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Smink, Carla; Hong, Lixuan; Kerndrup, Søren; Sperling, Karl; Möller, Bernd

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Carla K. Smink, Associate Prof., Lixuan Hong, Ph.D.-student, Søren Kerndrup, Associate Prof., Karl Sperling, Ph.D.-student and Bernd Möller, Associate Prof.

Aalborg University
Department of Development and Planning
Fibigerstraede 13
9220 Aalborg East
Denmark

Abstract

In a recently started EU Interreg IVB project 'Cradle to Cradle Islands', the cradle-to-cradle concept is going to be applied to a number of islands in the North Sea region, aiming at 100% renewable energy supply.

The transformation of island energy systems is a challenging task, although islands such as Samsø in Denmark have shown the way. While technologies exist and are readily available on the market to produce electricity and heat and to provide mobility, the difficulties typically lie in creating the institutional, economical and regulatory settings to make people and companies invest in these technologies.

The specific challenge for islands is their dependence on energy supply from the mainland. Also, on most islands there are competing land uses for renewable energy from wind or biomass production. Areas are more sensitive and tourism and nature conservation often prohibits the development of renewable energies. Furthermore, islands often lack the economic capabilities of large scale investments. Therefore the introduction of renewable energy sources requires a careful planning process facilitated by social learning.

This paper describes how the Cradle to Cradle Islands project develops and applies simple energy planning tools specific for each island, which are then used to start discussions on the islands on the pros and cons of renewable energy development, by providing information and real choices, and by starting social learning processes.

Introduction

Products in the current industrial system are designed on a linear, one-way *cradle*-to-*grave* model; resources are extracted, shaped into products, sold, and eventually disposed of in a 'grave' of some kind, usually a landfill or incinerator (McDonough and Braungart, 2002: 27). The cradle-to-grave approach creates enormous amounts of waste and pollution. This way of thinking about the environment encourages us to reduce, reuse and recycle. Whether it is a matter of cutting the amount of toxic waste created or emitted, or the quantity of raw materials used, or the product size itself, reduction in any of these areas does not halt depletion and destruction – it only slows them down, allowing them to take place in smaller increments over a longer period of time (McDonough and Braungart, 2002: 53-54). The *cradle*-to-*cradle* approach, on the other hand, could be an alternative to the in due course established cradle-to-grave model. In the cradle-to-cradle approach products are designed in such a way that they do not pollute and are part of either the biological cycle (i.e. the natural processes of ecosystems in which biological nutrients are re-used in safe and healthy cycles of abundance) or the technological cycle (i.e. a material having the ability to maintain its inherent value by circulating in a closed-loop system, which includes manufacture, use, recovery and re-use) (EPEA, 2010b). It has to be stressed that focus is not solely on products; industrial processes and systems are part of the cradle-to-cradle approach as well. The system approach is precisely what the Cradle-to-Cradle Island project (C2CI-project) focuses on.

The C2CI-project is an Interreg IVB project that runs from January 2009 to the summer of 2012. In the project, 22 partners from 6 countries around the North Sea are participating, including 11 islands[1]. Among other things, the project aims at developing a cradle-to-cradle methodology for islands. It is no coincidence that these islands have been chosen; these islands are excellent locations for experiments with innovative solutions because they have a lot in common:

- Large number of visitors in summer
- High demands on water, energy, transport and goods in the peak season
- The ambition of becoming self sufficient in energy and water
- High visibility of sustainable activities
- Their particular geography does potentially allow for a systematic understanding of flows in a community, including flows of materials, water and energy

[1] Shetland Islands, UK; Texel and Ameland, the Netherlands; Spiekeroog and Region Uthlande, Germany; Samsø and the municipality of Norddjurs (Anholt), Denmark; Ven and Tjörn, Sweden; the Environmental Centre at Runde and Vågan/Lofoten, Norway.

Of course, the islands participating in the C2CI-project do also differ from each other; the islands do have different strengths and weaknesses in areas like water and energy production and consumption.

