



MASTER THESIS:

Energy Management System

«Actions for agile and simple implementation»

Author:

Fanny Elisabeth Abotnes

Date: 04.06.2015

Energy Management System



«ACTIONS FOR AGILE AND SIMPLE
IMPLEMENTATION»

FANNY ELISABETH ABOTNES

Acknowledgement

This report is a final part of my two-year master's degree in Sustainable Manufacturing at Gjøvik University College. The report is conducted as an independent study with Kristian Martinsen from Gjøvik University College as supervisor and Mathias Holm from Brynild Gruppen department Fredrikstad.

Through the subject TØL 4081 Project Work, I choose Brynild Gruppen as a collaborator for a project on Energy management (EMS) and consumption. Throughout the Project work, there were a thesis proposal on how to implement an EMS, the thesis were then a natural choice for me.

I want to give a huge thanks to Kristian Martinsen for good guidance, encouraging words and motivation throughout the work process.

Furthermore, I want to thank everyone who has been involved in connection with the thesis through interviews and e-mails.

I also want to thank my immediate family, including my father, mother, brothers and sister in law for great support throughout this work and long education. I will also have to thank my in-laws for help and support associated with the thesis.

Finally, my dear significant other I need to dedicate to you huge gratefulness for understanding and endurance throughout the thesis and my many years of schooling. I love you with all my heart.

Moss, June 4 2015

Fanny Elisabeth Abotnes

Abstract

Title:	Energy Management System	Date:	04.06.2015
	"Actions for agile and simple implementation"		
Participant:	Fanny Elisabeth Abotnes		
Supervisors:	Kristian Martinsen and Mathias Holm		
Employer:	Brynild Gruppen AS		
Keywords (3-5)	EMS, Implementation, ISO standards, Climate targets and laws, Management methods		
Number of pages/words:	144 / 29 830	Number of appendix:	6
		Availability:	Open
<p>The principle of energy management have been in businesses interest from the beginning of the 70's, EMS is the interaction between people, technology and organization. The report is the result of an analysis of the requirements of EMS given in ISO standards, different guidelines such as Enova's, EU climate targets and Norwegian laws.</p> <p>It examines sustainable development, renewable energy sources and energy efficiency associated with the field EMS. Furthermore, the thesis introduces management methods, and introduces what international countries do to simplify implementation of an EMS.</p> <p>Brynild Gruppen (BG) is one of Norway's largest family owned brand companies with roots dating back to 1895. The report maps how the case works throughout implementation of an EMS, and present the results linked to interview rounds.</p> <p>The thesis conclude that it is required for agile and simple implementation of an EMS to allocate enough time and resources, that the organization have a well-functioning management system, and to ensure that employees are given ownership of the EMS and use guidelines with checklists to have full overview of the implementation.</p>			

Terminology

Abbreviations	Meaning
BG	Brynild Gruppen
BRC	BRC Global Standards
CICERO	The center Climate Research
EL	Energi Light
ELL	Energiledelse Ligth
EM	Energy management
EMS	Energy management system
EnMS	Environmental management system
Enova	State enterprise
EU	European Union
IPCC	Intergovernmental Panel on Climate Change
ISO	International organization for standardization
PDCA	Plan, Do, Check and Act
PFE	Energy efficiency in energy-intensive companies
UN	United Nations
UNEP	United Nations Environment Program
UNFCCC	United Nations Framework Convention on Climate Change
UNIDO	United Nations Industrial Development Organization
WMO	World Meteorological organization

Figure list

<i>Figure 3.1 – Sustainable development, made by author</i>	15
<i>Figure 3.2 – Benefits from energy efficiency, (Houssin 2013)</i>	18
<i>Figure 3.3 – Organization structure, drawn by author (Notatene 2015)</i>	30
<i>Figure 3.4 – Plan, Do, Check and Act, made by aithor</i>	35
<i>Figure 3.5 – Deming’s circle on EMS, (nepas 2007)</i>	37
<i>Figure 3.6 – Concepts within context, energy efficiency, EM, EMS and ISO 50001, (Rasmussen 2014)</i>	38
<i>Figure 3.7 – PCDA approach for ISO 9001, (ISO 2008)</i>	48
<i>Figure 3.8 – PCDA approach for ISO 140001, (ISO 2004)</i>	49
<i>Figure 3.9 – PCDA approach for ISO 50001, (ISO 2011a)</i>	49
<i>Figure 3.10 – PCDA approach for «Enedrigsledelse i industrien», (Enova 2012e)</i>	60
<i>Figure 4.1 – Hierarchy for BG, organization structure, made by author</i>	80
<i>Figure 4.2 – Line distribution at BG, EMS responsible, made by author</i>	86

Table list

<i>Table 1.1 – Structure of the thesis</i>	4
<i>Table 3.1 – Comparison between ISO 9001, 14001 and 50001 (LTD. 2014)</i>	50
<i>Table 3.2 – Checklist for establishment of EMS, (Enova 2012e)</i>	65
<i>Table 3.3 – Summary of checklist from the German implementation guide, (Kahlenborn 2010)</i>	71
<i>Table 3.4 – Checklist for level 1 in Swedish guide for simple implementation, (Nilsson 2014)</i>	75
<i>Table 3.5 – Checklist for level 2 in Swedish guide for simple implementation, (Nilsson 2014)</i>	75

