements in respect of limiting CO₂ generation has undoubtedly led to a new openness being shown towards alternative energy resources⁵⁶. In addition, the fact that cooperation has often stimulated change⁵⁷ has also been emphasized as an important element here. Cooperation in relation to practicalities such as running

discussion and information access in order to ensure a fast and "undisturbed" procedure. They did not succeed, however, and among the reasons for this was the demands made by the international company Alcoa that not only should the procedure be open while fulfilling all national and regional demands regarding investigation of the possible consequences of establishing the plant, but also should be proactive in relation to other claims that might come up in relation to openness. The reason for this was that for Alcoa to become not only the world's largest player on the Alumina market, but also manufacture a company profile showing responsible action in a country where the question of negative consequences for indigenous persons might have destroyed the image.

50 Interviews 12, 23, 53

51 Interview 20

52 Interview 21

53 Interview 36

54 Interviews 22, 27, 28

55 Interviews 36, 53

56 Interview 3

57 Interview 46

joint networks and production facilities has been stressed, but the most common comment in this context concerns cooperation activities in relation to the exchange of experiences, joint courses, seminars and workshops, studying new technologies, arranging study tours etc., each have shown good results.

Lobbyists are however viewed as a major hindrance to the establishment of alternative energy systems as they are seen as competing for the same resources and manpower, and for the same funding sources. While not purveying direct misinformation, by means of their one-sided information campaigns and the often total lack of proper information regarding alternatives, they tend to limit interest in the move towards new approaches to energy generation⁵⁸.

4. Transforming systems

In order to understand the ongoing changes, the theoretical focus of the project has been on transformation processes in which society changes in fundamental ways over longer periods of time, with emphasis on the role of policies in bringing about structural change, and in particular how their management involves sensitivity to existing dynamics and the regular adjustment of goals to overcome the conflict between long-term ambition and short term concerns⁵⁹.

A point in this regard is that societal functions are fulfilled by socio-technical systems, which consist of a cluster of aligned elements, e.g., artifacts, markets, regulation, cultural meaning, infrastructure, knowledge, maintenance networks and supply networks, and that transitions in the wider transformation process are conceptualised as system innovations, i.e., a change from one socio-technical system to another⁶⁰. The key questions in respect of the energy systems of West Norden and its sparsely populated regions in particular relate to these socio-technological changes, and in this respect it is relevant to emphasise three different levels: micro, meso and macro levels.

- The micro level comprising individuals or individual actors such as companies, environmental movements etc., often characterized by *niche* level technological changes related to individual actors and technologies;

- The meso level comprising networks, communities and organizations, often characterized as socio-technical regimes, relating to dominant practices, rules and shared assumptions where the interests, rules and beliefs that underlie policy are mostly geared towards optimising rather than transforming systems;

- The macro level comprising conglomerates of institutions and organizations such as cross regional cooperation efforts and national policies, relating to what are referred to as socio-technical landscapes encompassing material and immaterial elements at the macro level: material infrastructure, political culture and coalitions, social values, worldviews and paradigms, the macro economy, demography and the natural environment.

A key question in relation to changes in the socio-technical systems is that of transition from one system to another which is important in relation to policy strategy, especially when focussing on the process of induced change towards sustainability⁶¹. On one hand through the recognition of the concept of endogenous technological change where issues such as the stock of human capital

58 Interviews 3, 4, 22, 28, 45

59 (Rotmans, Kemp and van Asselt)

60 (Geels, Schot)

determines the rate of adjustment⁶² but also that external relations including access to knowledge is an integral factor in determining whether regions provide the relevant system of reference for knowledge-based economic development⁶³. In this context the concept of Triple-Helix could become relevant as a perspective in relation to the integration of the micro, meso, and macro levels⁶⁴.

With transition management being the key issue in the theoretical framework outlined above, two approaches have been analyzed, applied and tested in connection with the project, the MCDA – Multi-Criteria Decision Analysis, and Technological Road-mapping.

4.1 Application of knowledge-based tools

The two suggested methods are on one hand individual tools that can be applied in relation to transitional analysis in general. At the same time they are methods that – in connection with technology – can be seen as two steps in a progressive approach to the transition problem.

4.1.1 MCDA – Multi-criteria Decision Analysis:

The recognition of the fact that technology managers increasingly are facing problems in respect of group decision where the scale and complexity of research, development and alliance efforts in emerging fields of technology mandate the need for a correspondingly sophisticated form of group coordination, the application of MCDA methods are often used to help decision-makers in such Situations⁶⁵. The method is more specific used to evaluate a variety of courses of action against a set of established criteria.

Decision analysis looks at the potential paradigms in which an individual or a group of decision maker(s) are looking for different options. Usually precise knowledge may be limited, and as our values, beliefs and perceptions are the force behind almost any decision-making activity, help will be needed. The individual evaluations are responsible for the perceived discrepancy between the present and a desirable state, and the imbedded values are articulated in a goal, which often will be the first step in a decision process. And the goal may be put forward by either an individual decision-maker or by a group of people, depending on the setting of the decision making process.