Aalborg University (AAU) models the island's energy system to integrate cradle-to-cradle thinking on islands. By doing so, AAU takes point of departure in one of the three main principles of the cradle-to-cradle approach, namely 'use of solar energy'. With regard to 'use of solar energy', McDonough and Braungart state (EPEA, 2010a):

'(…) Systems that are driven using solar energy are systems that are using today's energy without having to put the futures of our children and their children at risk. It is most certainly within the capabilities of today's technology to profitably incorporate the use of and reliance on solar energy into the design of production systems. The direct capture of solar energy is one possibility. Wind energy, created as a result of sunlight causing thermal differences in the atmosphere, is a further source. Biomass and other energy sources also form creditable possibilities'.

This leads us to the objective of this article. We will describe how the C2CI-project develops and applies simple energy planning tools specific for each island, which are then used to start discussions on the islands on the pros and cons of renewable energy development, by providing information and real choices, and by starting social learning processes. We will describe the origin of the energy planning tool and how the model is adapted to the island of Spiekeroog (Germany).

Theoretical framework

As mentioned in the introduction, islands can play an important role in demonstrating the implementation of sustainable, integrated approaches, such as the cradle-to-cradle concept. Not only do they provide ideal grounds for the full-scale testing of new solutions in a relatively protected and well-defined context, but also does their particular geography potentially allow for a systemic understanding of flows in a community, including flows of materials, water and energy. Working towards transforming these flows into self-sustaining cycles is essential to the realisation of the cradle-to-cradle approach. When it comes to energy flows, islands differ in terms of available resources and thus with regard to their dependency on the import of energy. While some islands may be or may become fully self-sufficient with energy, other islands depend and may continue to depend on connections to the mainland. Apart from that, islands may differ regarding the overall energy demand and the way energy is being converted and supplied. Understanding the interplay of these processes in the energy system is a necessary first step towards making informed decisions with respect to future development. Due to these particularities certain forms of (technological) change will have different impacts within different islands' energy systems. These considerations call for a quantitative tool that can help evaluate how feasible the implementation of a technology is, having the effects on the entire energy system in mind. First we will present the need for such a tool from a planning perspective. Next, we will present a quantitative tool (the Interactive SWOT Energy Tool), which in our opinion can contribute to mapping the islands' energy system, and by this make informed decisions with respect to future development.

In planning theory, we can distinguish between three types of planning: rational comprehensive planning (synoptic planning), participatory and communicative planning and incremental planning (Christensen, 2000). We will briefly describe these three types of planning in their 'pure' form. However, we do realise that – in reality – most countries do have a mix of participatory planning and incremental planning or rational planning. Nevertheless, the three types of planning do say something elementary about the principles how to impose goals and how to choose among means to meet these goals (Christensen, 2000). The purpose of this theoretical review is to argue why the Interactive SWOT Energy Tool could be a useful tool for all actors involved in the planning process to impose goals and to choose among alternatives (means) to meet these goals.

Rational comprehensive planning (synoptic planning)

Under the rational model, planners analyse situations, define goals, identify obstacles that prevent these from being accomplished, develop alternative solutions, compare these, decide on a preferred approach, implement this, and then evaluate its success (Wheeler, 2004: 43). In other words, the rational planning model can be regarded as a linear planning process. Rational comprehensive planning typically looks at problems from a systems viewpoint, using conceptual or mathematical models relating ends (objectives) to means (resources and constraints), with heavy reliance on numbers and quantitative analysis (Hudson, 1979: 389). Table 1 gives an overview of the strengths and weaknesses of rational comprehensive planning.

Table 1 *Strengths and weaknesses of rational comprehensive planning* (based on Wheeler, 2004: 44 and Hudson, 1979: 389)

Participatory and communicative planning

One main response to the shortcomings of the rational comprehensive planning method was the rise of participatory planning from the late 1960s and 1970s onwards (Wheeler, 2004). This new theoretical perspective emphasises both public participation and ongoing processes of communication between planners, citizens, developers, government officials, and other parties as the main mechanism through which things get done and people learn (Wheeler, 2004: 45). Table 2 gives an overview of the strengths and weaknesses of participatory and communicative planning.