Graph list

<i>Graph 3.1 – Global potential for energy efficiency, (Houssin 2013)</i>	19
<i>Graph 3.2 – ISO 9001:2008 certificates in Norway, (ISO 2015b)</i>	51
<i>Graph 3.3 – ISO 14001:2004 certificates in Norway, (ISO 2015b)</i>	51
<i>Graph 3.4 – ISO 50001:2011 Certificates in Norway, (ISO 2015b)</i>	52

Picture list

<i>Picture 4.1 – Overview of Brynild Gruppen AS in Fredrikstad, Norway (Brynild 2014)</i>	77
---	----

Content

Acknowledgement	I
Abstract	II
Terminology	III
Figure list	IV
Table list	IV
Graph list	IV
Picture list	IV
1 Introduction	1
1.1 Intro	1
1.2 Background	1
1.3 Research question	2
1.4 Limitations	3
1.5 Scope and reference use	3
1.6 Structure	4
2 Method	5
2.1 Intro	5
2.2 What is method?	5
2.3 Method view	7
2.4 Which methods are used?	8
2.5 Validity and Reliability	11
2.5.1 <i>What is validity and reliability?</i>	11
2.5.2 <i>Thesis validity and reliability</i>	11
3 Chapter 3 Theory	13
3.1 Intro	13
3.2 Sustainable development	13
3.2.1 <i>Renewable resources</i>	15
3.2.2 <i>Energy efficiency</i>	17
3.2.3 <i>UN climate panel</i>	19
3.3 Norwegian and European Union (EU) climate targets	21
3.3.1 <i>EU commitment to 2030 and EU's role in international climate efforts</i>	23
3.3.2 <i>Norwegian climate targets</i>	24
3.3.3 <i>Norwegian Environmental legislation</i>	26
3.4 Management method	30
3.4.1 <i>Organizational structures</i>	30
3.4.2 <i>Management systems</i>	34
3.4.3 <i>Energy management system (EMS)</i>	36
3.5 ISO standards	40
3.5.1 <i>General information about ISO standards</i>	40
3.5.2 <i>ISO 50001:2011 Energy management systems</i>	42
3.5.3 <i>ISO 14001:2004 Environmental management systems</i>	43
3.5.4 <i>ISO 9001:2008 Quality management systems</i>	44
3.5.5 <i>New audits for ISO 9001:2008 and 14001:2004</i>	45
3.5.6 <i>Context and similarities between ISO 9001, 14001 and 50001, and their structure</i>	47
3.5.7 <i>Certification</i>	51
3.6 Enova	53
3.6.1 <i>Background</i>	53
3.6.2 <i>State Aid</i>	53
3.6.3 <i>Enova and energy management</i>	54

3.7	Implementation	56
3.7.1	Implementation of a management system	56
3.7.2	Implementation of an EMS using ISO 50001:2011	57
3.7.3	Implementation of an EMS using Enova's "Energiledelse i industrien"	60
3.7.4	General challenges with implementation of a management system	66
3.7.5	General challenges with implementation of an EMS	66
3.8	Software	68
3.8.1	General information	68
3.9	International, what can Norway learn from other countries	69
3.9.1	Germany	69
3.9.2	Denmark	71
3.9.3	Sweden	73
4	Case	77
4.1	Intro	77
4.2	Brynild Gruppen	77
4.2.1	Background	77
4.2.2	Organization structure	78
4.3	Interviews at BG	81
4.3.1	General information of the interviews	81
4.4	Results from interview round one	82
4.4.1	Interview with EC from COWI	82
4.4.2	Interview with SD from BG	82
4.4.3	Interview with MM from BG	83
4.4.4	Interview with PM from BG	83
4.5	Results from interview round two	84
4.5.1	Mapping of EMS at BG	84
5	Discussion	87
5.1	System for EMS in Norwegian companies as BG	87
5.1.1	BG's relation to Norwegian and international goals of sustainability and climate	87
5.1.2	BG's relation to legal environmental requirements	88
5.1.3	Saved energy costs for BG	88
5.2	The implementation of EMS at BG	89
5.2.1	Summary of the status of the implementation of energy management in BG	92
5.2.2	Success factors for BG	92
5.3	Will implementation of an EMS in an industrial company as BG affect an organization's energy costs-, consumptions and greenhouse gas emission?	94
5.4	Norway could consider	95
6	Conclusion	96
7	Future work	97
8	Bibliography	98
9	Appendices	103
1	Appendix – Project agreement	1
2	Appendix – Publishing contract	4
3	Appendix – Informed consent (for interviews)	7
4	Appendix – Interview round one	10
5	Appendix – Interview round two	19
6	Appendix – "Evalueringssnøgle til energiledelse"	23



1 Introduction

1.1 Intro

In this chapter, the thesis is defined. First, the background for the thesis is presented, then the research question with its main goal through various objectives and actions. Further, the thesis is confined through its limitations.

1.2 Background

Today greenhouse gas emissions lead to global warming and serious environmental problems. Such gas release occurs partly by the combustion of oil, gas or coal. Most of today's emissions come from rich countries. Environmental problems such as drought, floods and other natural disasters strike hardest out against people in poor countries. Another consequence is a continuous threat to the biological diversity.

To prevent climate change and to create sustainable development, must mindset relating to choice and use of energy resources change. We need to invest more on renewable resources such as water, wind and sun.

In the future, increased power demand, higher energy prices and greater environmental awareness provide the basis for greater focus on energy use. Production companies will in all probability be prepared to adapt to new requirements in relation to a more sustainable and efficient utilization of resources. The effect of adaptation will provide results in terms of reduced energy costs, which in turn will contribute to a strengthened competitiveness.