The goal of the integrated decision-making support is to provide the decision-maker with the possibility of seeing different options, and to make the best possible decision based on past and present information and future predictions through a set of systematic procedures for analyzing complex problems dividing the decision problems into a number of more manageable parts; analyzing each part; and integrating these parts in a logical manner to produce a meaningful solution⁶⁶.

In the case of energy development, this means to be able to predict in advance the risk and vulnerability of different types of energy production systems as well as energy distribution systems and infrastructure to hazards, both natural and man-induced. This, however, requires that data be transformed into knowledge, and that the consequences of information use, as well as decision-making and participatory processes, be as well presented as analyzed carefully.

61 (van de Kerkhof, Wieczorek)

62 (Romer)

63 (Cooke, Leyesdorff)

64 According to Etzkowitz (2002) the “triple helix” is a three dimensional spiral model of innovation that captures multiple reciprocal relationships in the process of knowledge capitalization, and with the university-industry-government relationship being of relatively equal and interdependent character. The first dimension is internal transformation in each of the helices, such as lateral ties among companies through strategic alliances or economic development mission by universities. The second is the influence of one helix upon another, for example, the role of the federal government in instituting an indirect industrial policy. And the third dimension is the creation of a new overlay of trilateral networks and organizations from the interaction among the three helices.

65 (Cunningham and van der Lei)

66 (Malczewski)

A multi-criteria decision problem usually involves selection of a number of alternatives to achieve an overall result, based on the specific qualities of those alternatives against a set of criteria. Qualities in this connection could be multidimensional, for instance characteristics of sustainability, stability, cost-effectiveness, maintainance problemst etc.. And the criteria will normally be weighted in terms of their importance to the decision maker, because criteria are rarely of equal importance. Criterion outcomes of decision alternatives will usually be organized in a table comprised of a set of columns and rows. The table rows represent decision alternatives, with table columns representing criteria. A value found at the intersection of row and column in the table represents a criterion outcome - a measured or predicted performance of a decision alternative on a criterion.

This is possible because when the method is applied to the problem, usually a rating of the alternatives will be formulated, and eventually ranked according to a set of preferences. As a consequence of this, the criteria must be measurable, and their outcomes must be measured for every decision alternative. It does not mean, however, that the criteria needs to be on a continuous scale. Also criteria measured at a nominal scale, such as yes/no; available/not available; present/absent etc. are valid, and will be taken into consideration in the comparison. The quality of information in any decision situation can be scientifically-derived hard data or subjective interpretations, from certainty about decision outcomes - deterministic information - through uncertain outcomes represented by probabilities, and to qualitative characteristics. This diversity in type and quality of information about a specific problem obviously calls for an approach where methods and techniques that can assist in information processing.

In general, therefore, MCDA problems involve six components⁶⁷:

- The setting of a goal or a set of goals the decision maker wants to achieve,
- Setting the decision maker or a group of decision makers involved in the decision making process preferences with respect to the evaluation criteria,
- The formation of a set of evaluation criteria (objectives and/or physical attributes)
- The formation of a set of decision alternatives,
- Dealing with the set of uncontrollable (independent) variables or states of nature (decision environment)
- Acknowledging the set of outcomes or consequences associated with each alternative attribute pair.

Ultimately, these methods and techniques may lead to better decisions. The sustainable energy planning, for instance, includes a variety of objectives, as the decision-making is directly related to the processes of analysis and management of different types of information (technological, environmental, economic and social). Very often, the traditional evaluation methods, such as the cost-benefit analysis and macro-economic indicators, are not sufficient to integrate all the elements included in an environmentally thorough energy plan, and in that connection in the selection of a specific technogial paradigm. Effective alignment of technology with the development objectives requires effective mechanisms for knowledge flow between the levels, in order to ensure that the expectations and needs of a society, the relevant businesses and the population are understood in relation to the specific products and especially in connection with the technology levels that are available. Similarly the ability of the communities to respond to the requirement by means of ensuring adequate technological capabilities should be understood and reflected in the process. And in this connection the multiple criteria methods seems to provide a tool, which is more appropriate to assemble and to handle the wide range of variables that is evaluated in different ways and thereby being able to offer a valid decision support. In practical terms: a set of energy planning alternatives are determined upon the implementation of installations of renewable energy sources and are assessed against economic, technical, social and environmental criteria identified by the actors involved in the energy planning arena.

67 (Keeney and Raiffa; Pitz and McKillip)

4.1.2 Technological Road-mapping

A first step in the moving from one paradigm to another is the evaluation of – and eventually choice between – different strategies. Another step will be the implementation process of the selected strategy. Several attempts have been made⁶⁸ to outline approaches to this part of the knowledge-based decision making, which in many ways are themselves variations of the MCDA framework described above.