Table 2 *Strengths and weaknesses of participatory and communicative planning* (based on Bechtel and Churchman, 2004: 2002)

Incremental planning

Incremental planning theory has been developed as an alternative to rational comprehensive planning as well. It was more and more realised that planning *practice* was different from planning *theory*. According to proponents of incremental planning, planning is not a rational activity; planning is an irrational process, dominated by ‘insignificant’ political ideas. Instead of selecting among several alternatives, decision makers consider alternatives that are more or less identical with status quo. In other words, only small steps (often not planned) are taken. Of course, not all alternatives can be taken into account. Some alternatives might be too extreme anyway. On the other hand, by beforehand eliminating alternatives too soon, might make more radical changes more or less impossible. We will come back to this later, when we introduce the *perception* of ‘no choice’ as discussed by Lund (2010). Table 3 gives an overview of the strengths and weaknesses of incremental planning.

Table 3 *Strengths and weaknesses of incremental planning* (based on Sillence, 1986: 53-61)

The perception of ‘no choice’

As we mentioned above, planners cannot take all alternatives into account, since some alternatives might be too extreme. But which alternatives are ‘too extreme’? And who is going to judge which alternative is too extreme? Lund (2010) has discussed this issue in his book ‘Renewable Energy Systems: The Choice and Modelling of 100 % Renewable Solutions’. Lund (2010: 13-32) discusses the perception of ‘no choice’, and states that this appears many times and in several forms also at the collective and societal level. If the general perception in society is ‘we do not want to have windmills in our local area’, everybody feels we have no choice; we cannot have windmills in order to achieve our goal of becoming self sufficient with renewable energy. However, as Lund argues, this does not include a few individuals who know better or different. The fact that single persons get new ideas or come up with new alternatives does not change the collective perception, as long as they keep these ideas to themselves – only if they raise awareness by convincing or informing the public in general, such knowledge becomes part of the collective perception (Lund, 2010). Nevertheless, the perception of ‘no choice’ may be manipulated by individuals or organisations that prove successfully in convincing the society in general that a certain alternative does not exist (Lund, 2010). Box 1 gives an example of such a collective perception of ‘no choice’.

Box 1 *Example of collective perception of no choice* (Lund, 2010).

Methods and tools

As the example in box 1 shows, at the regional level, there was no true choice. However, at a higher level, society did have a choice. Islands in the C2CI-project might feel to be in the same situation as the city of Aalborg in the 1990s, a perception of ‘no choice’. If designed and applied properly, the Interactive SWOT Energy Tool (see below) could contribute to raising awareness among the public in general about (all) alternatives to the current energy system, which then might lead to diminishing the perception of ‘no choice’. Next, we will go into detail with the methodology applied.

Politicians might agree as well as disagree upon goals to be achieved and they do not necessarily know (yet) which means to use to achieve the goal. As we illustrated above, the different planning theories prescribe the way planning should be. However, we did also state that most countries in reality do have a mix of participatory planning and incremental planning or rational planning. For us, it has been important to develop a tool that can be used within different planning traditions, which is illustrated in figure 4.

Figure 4 *the Interactive SWOT Energy Tool in relation to different types of planning* (inspired by Christensen, 2000: 24)

It is important to note that we don’t want to take a normative approach, i.e. that the Interactive SWOT Energy Tool tells how planners should choose among alternatives. The purpose of the tool is twofold. Firstly, to identify and quantify imminent problems (‘hot spots’) and opportunities related to the energy system on the respective island, and thereby help find and answer the question of where it does make most sense to start implementing energy projects from a system perspective. Secondly, the model can facilitate the exchange of knowledge between the partner islands by creating a common ‘language’ in the form of comparable key parameters. In this way the model can be a communication tool in the dialogue between the partners involved, and can motivate projects by illustrating best practice examples. Therefore, our approach might be more a behavioural approach. The behavioural approach focuses on the limitations which planners are up against in trying to fulfil their programme of rational action (Faludi, 1973). Therefore, we have also chosen to include the SWOT-method in the C2CI-project. The SWOT-method (called ‘design school method’ by Mintzberg (Mintzberg, 1994)) is one of the basic planning models (Mintzberg, 1994) and can be a useful planning tool for islands to formulate a strategy for, for example, become self-sufficient with regard to renewable energy.