For an organization to be able to have a sustainable production, it is important that the organization always have an overview of their energy use and costs. To achieve this, it can be appropriate to implement an energy management system (EMS). Implementation of an EMS in an organization can contribute to create an overview of the current energy consumption, help to manage energy consumption and costs, contribute to an environmental conscious operation with less greenhouse gas emission, and create a good reputation for the organization.



Energy Management System

«Actions for agile and simple implementation»

1.3 Research question

What actions are required to enable for an agile and simple implementation of an energy management system (EMS)?

Thesis main goal:

Increase the understanding of energy management systems and implementation methods.

To do this, following objectives and actions have been developed:

Objectives:

- Evaluate the extent to which the implementation of an energy management system in an industrial company as BG will affect the company's energy costs- and consumptions, and greenhouse gas emissions.
- Evaluate energy management systems at an international level. Does Norway have something to learn at an international level?

Actions:

- Analyze literature such as studies, reports, etc. for implementation of energy management systems, ISO standards, sustainable development, renewable energy sources, energy efficiency and legal sources.
- Analyze methods related to management systems in relation to each other.
- A case study with Brynild Gruppen (BG) as an example as a small and medium-sized enterprises (SME). In this part, there have been made and prepared interviews to gather necessary information regarding BG.

The case study includes among other:

- A brief description of the Company BG
- Organization mapping – type of management system, use of software, etc.
- Goals for implementation in the organization.
- In what way will the system be implemented?
- Which part of the organization will be affected by the implementation?



Energy Management System «Actions for agile and simple implementation»

1.4 Limitations

Today there are several standards and guidelines for implementation of a management system in an organization. The thesis is limited to look at ISO standard “*ISO 50001:2011 Energy management systems, Requirements with guidance for use*”, in context with “*ISO 9001:2008 Quality management systems Requirements*” and “*ISO 14001:2004 Environmental management systems Requirements with guidance for use*”, cf. ISO 9001:2015 and ISO 14001:2015. The thesis also refers to Enova`s guideline “*Energiledelse i Industrien*” which is central for implementation of an EMS in Norway and also in the case study.

The thesis is limited to primarily focus on the implementation process of an EMS. BG will be used as an example in this case.

In addition, the thesis will look at EMS at an international level. Since Norway recently decided to follow EU`s climate targets it has been natural to focus on countries within EU. The thesis is therefore limited to focus on nearby EU-countries such as Sweden, Denmark and Germany and then compared to economic incentives for organizations, legislation related to energy use and appropriate tools that aid for agile and simple implementation.

1.5 Scope and reference use

The report is a final master thesis of 30 ECTS at Gjøvik University College. In the thesis, there will be text that lacks references. This text revolves on the authors own knowledge and assessments. Information acquired through interviews, telephone, e-mail, is preserved in notes. The interviews can be seen in respectively 4 Appendix – Interview round one and 5 Appendix – Interview round two. The information has been used as supplementary information in the thesis without reference in the text.



Energy Management System

«Actions for agile and simple implementation»

1.6 Structure

The thesis is built as a scientific report with guidelines for writing master thesis from Gjøvik University College. The master thesis places emphasis on the report's readability, professional terminology and expressions is limited and described in a terminology list earlier in the report. The thesis follows a structure of six main chapters. In addition, chapter 7, 8 and 9, respectively further work, bibliography and appendices.

The structure is as followed:

Chapter 1	<i>Introduction</i>	The introduction explains the thesis background, research question, objectives and actions. Furthermore, limitations, scope and reference use, and structure are described.
Chapter 2	<i>Method</i>	The chapter describes what method is, which methods that are applied and why they are used. Further, the thesis reliability and validity is evaluated.
Chapter 3	<i>Theory</i>	This chapter introduce energy management system (EMS), as well as knowledge on sustainable development, renewable energy and energy efficiency. In addition, ISO standards and Enova's guideline is researched.
Chapter 4	<i>Case</i>	This chapter provides a description of the case organization BG, with results from the two interview rounds.
Chapter 5	<i>Discussion</i>	The chapter discusses the thesis main question through findings and responses from the thesis literature. Discussion of the case follows Enova's guideline.
Chapter 6	<i>Conclusion</i>	The conclusion answers the thesis research question, with a list of actions.
Chapter 7	<i>Future work</i>	The chapter presents proposals for future work based on research throughout the thesis and the thesis results.
Chapter 8	<i>Bibliography</i>	The bibliography lists the references used throughout the thesis. The list is divided by type of references (books, standards and internet) which gives the reader better overview of the list.
Chapter 9	<i>Appendices</i>	This chapter contains the appendix, including project agreement, publishing agreement, informed consent, two interview rounds and "Evalueringssnøgle til energiledelse".

Table 1.1 – Structure of the thesis



2 Method

2.1 Intro

The main purpose of this chapter is to explain what method is, which methods that are used and why they are used. Further, the thesis reliability and validity is considered.

2.2 What is method?

The book, "Å forske på samfunnet" defines method as:

"The teachings of the tools one can use to gather information".

We can say that method is various tools we use to solve one or more tasks, and the information we collect is often referred to as data. By the choice of a method, one must know the alternatives that exist. One method provides one type of data, and another method another type of data. We distinguish between two main types, respectively quantitative and qualitative methods. Quantitative data is considered as "hard data" and qualitative data considered as "soft data". The main difference between quantitative and qualitative data relates to whether the information is expressed in numbers or as text (Grønmo 1996).