The technology roadmap (TRM) approach is closely related to the framework described above, as technology, product and access to systems and services in relation to the time dimension are primary components. Where the MCDA, however, focusses on the construction of matrix, the TRM has the time-line as its primary tool. The TRM could be seen as a consultative process that is designed to help decision makers and stakeholders to come together to jointly identify and prioritize the technologies needed to support the chosen strategy (or strategies), and on the time-line identify barriers and constraints. This include for instance indntification of the critical technologies as well as the skills required to properly utilize the technologies of the future. Consequently the TRM therefore also serves as a means to achieve a joint decision on future research and development, future skills development, and to establish a commitment to work together to address these challenges.

There are several ways of defining the key components, and in relation to this particular project a general model of information flows and thresholds has been outlined, leading to the following suggested structure of an adjusted technological roadmap in determining and testing the relevant policy measures⁶⁹:

Phase 1: Preliminary activity phase, defining the essential conditions and outlining the scope and boundaries for the technology roadmap. In this context the activity includes identification of the critical issues determined by the questions of systems maintenance versus systems integration, and systems replacement.

Phase 2: Development phase, encompassing (as general examples, but each step is case sensitive):

- Identification of the “product” of the roadmap, i.e. what is the overall structure to be analyzed,
- Identification of the critical system requirements and their targets
- Specification of the major technology areas (transformation requirements)
- Specification of the technology drivers and their targets
- Identification of the technological alternatives and their timelines
- Recommendations in respect of the technology alternatives that should be pursued
- Creation of the technology roadmap

Phase 3: Policy phase, outlining the policy measures and testing them on existing as well as suggested forecasts of future conditions.

Phase 4: Follow-up activity phase (optional)

4.2 Feasibility of knowledge-based tools for practitioners

Both tools presented above have been discussed in connection with the analysis of the empirical data collected in relation to the development of energy systems in the Nordic periphery. While the empirical data provided by means of documents and statistics has served as a key component in outlining the technological basis of such systems for the MCDA, the roadmaps have been evaluated directly by means of interviews with stakeholders in the region, and used as a means of identifying

68 (Gedsri, Vatananan, and Dansamasatid; Yasunaga, Watanabe and Korenga; Abe, Ashiki, Suzuki, Jinno and Sakuma)

69 Strauss et al., 1998

potential conflicts and deficits in current policy measures.

It has been quite clear that the MCDA approach has been seen as a possibility to ensure a more effective alignment of technology with the development objectives⁷⁰, and thereby ensure more effective mechanisms for knowledge flow between the different levels in the decision process. It has been seen as an obvious tool in ensuring that the expectations and needs of both stakeholders and decision makers are met⁷¹. In connection with the presentation of the options for a technology shift for a broader audience, the presentation of specific products and especially the technology levels that are available are very much appreciated⁷². Similarly the option of letting the communities respond to whatever requirement any new systems may generate, and thereby enabling the communities' concerns being reflected in the process, has been considered one of the most important advantages of the method⁷³. So in this connection the multiple criteria methods seems to provide a tool, which on one hand seems to be appropriate to assemble and to handle the wide range of variables that is evaluated in different ways, and at the same time opening up for the offering of a valid decision support.

Similarly the TRM has been emphasized due to its capacity through a time-line to help decision makers and stakeholders to jointly identify and prioritize the technologies needed to support the chosen strategies, and on the time-line identify barriers and constraints⁷⁴. A general concern is the identification of any critical technologies, but especially the identification of the skills required to properly utilize the technologies of the future, and ensure that it becomes an integral part of the planning process⁷⁵. As suggested above, the TRM therefore also serves as a means to achieve a joint decision on future research and development, future skills development, and to establish a commitment to work together to address these challenges.

The application of the knowledge-based tools outlined above has two advantages in relation to being k-based tools for practitioners. Firstly the application of these tools represents a structural approach which can be applied both through desk-studies as in connection with workshops. And, in addition, they can also be applied at the micro, meso, and macro scale, benefiting from background material available at all three levels.

The background materials – the indicators – which should be developed in advance, should, in the case of energy systems, encompass the following:

- Major technology areas
- Critical system requirements
- Transformation requirements
- Technology drivers and their targets
- Technology alternatives and their timelines
- Policy measures
- Historical outlines
- Forecasts of future conditions.

The application of the approach to the empirical data developed within the project seems to indicate that the approach is feasible as well as productive in relation to testing and outlining policy measures at the three individual levels. The particular advantage gained, however, is the cross-fertilization benefits of including all three levels in the analysis, as this enables the identification of missing links that may be crucial in connection with the development of a coherent and inclusive national strategy.