SWOT

The analysis of an organisation's internal strengths and weaknesses and its external opportunities and threats are described as SWOT-analysis (see also figure 1). SWOT stands for Strengths, Weaknesses, Opportunities and Threats.

SWOT-analysis has been primarily used in private organisations; in this type of organisations it is important to clarify the factors that will make the company capable of surviving competition in the marketplace and to be profitable and expanding (Sørensen and Vidal, 1999). This setting of a strategy, where the organisation is seen as an organism in constant struggle to adapt to the environment is reflected in the SWOT-analysis (Sørensen and Vidal, 1999: 25). In the C2CI-project, it will not be organisations but islands that are studied. Islands do not face a reciprocal competition like private companies do, and that might also be the reason that previous work on SWOT-analysis related to islands is limited; see for an example on the optimization of water resource management using SWOT analysis on Zakynthos island in Greece Diamantopoulou and Voudouris (2008). We have chosen to use the SWOT-method in combination with the energy model in the C2CI-project because together these tools/methods can potentially be a useful planning tool for islands to formulate a strategy.

Figure 1 *The SWOT model presented in a matrix model*

The SWOT-matrix, as shown in the figure above, is used to provide structure and overview in the SWOT-analysis. This systematic structuring of the links between Strengths, Weaknesses, Opportunities and Threats is the main contribution of the SWOT-analysis to (strategic) planning (Sørensen and Vidal, 1999). In the C2CI-project, the SWOT-analysis is used to structure a qualitative and quantitative clarification of the situation on the islands (internal), as well as to examine the factors surrounding the islands that may affect this situation (external). However, it is not only about analysing an island's strengths in order to be able to formulate opportunities; it is very much about the challenge of overcoming weaknesses to exploit opportunities as well. 'After all, a weakness is the absence of strength (…) and to overcome an existing weakness might become a distinct strategy' (Weihrich, 1982: 54). More specifically, we will examine the following steps (inspired by Sørensen and Vidal, 1999: 26):

Figure 2 *Steps within the SWOT-analysis* (inspired by Sørensen and Vidal, 1999: 26)

In order to structure the situation on the islands in the C2CI-project, we focus primarily on steps two to five. The *status* will describe the current situation on the island (e.g. how much energy comes at present from renewable sources, and from which renewable sources?), the *analysis* describes the direction islands are aiming at (e.g. which initiatives have already been put into place in order to increase the use of renewable energy), *planning* (I) focuses very much on reviewing whether or not an island moves into the 'right' direction, compared to the goals that have been formulated. Of course it is difficult to judge whether or not a particular initiative is a move into the 'right' direction that is why the SWOT-analysis is supplemented with an energy model (see also below). *Planning* (II) is about how to change the direction chosen, if the outcome of 'planning I' is judged 'not desirable' or 'not right'. In the C2CIproject we will not focus on *action*, since it has to be the islands themselves to choose among the alternatives (based on the Interactive SWOT Energy Tool, see next section).

Energy model

Modelling an island's energy system can be done on the basis of a number of key parameters (e.g. fossil fuel consumption, electricity demand, heat demand and so on), and the energy model, presented in the following, is one approach to doing so. Through its relatively plain and user-friendly design it can make information accessible in an interactive way. The calculation of simple energy flows and the related environmental impacts and possibly the economic effects can illustrate strengths and weaknesses, which in turn can point to possible paths of development. With the model several energy scenarios can be calculated quickly, from which concrete energy strategies can be devised and specific development projects can be defined. The model is designed for public officials and other interested stakeholders, who normally do not work with energy systems analysis and therefore can be a common ground for learning about local and regional energy flows and the related dynamics.
The model is divided into Energy Sources, Energy Supply and Energy Services (see figure 3). This division reduces complexity of the entire energy system and allows for the independent assessment of changes made to either of the subsystems. As each change to any of the technologies used in each of the subsystems will have consequences in other parts of the energy system, the connectedness of energy flows and technology choice will become visible.