Quantitative methods are collecting data where the results of the investigation characterized as measurable numbers or other amount units. A quantitative approach is systematic and structured. The most common approaches for quantitative method is structured interviews, questionnaires and structured observations (Helseth 2010).

By using quantitative approach, the interviewer often set predetermined questions. Using questionnaires, the interviews could be asked face to face, over the phone or trough internet (e-mail, survey pages, etc.). Enquete is questionnaires that are self-administered. This means that the respondent reads the questions self and write down their answers on a form that the interviewer has made.



Energy Management System

«Actions for agile and simple implementation»

Qualitative methods are collecting information that cannot be quantified (numeric), where the data exists as text or verbal statements. Common approaches for qualitative methods are observations in the field, unstructured and semi-structured interviews. By use of observation, we can easily observe what the “objects” actually do, as opposed to what they say they do or have done.

From observation, the observers can form their own thoughts and opinions on the actions they see. By semi-structured interviews, there are no questions formulated as accurate as when one use structured interviews. Often interviews are formulated as keywords and descriptions, more as a loose conversation within some frames.

Unstructured interviews are a form where the interviewer withdraws and allows the interviewee to steer the conversation. At the start of a project, this method is preferable, since the interviewer does not know which questions that should be asked, in relation to the topic. The advantage of such a flexible interview form is that it brings out several viewpoints. On the other hand, one cannot ask the same questions to all respondents. Semi-structured and unstructured interviews are both interview methods where one use to go in depth of a subject (Malt 2009).

Another distinction is between open and closed questions. Open questions gives the respondent the opportunity to respond freely, while closed questions gives predetermined answers.



2.3 Method view

In research, we can choose to use a method view to determine the reality of the research. Arbnor and Bjerke determine that there exist three method views to follow.

- System view

System view is about how different ingested systems work together, and whether there are ways to find solutions by analyzing systems and their relationships. The usual asked question is "how". The system view also known as the system theory is an interdisciplinary study of an organization, but with system thinking and language. The objects in this view can be components from a single organism.

- Analytical view

Analytical view is a pure analytical approach that involves "cause-and-effect". This looks at reasons alone, and try to find the root of cause. The most common question when using this is "why". Analytical view are essentially used in logical approaches. Furthermore, the view revolves on models, causal relations, hypotheses, problem formulations, deduction, and induction and so on. The methodological is the concept of the view, with its roots in positivism approach and engineering science.

- Actor view

The actor view is the overall assumption that there exist just whole structures of meaning, which is constructed socially. Actor's view perceives reality as a social construction. The overall social construction of reality is a direct result of the total dialectic interaction between the individuals involved. The reality is considered as subjective understandings, expressed through social constructs (Arbnor 2008).



Energy Management System

«Actions for agile and simple implementation»

2.4 Which methods are used?

In the thesis there have been made several assessments related to choice of methods. In some parts of the study, the elections have been intuitive. It is initially specified that the thesis is divided into actions; this itself has resulted in the use of several methods.

- Method view

The methodical basis for this thesis will be the analytical view. This choice is made, since the positivist perspective inspires the analytical view. The choice of the positivist perspective is made since it is consistent with the thesis focus on analyzing relationship in different systems, and one can implement new systems based on what I mean is cause-and-effect relationships.

- Literature study

The literature study has helped to provide data on the subject energy management system (EMS), sustainability, renewable energy, and relevant sources of different laws and what exists of implementation guidelines of an EMS. The data that is collected is retrieved from Norwegian and international literature, various articles, standards and internet sources. The literature adopted are prepared by experienced people in the field EMS both in Norway and at an international level.

The discipline of EMS is evolving. It has been important to look at new and “old” literature to get an understanding of the evolvement, as well as to generate new literature on the subject. When collecting literature in relation to EMS, internet have been central. Mainly, Google and Google scholar are used as search engines.

- Case study

In the case study, it has been prepared interviews as basis for analysis of Brynild Gruppen’s (BG) implementation process regarding EMS. The mapping of the organizations EMS is from e-mail correspondence and interviews. Instead of e-mails the organization EMS mapping could be done just through interviews, this since interview method could lead to more useful and relevant information using follow-up questions during the interviews.



Energy Management System *«Actions for agile and simple implementation»*

On the other hand, interview is a time consuming method, especially when the interviewees are people in key roles and have a heavy workload, and time and place could be difficult to set for a new interview. In addition, to do an interview one need to have full understanding of the subject that one will find information about. For that reason, it is difficult to do interviews in the begging of a project. Therefore, for this thesis it has been important to conduct two interviews.

The first interview has been with four central persons with key positions in the EMS project. The second interview has been with two central persons. Both interviews, has provided the author with necessary information regarding BG's implementation process and organization.

Further, there have been e-mail correspondence with key people in Denmark and Sweden. This were done to fully understand what international countries do when it comes to EMS. This were not necessary, but it have made it easier to understand what these countries actually do for implementation of EMS and which laws and regulations they follow when it comes to EMS.

- E-mail

Throughout the thesis there have been several small inquires to key people when it comes to EMS. This is done to gather information and documentation on the subject. In order to identify laws and regulation at an international level and to see what Norway can learn from other countries, it has been conducted several e-mails using unstructured interviews. Advantages by using e-mail surveys is that it is easy to reach the correspondents, the questions get directly to the correspondent, and the interviewer can ask as many persons as needed.