⁷⁰ Interview 9, 23; 46, 12

⁷¹ Interview 22, 9; 23, 33

⁷² Interview 36, 18

⁷³ Interview 48, 8

⁷⁴ Interview 21, 12; 46, 22

⁷⁵ Interview 9, 28

References

- Action Plan for Nordic Energy Co-operation 2006-2009 (2005). Nordic Council of Ministers, <http://www.norden.org/pub/miljo/energi/uk/ANP2005732.pdf>
- Byrkjedal, Ø. "Nanortalik A preliminary analysis of the wind measurements" – "Renewable Energy System Concepts for Nólsoy, The Faroe Islands" - Renewable Energy System Concepts for Nólsoy, The Faroe Islands.
- Caporaso, J., and D. P. Levine (1992) *The Theories of Political Economy*. Cambridge University Press.
- Cooke, P., and Leydesdorff, L. (2006) Regional Development in the Knowledge-Based Economy: The Construction of Advantage. Introduction to the Special Issue. *Journal of Technology Transfer*, 31 (1), 2006, 5-15.
- Cunningham S. W., and van der Lei, T. (2004) Fast and Frugal Algorithms for Adaptive Policy, *Proceedings: IEEE International Conference on Systems*, Manchester.
- ECON PÖYRY (2008) The expanding bio-energy market in the Nordic countries – Possibilities and consequences. Commissioned by Nordic Energy Research, Oslo. (Unpublished)
- Energy, transport and environment indicators – 2007 edition (2008). Eu-rostat pocketbooks. European Commission http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-DK-07-001/EN/KS-DK-07-001-EN.PDF
- Energy - Yearly statistics 2006. Euro-stat Statistical books (2008). http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-PC-08-001/EN/KS-PC-08-001-EN.PDF
- Environmental Leader 2007, Vestas Wind Systems, Top Green Company of 2006 available on line at: <http://www.environmentalleader.com/2007/01/29/portfolio-21-vestas-wind-systems-top-green-company-of-2006/>
- Esty, D. C., M. Levy, C. Kim, A. de Sherbinin, T. Srebotnjak, and V. Mara (2008) *2008 Environmental Performance Index*. New Haven: Yale Center for Environmental Law and Policy. <http://epi.yale.edu/Home>
- Etzkowitz, H. (2002) Innovation in Innovation: The Triple Helix of University-Industry-Government Relations. *Social Science Information*, Vol. 42, No. 3, 293-337.
- GHK & IEEP (2007) for European Commission's DG-Environment, Links between the environment, economy and jobs. http://ec.europa.eu/environment/enveco/industry_employment/pdf/ghk_study_wider_links_report.pdf
- Keeney, R., and Raiffa, H. (1993) Decisions with multiple objectives: preferences and value tradeoffs. Business & Economics.
- Klitkou, A., T. E. Pedersen, L. Scordato, and Å. Mariussen (2008). Competitive policies in the Nordic Energy Research and Innovation Area eNERGIA. NIFU STEP, Oslo. Part 1: Country reports, Rapport 25 / 2008. <http://www.nifustep.no/content/download/35113/162010/file/NIFU%20STEP%20Rapport%2025-2008.pdf> Part 2: Technology reports, Rapport 26 / 2008. <http://www.nifustep.no/content/download/35114/162031/file/NIFU%20STEP%20Rapport%2026-2008.pdf>
- Lemgart, M. L. et al. , 2004, "Muligheter for fornybare energisystemer og hydrogenteknologi i Vest-Norden - Energiplanlegging og systemstudier" - Fornybare energisystemer og hydrogenteknologi i Vest Norden.
- Ministry of the Environment (2007) Iceland's Climate Change Strategy.
- Nordic Road Map - Programme for the Icelandic Presidency of the Nordic Council of Ministers 2009 (2008). The Nordic Council of Ministers, Copenhagen. <http://formennskadansk2009.forsaetisraduneyti.is/media/Formennska2009/Enska.pdf>
- Rotmans, J., R. Kemp, and M. B. A. van Asselt (2001) More evolution than revolution: transition management in public policy. *Foresight*, 2001. 3(1): p. 15-32.
- Ruokonen J., G. Aronsen, A.-M. Turkama, K. Gautesen, M. Nilsson, J. Ollikainen and M. Atle (2008) Promotion of renewable energy in the Nordic countries – Opportunities for harmonization of instruments. *TemaNord* 2008:598. Nordic Council of Ministers, Copenhagen.
- DeCarlo, S. The World's Biggest Companies. Forbes Special Report.