Figure 3 *The Interactive SWOT Energy Tool*

Origin of the Interactive Energy SWOT Tool

The idea of displaying and analysing energy systems in relatively simple inventories by means of a spreadsheet programme has previously been applied in the 'Energize Regional Economies' project (ERE-project) (Province of Fryslân, 2008). Such inventories were built for a number of regions in the North Sea region and to facilitate learning and the use of these tools an energy model for the island of Samsø (Denmark) was prepared as input to one of the ERE-project meetings. Between 1997 and 2007 Samsø had managed to convert its electricity demand to be based on 100 % renewable energy sources[2]; the plan for which had been drafted already in 1997 (PlanEnergi, 1997; PlanEnergi and Samsø Energy Academy, 2007). As such, the energy model for Samsø was built after the energy plan had been implemented and therefore mainly serves as visualisation, communication and continuous improvement

[2] At the same time, the generation of surplus electricity from wind turbines compensates for fossil fuels used in the transport sector on an annual basis. Moreover, about 70% of the heat sector has been converted to renewable energy sources during the same ten-year period (PlanEnergi and Samsø Energy Academy, 2007). It should also be noted that these conversions have mainly been achieved by utilising local resources and with a substantial share of local involvement and ownership.

tool. In the C2CI-project Samsø and the energy model serve as best practice examples, containing concrete (technological) alternatives, from which energy models for other participating islands are derived.

Spiekeroog

Spiekeroog is one of the East Frisian Islands located in the German part of the North Sea's Wadden Sea area. The island is about 18 km^2 and a population of around 800 people. Approximately 90 % of the island is protected in the Lower Wadden Sea National Park. The distance to the mainland is circa 6 km and is covered by a ferry service. The main source of income is tourism with roughly 90.000 holidaymakers and 600.000 overnight stays per year. Compared to Samsø, Spiekeroog can be considered relatively inexperienced in dealing with issues related to renewable energy. Apart from a 225 kW wind turbine and a few photovoltaic (PV) installations, which produce as much as 8% of the electricity demand, the island is nearly entirely dependent on energy supply from the mainland. All home heating is based on natural gas, which is supplied by a pipeline and the electricity is supplied through a submarine cable. There is very limited agricultural activity on the island and due to the National Park motorized transport is restricted and has been substituted by a few electric vehicles.

Building the Interactive SWOT Energy Tool for Spiekeroog was carried out in close cooperation with the municipality's environmental coordinator on the island. This cooperation was essential for getting the required data, for instance, regarding the existing building stock. The environmental coordinator could also provide valuable information with regard to the feasibility of the different technology options. For instance, being a part of the National Park limits the feasible wind power potential on the island considerably. Or, many houses in the old town are protected and a tourist attraction, which sets some limitations to installing e.g. PV or carrying out energy efficiency measures. In this way more realistic suggestions for future scenarios could then be included into the tool.

A couple of issues became apparent when building the modelling tool together with Spiekeroog. One crucial difference compared to the situation on Samsø seems to be the general economic situation of the population. Unlike other islands Spiekeroog has not experienced a drastic decline in income from tourism activities. Therefore the need for reflection about future development of the island seems to be less recognized by the islanders. People are in general wealthy, which may be the reason why as little change to the status quo as possible is desired. This general attitude among the population as conveyed by the environmental coordinator is to a certain degree reflected in the modelling tool, including the suggestions for scenarios.