In addition to these advantages, there are also drawbacks. The most important to understand is that the interviewer do not have control over the answers the correspondents give. The correspondents can choose which questions to answer, and which one not to answer. The results from the e-mail's unstructured interviews can also be misinterpret by the interviewer.



Energy Management System

«Actions for agile and simple implementation»

- Interview

As mentioned earlier interviews has been made for key people in the EMS project at BG. The results have provided information that cannot be achieved through reading literature. The first interview were prepared with open questions. Throughout the preparation of the interviews there were important to think about ethics due to the participant's anonymity.

Informed consent is important in general when one do research that people are involved in. informed consent mean that the researcher need to inform the participants of the study, risks, and rights. Participants must receive all necessary information about the study – purpose method and be informed about all risks that can include in the research. The participants must decide by themselves to take part in the interview. They can break out at any time.

An alternative method instead of interviews could have been questionnaires, were questions are formulated in such way that the respondent could answer prefixed alternatives such as yes/no/maybe.

However, using such method the person making the questionnaire need to have great experience and knowledge in the field of importance. On the other hand, one can say that a questionnaire can help the respondent to write down their answers, and this can assure that one can ask further workers in the organization. Nevertheless, this can cause the response to be misinterpreted.



2.5 Validity and Reliability

2.5.1 What is validity and reliability?

Validity can be translated by using the word "authentic". In research, a method can be more valid than another can. Validity expresses whether the chosen methods measures what we actually want to measure. In other words whether the measurements method, is valid or not (SNL 2009b).

Reliability can be translated with the word "dependability ". If one performs a method multiple times and the result is almost the same each time, one can say that the test has high reliability. If the result is highly variable, the reliability is low. In other words, expressing reliability is the extent to which a measuring method is stable and have similarities in the measurements (SNL 2009a).

2.5.2 Thesis validity and reliability

The quality of the literature is by the author considered to be good. This is mainly because of those who have prepared the literature and the year it was prepared. The author has carefully considered material extracted from articles and journals in relation to credibility and age. Research articles are determined to have good quality by identifying the research reliability and validity. The validity is determine by which the studies data, allows the researcher to conclude accurate to cause-and-effect.

In the literature study, the requirements given in ISO standards and other guidelines is studied on a broad basis. Furthermore, literature of sustainability, renewable energy sources, and laws and climate targets are research thoroughly. For this reason the author, consider the validity of the literature study as relevant and good.

The author has, continually evaluated the quality of the information gathered through interviews and e-mails. The interviews validity depends on whether the interview where answered by the right people or not. The interview questions also need right formulation so that they provide necessary information in relation to the thesis.



Energy Management System

«Actions for agile and simple implementation»

In relation to the thesis, the author considers the chosen method as valid. Respondents in the study has been submitted the same questions and issues. It is the author's assessment that the answers of the questions are good and relevant, and that the right persons responded. Author have for privacy reasons chosen to anonymize respondents in the thesis text. The author considers the reliability of the studies as good, and that one would get similar results if the interviews were conducted again.

The interviews covered four people. Despite this, this could affect the thesis reliability, but it is still reason to argue that the reliability is good. This because the respondents in the interviews has been central persons related to the implementation of EMS in the organization.

Furthermore, the case in this thesis has covered one organization. One could argue that research of multiple organizations could give different answers and aspects. However, the author has reason to believe that the results would be the same whit research of more organizations, and that the thesis still would have come to the same conclusion. By author's assessment, the thesis is answered on a solid foundation.



3 Chapter 3 Theory

3.1 Intro

This chapter introduces the field, energy management system (EMS). The chapter provides knowledge on sustainable development, renewable energy and energy efficiency. In addition, knowledge on EMS, ISO standards and Enova's guideline is given. The chapter also provides knowledge on EMS and climate targets at an international level.

3.2 Sustainable development

In short, sustainable development is about taking care of the needs for people who live today, without compromising the futures generation to meet their own needs. To create sustainable development, three areas needs consideration:

- Environment
- Economy
- Social conditions

Sustainable development were for the first time introduced when the World Commission came with the report *"Our Common Future"* in 1987, this report made sustainable development central within the policy for the environment. World Commission believes that people living today must take care of the world, so that future generations will have the same good conditions that people had when they first came to earth. The World Commission says:

"Sustainable development implies that all will be covered their basic needs and that everyone gets an opportunity to satisfy the expectations of a better life" (Rindall 2013).

In energy management, sustainable development plays a major role. Sustainable development is meant to maintain the living on earth, not do any damage or harm to any living things, like the atmosphere, water and ocean, dirt or any other organisms. This means that all environmental problems that is brought by humans, needs to be taken under control.



Energy Management System

«Actions for agile and simple implementation»

Ways of doing this is to use more renewable energy resources and decrease the use of non-renewable resources. When it comes to sustainable development for the environment, it is important to get hold of climate change, this by making changes in all areas. Increased emissions of greenhouse gases is the biggest problem now days. Greenhous geses can lead to floods, droughts and other natural disasters, and these natural catastrophes affects the poor countries hardest.

The greenhouse gas emission come by using oil, coal and gas. These resources are not renewable; this means that every country needs to contribute to use renewable resources such as water, wind, sun, etc.