- http://www.forbes.com/2009/04/08/worlds-largest-companies-business-global-09-global_land.html
- Strømmen, K. "Introduction of Renewable Energy Systems in Remote Communities in the Nordic Region - A Case Study of Nólsoy, The Faroe Islands" and Ulleberg, Øystein et al. Both 2006.
- Tapio, P. (2005) Towards a theory of decoupling: degrees of decoupling in the EU and the case of road traffic in Finland between 1970 and 2001. *Transport Policy*, Volume 12, Issue 2, March 2005, Pages 137-151.
- Tennbakk, B., B. Rydén, and H. Sköldbberg (2006) The energy policies in the Nordic countries. In: *Ten Perspectives in Nordic Energy. Final report for the first phase of the Nordic Energy Perspectives project.*
- Tolonen, J., B. Rydén, and H. Sköldbberg (2006) Support Schemes for renewable energy in the Nordic countries. In: *Ten Perspectives in Nordic Energy. Final report for the first phase of the Nordic Energy Perspectives project.*
- Ulleberg, Ø., and A. Mørkved "Renewable energy and hydrogen system concepts for remote communities in the west Nordic region - the Nólsoy case study", 978-82-7017-697-7.
- Van de Kerkhof, M., and A. Wieczorek (2005) *Learning and stakeholder participation in transition processes towards sustainability*. Vrije Universiteit, Holland.
- World University ranking of JTU (Institute of Higher Education Shanghai) (2008). Academic Ranking of World Universities (ARWU) and Academic Ranking of World Universities by Broad Subject Fields (ARWU - FIELD 2008) <http://ed.sjtu.edu.cn/ARWU-FIELD2008.htm>

Web-pages:

- http://www.sum.uio.no/susnordic/comparative/energy_use.html
- http://www.stratfor.com/memberships/131678/analysis/20090206_sweden_preparing_nuclear_power_boom
- <http://emi-web.inel.gov/roadmap/guide.pdf>
- <http://www.nordicenergysolutions.org/performance-policy/nordic-cooperation/the-west-nordic-project>

Annex 1: Interviews

The following list include the persons who have been interviewed in connection with the project. The list is organized according to country and order of interviews. The system of references in the text does not relate to the order of the list. Further details and excerpts from the interviews are available in Rasmussen, R.O. and Hansen, K. G:

Finland

Rovaniemen Energia Oy: **Veikko Leivonmäki** Director of Rovaniemen Energia Oy.
Kemijoki Oy: **Kari Lamminmäki**, Senior Vice President, Production, and Antti Aula, **DTech**, Senior Vice President, Hydropower and Business Development.
Northern Finland Environmental Permit Authority: **Sami Koivula**, Consultant, and **Valtteri Niskanen**, Presenting Officer.
Metsähallitus: **Antero Luhtio**, Director, and **Erkki Kunnari**
Thule Institute, University of Oulu: **Kari Strand**, Dr., Programme director: 'Global Change in the North',
Finish Wind Power Association. (STY): **Jari Ihonen**
MOTIVA: **Timo Määttä**, Head of Unit - Renewable Energy
SLL (Finish Association for Nature Conservation): **Eero Yrjö-Koskinen** Managing Director, and **Janne Björklund**, Nuclear Campaign Coordinator

Iceland

Landsvirkjun (National Power): **Thorstein Hilmarsson**
RES, The School for Renewable Energy Science: **Arnbjörn Olafsson**, Director of International Affairs
OS Orkustofnun (National Energy Authority): **Agusta Loftsdóttir**, Ph.D. Physicist (Manager Alternative Fuel)
ISOR (Iceland Geosurvey), Akureyri: **Bjarni Gautason** Ph.D. Senior Geologist
NORDURORKA HF: **Stefan H. Steindórsson**, Vélteknifræðingur
Háskólinn á Akureyri (University of Akureyri): **Axel Björnsson**. Dr. Rer. Nat. Professor of Environmental Sciences
RES. The School for Renewable Energy Science: **Dr. Björn Gunnarsson**
FSA (Akureyri University Hospital – Regional Hospital): **Bjarni Jonasson**, Human Resources Manager
ALCAN á Íslandis: **Jakobina Jónsdóttir** (Human Resources), **Gylfi Ingvarsson** (Staff), **Olafur T. Gudnason** (Public Relations)
ALCOA Fjarðaál: **Erna Indridadóttir** (Community relations manager), **Hilmar Sigurbjörnsson** (Community relations), **Hafsteinn Viktorsson** (Production manager), **Óskar Borg** (Procurement manager), **Steindór Tórdarson** (Human relations manager), **Gudmundur Bjarnason** (Project manager, former Mayor of Fjardabyggd)
Municipality of Fjardabyggd: **Gunnar Jónsson**, Director of Finance and Administration
Trade Union, Fjardabyggd department: **Sverrir Albertsson**, chairman

Norway

Tromsø Kommune: **Wim Weber**, Environmental advisor
Fred Olsen Renewables AS: **Bjørn Blix**, Project manager
SWECO, **Harald Storås**, Master of Science, Energy consultant
Vadsø Erhvervsudviklingsrådgiver: **Nicolaj Christensen**.
Finnmarks Eiendomme: **Trond Aarseth**
Varanger Kraft AS.: **Tore Martinsen**, Business developer, and **Leif E. Jankila**, Manager

Finnmarks Fylkeskommune: **Jakob Nilsen Øyen**, Petroleum- og energirådgiver, Dept. Trade and Industry.