Discussion and conclusion

The aim of this article was to discuss the need for a planning tool that can contribute to identifying the Strengths and Weaknesses as well as the

Opportunities and Threats (SWOT-analysis) of islands' energy systems. The purpose of building such a relatively simple energy planning tool has been to start discussions on the islands on the pros and cons of renewable energy development. Finally, the tool could contribute to social learning processes by providing information and therefore possibilities to make 'real choices'.
Given that the C2CI-project is in its early stages, it can only be indicated how the Interactive SWOT Energy Tool is used in the pre-planning process, i.e. to describe the 'status' and to make the 'analysis' on the islands' energy systems (see figure 2).
The Interactive SWOT Energy Tool can be used within the different planning traditions, as shown in figure 4. In that sense, the tool is flexible and it is possible to adapt the model to the specific conditions on the islands. In the next phase of the project, it will be investigated how the different planning traditions influence the use of the model. It is expected that the Tool can open up discussions of incorporating cradle-to-cradle alternatives in future energy systems and can thereby potentially encourage the investigation of more 'real choices'. At the same time, it is likely that specific planning traditions shape and limit the outcome of the Tool.

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Table 1 *Strengths and weaknesses of rational comprehensive planning* (based on Wheeler, 2004: 44; Hudson, 1979: 389 and Flyvbjerg, 1998)

Strengths	Weaknesses
Its basic simplicity	It is often seen as overly expert-driven
A clear, straightforward method of formulating policy and programmes	Based on a mind-set in which detached, ‘objective’ planning analysts determine policy rather than letting public concerns drive the planning process
Useful at different levels of planning	Relying mainly on quantitative analysis of data rather than taking into account less tangible, qualitative elements
Meshes well with the use of indicators to measure (sustainability problems and the effectiveness of policies)	Planners may become seduced by the expert
Appears logical to many members of the public	Overlooks the realities of political power
Tends to be respected by local political leaders	Often fails to take into account important social and environmental issues that were not part of the intellectual mainstream of the time
Can be distinguished to offer opportunities for public involvement	Disjuncture between individual rationality and collective rationality

Table 2 *Strengths and weaknesses of participatory and communicative planning* (based on Bechtel and Churchman, 2002)

Strengths	Weaknesses
Potentially more credible planning decisions Anticipation on public protest Potential for variety of input Transparency of decisions	Access to planning arenas Eligibility of participants Selection of methods and techniques to be used

Table 3 *Strengths and weaknesses of incremental planning* (based on Sillence, 1986: 53-61)

Strengths	Weaknesses
Continuous readjustment of goals Potential for more 'realistic' and pragmatic decisions Lower risks (e.g. economic) for failure at the short time	Many decisions are not incremental Many incremental decisions have none-incremental implications A small number of consequences is calculated Incrementalism leads to systematic distortions in the production of public goods Problems are not solved – they are only alleviated Incrementalism under-values the effect of externalities Incrementalism under-represents minority interests Incrementalism leads to immobility of resources It neglects the system

Decision for a new power station in Aalborg (Denmark) in the 1990s

The power company was owned by the municipality and the electricity consumers and the decision was made by a board of representatives and politicians. When the issue was put on the agenda, only one solution was presented: to build a coal-fired power station. One of the representatives was frustrated, he felt he had *no choice*, since voting 'no' would mean that Aalborg, sooner or later, would have no electricity supply. The county of Northern Jutland had to decide whether to approve the plant or not. In the public debate, the argument of job creation from the construction work played an important role. The coal-fired power station was one of the least job creating alternatives in relation to the lifetime of the plant. To spend the money on renewable energy in combination with fuel-saving technologies would save the imports of coals and leave much more money for local job creation. However, the power companies' association in Western Denmark argued that if the coal-fired power station was not approved, they would spend the money on a power station somewhere else outside the region of Northern Jutland. This led to a collective perception of *no choice* in the region.

Box 1 *Example of collective perception of no choice* (Lund, 2010).

Figure 1 *The SWOT model presented in a matrix model*

Figure 2 *Steps within the SWOT-analysis* (inspired by Sørensen and Vidal, 1999: 26)