Sustainable development are also important when it comes to the economy. This means that we need to decrease the difference between rich and poor. There are for the most part of the world people living in poor countries, and for this reason, rich people use most of the resources. To decrease the gap between rich and poor it is important to have an equal spread over the world, for use of all resources. However, this also connect with the focus on the environment.

When it comes to the social conditions in sustainable development, the focus is the constant growth of people. This increases the usage of the natural resources. The focus here is to provide poor women and women in general to have the opportunity to choose how many children they want. There is also lack of education and health services; by establishing schools and educating people, will there be more work areas, that will result in helping poor to provide for their families and also give women much needed health service (FN 2012).

Figure 3.1 shows simplified sustainable development.

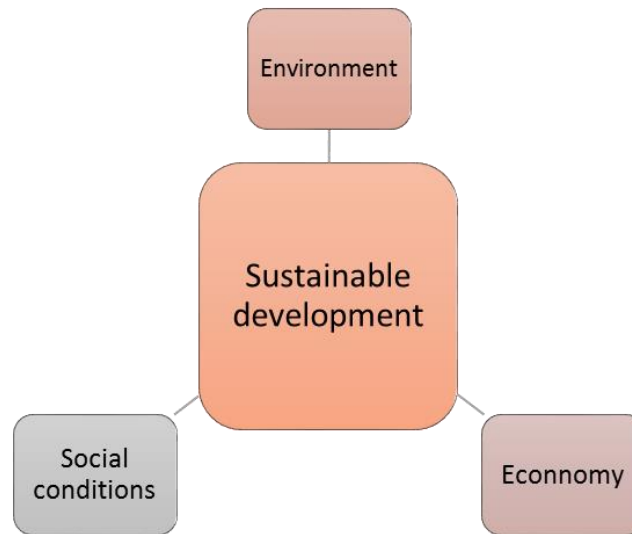


Figure 3.1 – Sustainable development, made by author

The next big step in sustainable development were the big conference in Rio de Janeiro in 1992. The conference, called the Rio-conference, was from a regime the UN developed. Here it was important to make an agenda for the 21 century, thus called Agenda 21. The goal were to established local action plans to engage the entire population, and the slogan were:

“Think globally - act locally” (Rindall 2013).

3.2.1 Renewable resources

Renewable resources are resources that can be used at any time, resources which "never" disappear even though we use a lot of them. Such resources can for example be energy made from the sun, wind, tide, and water. However, there are also renewable resources that are conditional; this means that it takes some time to renew them. For example, agriculture, fish, forest and fresh air are conditional resources. These renewable resources will disappear if we do not use them carefully. If we fish too much, the fish population will decrease. The same goes for the forest, if we cut too many trees, there will not be any trees left.



Energy Management System *«Actions for agile and simple implementation»*

The non-renewable resources are the one that we never can renew, or it could take millions of years to renew them. However, some resources can be recycled, like aluminum, paper, glass and iron, but the once who is not recyclable are oil, gas, and coal.

Energy resources are one of the most important resource that the world need when it comes to for example food and electricity. The focus now is to decrease the use of non-renewable resources and try to use as much renewable resources as possible.

However, this is a difficult task since the whole world is dependent on non-renewable resources. This will ultimately do that there would not be any non-renewable resources left. So, if the people of earth increase use of renewable energy and be more energy efficient, the energy security, environmental impacts and economic benefits would increase. It is important to try to find new ways of utilize renewable energy resources.

When discussing frameworks for renewable energy, most often it lies with the government efforts to improve competitiveness of the industry. Renewable energy has generally high investment costs and low operating costs. Renewable resources compete mainly with energy production, based on coal, oil and gas. Of these, coal, oil and gas it is the low entry costs that are the advantage in the short term. However, in long term, renewable energy resources will reduce energy costs and environmental damage. Accordingly, renewable energy resources will benefit if companies invest in them (Wikispaces 2009).

In Norway renewable energy resources are a large part of the energy consumption, most of this comes for hydropower. Approximately 99% of the produced electricity comes from hydropower. Norway also use wind farms and bioenergy, but the wind farms are not at the same scale as the hydropower plants, and the bioenergy are for the most part just used for transport.



Energy Management System

«Actions for agile and simple implementation»

Norway have the ability to be more renewable, we have the economy to produce wind farms, hydropower plants and solar energy solutions. Norway have great knowledge when it comes to producing solar cells and which material to use, we just need to take it into action (Eivind 2014).

In Norway there are some organization's that have started using renewable energy sources, the largest organization of them all is ASKO in Vestby, Akershus. ASKO were finished fall 2014 with the implementation of the largest solar cells for an organization in Norway. It have a rated power at 370 kW and have around 1480 photovoltaic modules which take approximately 2400m² space of the roof (Ramm 2014).

3.2.2 Energy efficiency

Energy efficiency is defined as a way to control and limit energy consumption. Energy efficiency is:

“Using less energy to provide the same service” (Lawrence 2015).

There are four potentials when it comes to energy efficiency:

- Theoretical potential

“Theoretical potential is the difference between the actual energy use at a given time and the one defines as a reference level for future energy use”.

- Technical potential

“The technical potential is obtained by correcting the theoretical potential with limitations result of technical and building physical conditions”.

Energy Management System

«Actions for agile and simple implementation»

- Economic potential

“By quantifying energy prices, costs of measures, the measures' life and discount rate, one is able to calculate profitability associated with the reduction in energy supplied by the measures”.