OED, Olje & Energidepartementet: **Håvard G. Lien**, Seksjon for fornybar energi.

IFE (Institut For Energiteknik): **Viktor Wikstrøm**, Information officer

NVE (Norges Vand/Vassdrags- og energidirektorat): **Lars Håkon Bjugan**, Senior Advisor

NORWEA, (Norsk Vindkraftforening): **Øyvind Isachsen**, Generalsekretær, and **Dr. Øistein Schmidt Galaaen**

“Natur & Ungdom”: **Håvard Lundberg**, Fagmedarbejder Energi.

Sweden

Norrbottnens energikontor AB, Nenet: **Fred Nordström** Director, President of Association of Swedish Regional Energy Agencies, FSEK. And **Christer Christersson**

Luleå Energi AB, **Erik Lundström**

Norrbottnens Län: **Matts Sjöberg**

Luleå Kommune, Teknisk Afdeling: **Ulf Wikström**

Umeå Energi: **Jörgen Carlsson**

Umeå Kommune **Johan Sandström**, Energi- og klimarådgiver,

Vesterbottens Län: **Birgitta Lunberg**

Faroe Islands

Jarðfeingi (Det Færøske energidirektorat): **Terji Durhuus**

Føroya Náttúruverndarfelag: **Kári Thomsen**, arkitekt og formand for den færøske naturværnsforening,

SEV (nationalt energiselskab): **Hákun Djurhuus**, Director, **Finn Jacobsen**, technical director, John P. Danielsen, economical director, and **Leivur Hansen**

Tvøroyri Kommune: **Lasse Jensen**

T.F. THOMSEN (Shell): **Anne Kirsten Thomsen** and **Thomas Thomsen**

Greenland

NUKISSIORFIIT, **Peter Nielsen**, informationsmedarbejder

Ístak Grønland / Nukissiorfiit: **Loftur Árnason**, Managing Director.

Sisimiut Forbrændingsanlæg, **Vagn Larsen**, driftsleder

A reflection on 1294 conversations: A discursive essay on knowledge-based tools in Swedish municipal response to climate change

Christian Dymèn, Per Francke,
Richard Langlais

1. Prologue

During the last few years, especially since 2006, when the IPCC began to release the preliminary results of its fourth review of global climate change research, the issue of climate change has become one of the most central issues on the municipal agenda. Swedish municipalities, for example, have for many years been working with energy questions such as district heating, which today would be considered as a climate change issue. The shift from being an energy issue to becoming a concrete response to climate change derives from the media's growing attention, as well as noticeable changes in our climate, as for instance expressed in more frequent occurrences of extreme weather. Even though the issue of climate change is still a "hot spot" in the Swedish debate, we feel that there is a certain maturity that is in its beginning, but perceivable, phases.

The question of adapting to climate change is becoming more important on municipal climate change agendas. The response, however, is today still mainly focused on mitigation activities, i.e. reducing emissions of greenhouse gases. By comparing results from our telephone surveys in 2007 and 2008, where we received 100% responses, it becomes clear that in the course of one year more and more municipalities are concretely responding to climate change, both in adaptation and mitigation. One explanation is that activities that previously were labelled as important for economic and energy efficiency, are today labelled as examples of climate change response, even though the activity as such is the same.

1.1 General observations and municipal activities

Several municipalities have established energy and climate change strategies, where concrete action mostly consists of energy-smart housing and building as well as using alternative energy supplies. It is also common that municipalities engage in transportation issues such as developing public transportation as well as encouraging citizens to walk and bicycle. Encouragement can be disseminated through information campaigns. Even broader and more comprehensive action is undertaken in municipalities' master plans (Swedish: översiktsplaner). Common activities included as responses to climate change in municipalities include: energy efficiency in buildings, development of district heating, car pools, measures implemented in the municipalities' own real estate, transport questions, information campaigns, projects in schools, energy advice, and so on. A clear majority of the municipal response to climate change is targeted towards mitigation, whereas few municipalities spontaneously mention adaptation measures. A noticeable trend today is that measures that earlier were referred to as for instance economic efficiency are today mentioned as being for climate change causes.

When we asked municipalities about their concrete actions and if they could identify projects or ideas that were especially noteworthy to highlight, some of their selected examples included projects that targeted schools. This shows that there is awareness that it is important to influence citizen's attitudes at an early stage of life. The overall impression is nonetheless that most municipalities work in similar ways when it comes to response to climate change.