Energy Sources

RENEWABLE ENERGY SOURCES		
Wind energy, on shore		
Installed power	11	MW
Annual production	27.940	MWh
Wind energy, off-shore		
Installed power	23	MW
Annual production	77.500	MWh
Solar power		
Installed capacity	0,1	MW
Annual production	100	MWh
Ocean power		
Installed capacity	-	MW
Annual production	-	MWh
Biofuel consumption		
Wood chips, pellets, straw etc	33.421	MWh
Transport biofuels	2.108	MWh
FOSSIL FUELS		
Fossil fuel consumption		
Oil for heating	**33.907**	**MWh**
Petrol	**8.383**	**MWh**
Diesel	**31.665**	**MWh**
Coal (outside region)	**-94.417**	**MWh**
Natural gas (outside region)	**-69.570**	**MWh**
CO2 ACCOUNT		
CO2 produced on Samsø	**19.430**	**tons**
CO2 outside	**-46.566**	**tons**

Energy Supply

HEAT PRODUCTION		
District heating (DH), biomass		
Share of towns where DH networks are built	100	%
Share of buildings connected in towns with DH	90	%
Installed capacity (heat)	4,6	MW
Annual heat production	23.218	MWh
Biomass consumption	25.797	MWh
Individual heating, biomass		
Buildings connected	20	%
Buildings with solar hot water	10	%
Biomass consumption	7.624	MWh
Individual heating, heat pumps		
Buildings connected	10	%
Electricity consumption	1.032	MWh
Individual heating, oil (residual)		
Buildings connected	70	%
Buildings with solar hot water	-	%
Oil consumption	33.907	MWh
Biomass cogeneration option (CHP)		
Share of district heating equipped with CHP	-	%
Installed capacity (power)	-	MW
Power production	-	MWh
Heat production	-	MWh
Biomass consumption	-	MWh
National grid residual supply		
Net electricity import/export annually	-88.123	MWh

Energy Services

Built environment	Floor area	
Dwellings	293	1000 m2
Commerce, public service and industry	141	1000 m2
Tourism and cottages	83	1000 m2
Growth of required floor space	2	%
Heat demand		
In towns and villages	20.638	MWh
In rural areas	30.959	MWh
Total	*51.597*	*MWh*
Heat savings	20	%
Electricity demand		
Households	13.500	MWh
Industry & agriculture	6.750	MWh
Trade & service	1.500	MWh
Total	*21.750*	*MWh*
Electricity savings	25	%
Transport demand		
Cars (petrol)	8.824	MWh
Cars (diesel)	3.251	MWh
Trucks and buses (diesel)	4.970	MWh
Ferries (diesel)	25.111	MWh
Total transport fuel demand	*42.156*	*MWh*
Transport energy savings	20	%
Share of electric road vehicles	5	%
Share of biofuels in transport	5	%
Total heat demand, incl. net losses	56.241	MWh
Total el. demand, incl. network losses	24.805	MWh

Prepared for the C2CI-project. Data based on the report Samsø Vedvarende Energi Ø, PlanEnergi 1997,
information from www.veo.dk and the Danish Energy Authority, 2001-2009.
Bernd Möller, Department of Development and Planning, Aalborg University, Denmark. Contact: berndm@plan.aau.dk

Figure 3 *The Interactive SWOT Energy Tool*

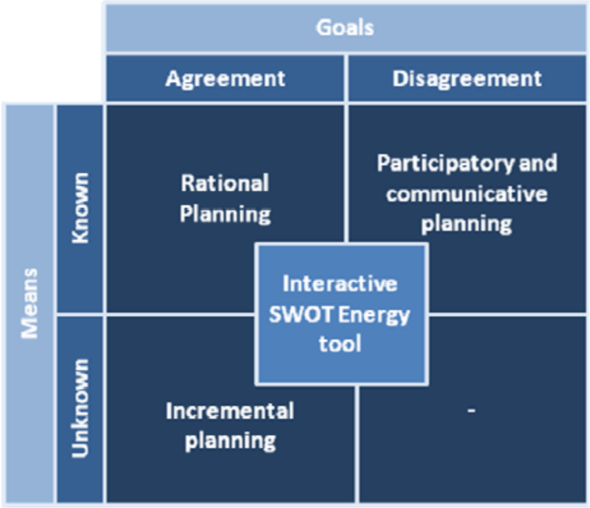

Figure 4 *the Interactive SWOT Energy Tool in relation to different types of planning in an ideal situation* (inspired by Christensen, 2000: 24)