- Realistic potential

“The realistic potential is there hardest to quantify. This is because one does not have a sufficient good basis to quantify rehabilitation rate. This factor is the one who alone matter most ability to affect the energy performance of buildings in an efficient manner”.

Energy efficiency can have many benefits, not just reduction in costs. Energy efficiency can help to reduce maintenance costs, environmental emission, infrastructure, etc. so thinking efficient can lead to more use of renewable resources and again use of renewable resources will benefit the production, development and the society’s sustainability. Figure 3.2 below will illustrate this.

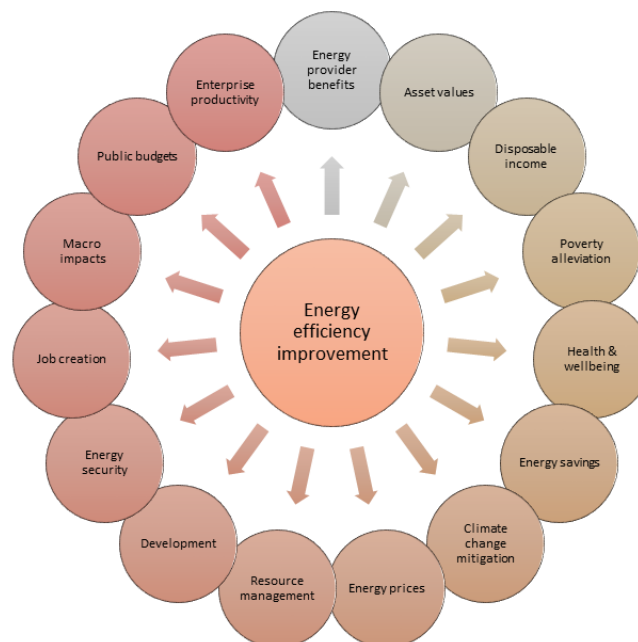
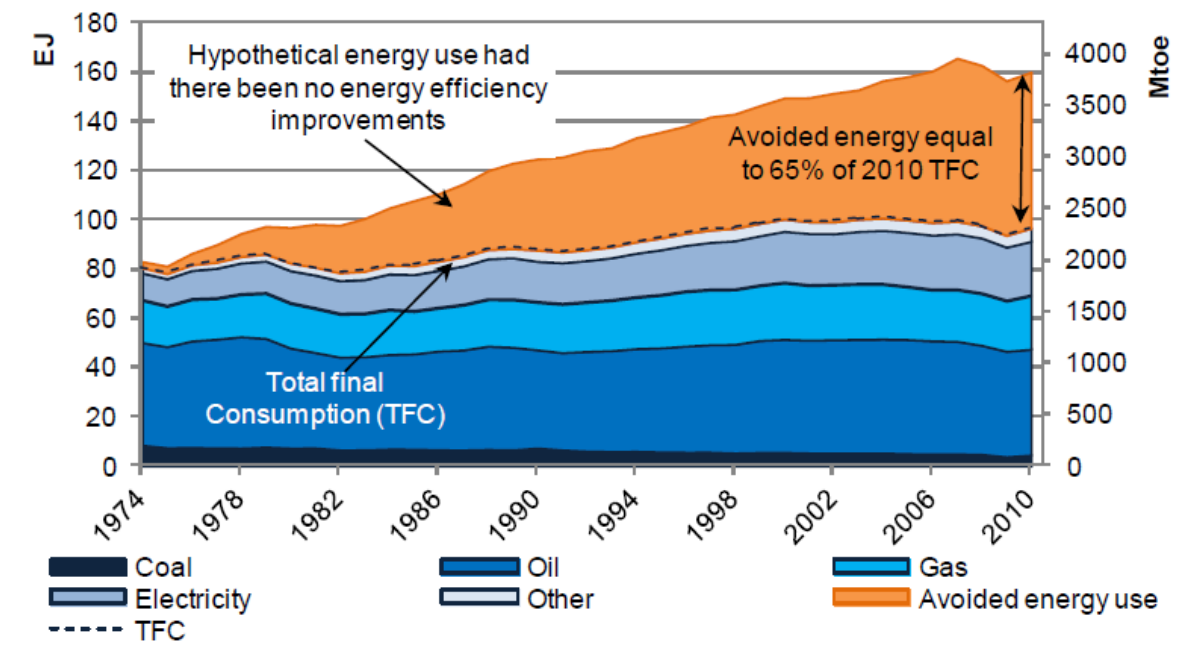


Figure 3.2 – Benefits from energy efficiency, (Houssin 2013)

Actions for energy efficiency in the industry can be categorized in different topics, for example low temperature, waste heat, electricity and combined heat and power, efficiency of support systems, improved operation and control, and streamlining of industry-specific core processes (Enova 2012c).

In addition, energy efficiency have been the largest energy resource, the last years. Due to this, there have been avoided energy consumption of 32 billion tons oil equivalent. Underneath there is a graph showing long-term improvements in energy efficiency in 11 World Energy Outlook (IEA) countries (Houssin 2013).



Graph 3.1 – Global potential for energy efficiency, (Houssin 2013)

3.2.3 UN climate panel

For a very long time, there have been knowledge that an increase in carbon dioxide levels in the atmosphere will give a temperature increase on Earth. This led to the UN by UNEP (United Nations Environment Program) and WMO (World Meteorological Organization) in 1988 to create the UN climate panel (IPCC).