1.2 Interpretations of the issue of climate change—performing the survey

Similar to an earlier edition of this survey, from 2007, our 2008 edition reveals that there is great confusion within municipalities with regard to responding to climate change. This confusion is primarily noticed when the interviewer (the researcher) is in the process of being shuffled between several persons before the right one for answering the questions is found. The first contact with the

municipality's switchboard provides a first indication of how the municipality organises its work for climate change. Sometimes, for example, the interviewer is asked whether we (the interviewer) mean the inside or the outside climate! Furthermore, there is great variety in how the switchboard interprets our question. Often our question is interpreted as being an issue of control, or checking, from the central authorities, whereupon we are transferred to, for instance, the municipality's department for environmental control (avdelningen för miljöskydd), where the officials make regular controls of how private companies follow the laws. In that referral, the focus becomes switched to one relying on environmental indicators and evaluation of how the municipality and private companies are following the laws and regulations.

In other cases, our phone call to the switchboard is transferred to the municipality's department for strategic planning (samhällsbyggnadsförvaltning). As a consequence of how we are switched to different departments, we achieve different interview results. Some interviewees respond on a strategic level whereas others respond more according to their professions, as for instance controllers and evaluators of how environmental indicators that are stated in laws and regulations are followed.

In some cases, the switchboard connected us to persons in positions of higher responsibility, such as the directors of various departments (förvaltningschef), or of the entire municipality (kommunchef).

Another interesting aspect to consider is whether the municipality has a structure for working with strategic dimensions of climate change or not. That climate change is a challenge is understood by most municipalities, but they have difficulties in handling the question, since the issue is often not prioritised and therefore does not have a clearly responsible politician or official behind it. One good example of how this is expressed in reality and of how the issue of climate change challenges the municipal organisation is the tradition of dealing with authoritarian control, such as shown in the example from the late 1970s when "radon" was highlighted as being very unhealthy for citizens. Since the end of the 1970s and up until now several laws and regulations have been adopted. This can be a reason why many switch boards ask whether we mean the inside or outside climate. However, it is even more interesting to focus on the municipalities' familiarity in working with strategic questions—not always clearly stated in laws and regulations—such as response to climate change. Municipalities face challenges in organising themselves for dealing with both climate change adaptation and mitigation. Today, many municipalities see these as separate issues.

1.3 Climate and gender

A specific question related to a gender perspective was added to our 2008 telephone survey. Representatives of municipalities were asked whether they had in any way been paying attention to the correlation between gender and response to climate change. When considering that question, however, it has always been difficult to measure whether women's empowerment in decision-making processes actually benefits work towards climate change response. Nevertheless, results from the survey clearly show that most municipalities have not reflected on the fact that there could be a correlation between engendered issues and climate change response. Approximately 50% of all municipalities have not discussed this matter. Other municipalities have in many cases begun to address the issue but are not undergoing any active measures. A few municipalities are involved in projects where gender and climate are key perspectives, often in transport and travel pattern questions.

The argument that the climate change issue is gender neutral is found among the municipalities. This is interesting, since the literature clearly reports that women and men affect the environment in different ways, and that men and women can have different approaches to the relation between environment and development (Johnsson, 2007; Kurian, 2000).

Furthermore, some municipalities have highlighted the fact that the climate change issue has been prioritised only when male decision-makers have realised the importance of the question. This indicates that there is a bias towards men's values in decision-making. Is men's engagement crucial in order to acknowledge the more sustainable ways of living expressed by women? Some municipalities have responded that women generally are more committed to climate change issues and have developed a better understanding of them than men have, generally speaking.

Is it possible that if women had had the same representation and legitimacy as men in decision-making, that the climate change issue would perhaps have had a more natural position in the municipal debate? Less mass-media attention would perhaps have been needed to instigate change if power was more equally distributed between women and men. Is it also not possible that the turning point for climate change response in municipalities would have been initiated much earlier?

1.4 Cooperation—a key to success

Some municipalities have a clear political mandate to work with the issue of climate change, where different boards of politicians and officials have been created. Such boards also facilitate the municipalities' cross-sectoral work, as well as collaboration between different municipal departments. Such cooperation as well as different kinds of networks on the regional and national level have been shown to be fruitful for an active response to climate change. Furthermore there was—between 2003 and 2008—a unique and encouraging state subsidy (KLIMP) for municipalities that wanted to activate or boost their climate change response. In our interviews, we noticed that this subvention was fruitful and encouraging for many municipalities.

Many of the municipalities that have shown an active environmental and climate change concern have at some point had access to KLIMP, or its earlier version, LIP. Through these economic incentives, the municipality has managed to improve the work and managed to create a better acceptance among politicians. Nonetheless, it should be mentioned that the state subventions have—through the competitive applications—been favouring strong and big municipalities, given their larger resources for making applications and strategies. Small municipalities have in turn felt underprivileged in this concern.

2008 was the last year for applying for KLIMP. Many municipalities mentioned in the interviews that not having access to the subvention could kill their engagement. However, there are other motivating measures undertaken in Sweden such as reliance on various networks. Several municipalities are associated with networks such as: Uthållig Kommun, Klimatkommunerna and Sveriges Ekokommuner. Especially the network Uthållig kommun has during the last year become strong and important and is double the size of Klimatkommunerna and Ekokommuner. Nevertheless, the three networks differ in their content and objectives. Ekokommuner, established in the 1980s, has a wider focus, whereas Klimatkommunerna are focusing on climate change issues only. The network Uthållig Kommun has its focus on reducing emissions of CO₂. Klimatkommunerna has during the last years introduced an interesting initiative where certain municipalities are given the responsibility of coaching—often they are the smaller municipalities with less than 10 000 inhabitants and with fewer resources—for producing a climate strategy. The principle of coaching municipalities has also been adopted by Naturvårdsverket, the agency that originally initiated the Klimatkommunerna network.

In certain counties, there are networks between municipalities and the region. In Skåne and Dalarna, there are two projects—Dala-MaTs and Skåne-MaTs—that deal specifically with issues of sustainable transportation and efficient transport logistics. Even though those projects have in general boosted the local municipal responses to climate change, there are nevertheless some municipalities in those counties that have not yet begun their response to climate change. A good example of how municipalities within a county can work together is found in the county

of Värmland. The county has been helping municipalities to develop a climate strategy. Several municipalities have, in the interviews, highlighted that there is still a lack of sufficient cooperation between municipalities, in the exchange of ideas and experience. Nevertheless, some of those who are in the more inactive category of municipal response argue that climate change is a question for the state to deal with. Interesting, however, is that the final report from the Swedish Commission on Climate and Vulnerability points out that the regional level is crucial and that regional authorities should collaborate with municipalities to a larger extent than they are doing now. Municipalities also emphasise that they need more resources to face those challenges.

1.5 Future challenges for municipal responses to climate change

When it comes to the future plans that the municipalities have been contemplating as part of their response to climate change, there are several obstacles that need to be overcome. The municipalities consider that the issues of transport infrastructure and climate change adaptation are difficult to reconcile. Regarding adaptation issues, municipalities emphasised the risks of flooding, erosion and other situations of more emergency character. Furthermore, those who concentrate on the challenges of adaptation have often been affected by extreme weather of some kind. The municipal respondents also emphasised that it is difficult to estimate future impacts of climate change, and therefore hard to plan for it. Performing studies to estimate, for example, future flood prone areas is expensive, while data from the state authorities is lacking.

Also interesting, but, perhaps, not surprising, is that in most cases the municipalities—when we asked if they feel vulnerable to climate change—emphasised issues related to adaptation to extreme weather. Some municipalities have, however, interpreted vulnerability as being a question of future gas price rises. This is especially true for municipalities that are dependent on commerce and car transportation. Issues with economic dimensions are often incommensurable with climate change responses. That economic incentives that would work in encouraging response to climate change issues can be fashioned was considered to be an important priority, with the argument that state subsidies as well as lower energy costs boost work on climate change response. Similar incentives are needed for municipalities to work for a more strategic and long-term response to climate change.

In the municipalities, the largest percentage of emissions of greenhouse gases emerges mostly from the transport sector. To be able to contribute to climate change mitigation, municipalities need to find ways of reducing their emissions. One prominent obstacle for municipalities is the fact that they do not fully control the development of the entire infrastructure, which in many cases is a regional and state responsibility, thus implying that municipalities may become vulnerable in the future. There are also regional differences as to how sustainable transport solutions can be implemented. It is much harder for sparsely populated areas to fund public transportation, for instance. There is perhaps also a need for economic incentives that would facilitate investment activity on the part of sparsely populated municipalities.

1.6 Analysis and perspectives

Having performed the extensive and complete telephone survey for two consecutive years, we are now able to better understand the driving forces as well as the challenges that municipalities face when responding to climate change. Comparing the results from the 2007 and 2008 surveys indicates that there is indeed an increase in the number of municipalities that are responding concretely to climate change. There are nevertheless a great number of problems and other difficulties that municipalities face. As described above, the most challenging aspects for municipalities are the transportation issues as well as those related to adaptation.

By analysing the 2008 results, with 2007 as a reference, it becomes clear that the question of responsibility related to climate change is also important. Depending on whether the municipality interprets the issue of response to climate change as a question of authoritarian control, or instead, as a question for strategic planning, the results will become either short-term or long-term, respectively. In the 2008 survey, a comparatively larger number of the respondents are managers, planners, or climate change developers, which implies that response to climate change has become more of a strategic question and less one of authoritarian control of private emissions. Municipalities that succeed in responding to climate change have also managed to infiltrate the question into high political and administrative levels, where cross-sectoral cooperation can be undertaken. Municipalities that respond concretely to the challenges of climate change seem, indeed, to know what's best for them.

References

- Johnson-Latham, G. (2007) A study on gender equality as a prerequisite for sustainable development. Environment Advisory Council, Sweden 2007:2.
- Kurian, P. A (2000) Engendering the Environment? Gender in the World Bank's Environmental Policies. Shgaten Publishing Limited.