Energy Management System

«Actions for agile and simple implementation»

IPCC together with the UN Framework Convention on Climate Change (United Nations Framework Convention on Climate Change, adopted at the environmental conference in Rio de Janeiro in June 1992) is the central institutional organ in the world related to working with climate issues. Further, the IPCC together with former Vice President Al Gore were in 2007, awarded the Nobel Prize for their work.

IPCC have from 1990 - 2014 published five reports on global warming and climate change.

- 1990: First Assessment Report (FAR)
- 1995: Climate Change 1995 (SAR)
- 2001: Climate Change 2001, the Third Assessment Report (TAR)
- 2007: AR4

The last report from 2013/14 called the Fifth Assessment Report consists of four sub reports, The Physical Science Basis (submitted in Stockholm September 2013), Impacts, Adaptation and Vulnerability (submitted in Yokohama March 2014) Mitigation of Climate Change (submitted in Berlin in April 2014) and AR5 Synthesis Report (submitted in Copenhagen October 2014) .

In the past 25-30 years there have been an extensive knowledge related to climate change, which also Norway has been participating. In 1990, the Center for Climate Research (CICERO) were established as a research foundation affiliated with the University of Oslo. Cicero is among the world leaders in certain fields of research on climate change. As a result, a number of Norwegian researchers have contributed to the IPCC climate reports.

Climate reports have consistently pointed to connections between human activity and climate change. In the first reports, one cannot unambiguously determine relationships. The latest reports establish such a relationship as very secure (95-100% probability) while it is determined that warming of the climate system is indisputable and that the amount of carbon dioxide, methane and nitrous oxide in the atmosphere has increased to very high levels (Hermansen 2014).



Energy Management System

«Actions for agile and simple implementation»

3.3 Norwegian and European Union (EU) climate targets

The last years the climate have changed, due to global warming. It have been important for countries around the world to reduce their greenhouse gas emission. Now Norway have also come with new and improved climate targets, this can be seen in the Parliamentary report no. 13 from 2014-2015 approved by the Government Solberg 06.february 2015. Important targets in the Parliamentary report no.13 from 2014-2015 is presented below.

Norway's contribution to a new international climate agreement:

“According to the IPCC global emissions of greenhouse gases will cause the temperature to increase with two degrees. The world risks very serious, irreversible consequences. Climate change and the global nature requires the widest possible cooperation among all countries. UNFCCC is the key instrument for such international cooperation. UNFCCC overarching goal is to stabilize greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. In practice, this is stated as an objective of limiting global warming to below two degrees compared to pre-industrial times. Through decision pursuant the UNFCCC in 2010 became two-degree target govern for the international climate negotiations ahead. Reducing emissions to a level that is in line with the two-degree target assumes that all countries contribute and that emissions are reduced in the most cost effective manner”.

Further,

“UN climate convention agreed in 2011 that there should be negotiated a new climate agreement in December 2015. The Agreement shall have effect from 2020 and shall cover all countries. As a basis for determining, the obligations of the agreement adopted under the UNFCCC in 2013 invited all countries to submit their indicative contributions / commitments in the agreement.



Energy Management System

«Actions for agile and simple implementation»

It shall take place within the first quarter of 2015 for those countries that are ready for it or in good time before the meeting in December. Submission of so-called indicative emission targets by the end of the first quarter of 2015, part of a negotiation process.

By 1 November 2015, the UNFCCC secretariat to present a synthesis report that shows the indicative contributions that countries have submitted, and the overall effect they have. This will be a very important basis for assessing whether the Paris Agreement will have high enough ambitions that manage to limit global warming to under two degrees”.

In Norway, there are some points that the government have decided to complete by the first quarter of 2015.

An agreement on joint fulfillment with the EU will involve:

- *“In quotas sector, Norway will contribute to the implementation of emission reductions of 43% compared to 2005 within the EU emissions trading scheme.*
- *Norway will also contribute to emission reductions in non-quota regulated sector by setting national emission targets for non-quota regulated sector in line with comparable EU countries.*
- *The EU proposes that some of the cuts in non-quota subject sector can be completed with the purchase of allowances in the EU emissions trading system or implementation of mitigation in other EU countries. Norway will make use of this flexibility in line with the EU countries”.*

Norway’s needs for higher ambitions:

“During 2013-2014, issued IPCC its fifth assessment report. If emissions are not reduced, we risk according to the report an average global warming of between 3.7 and 4.8 degrees by 2100 compared with the period 1850-1900. Drought, floods and other climate change could have even greater consequences than previously believed.



Energy Management System

«Actions for agile and simple implementation»

The report says that we can reduce the risk, partly to adapt to the coming climate change and by reducing global emissions so that we slows climate change”.

International cooperation on climate change and basis for a new agreement:

“Contributions to emission reductions will be absolutely central to an international agreement, because it is the sum of the efforts of all countries that determines the extent to which we can limit global warming. Efforts to reduce anthropogenic emissions of greenhouse gases has been going on for decades. The Kyoto Protocol was the first binding agreement, which imposed reciprocal restrictions on several countries' emissions. Norway is calling for the UN climate conference in Paris achieved agreement on a binding international agreement”.

Box 2.2 from the Parliamentary Report no.13: Norway's international climate commitments: In this box, there are four important points that the Norwegian government already have relied on in connection with international cooperation, Climate and forest initiatives, the green climate fund, clean energy, climate adoption and other mitigation, and Short-lived climate pollutants.

3.3.1 EU commitment to 2030 and EU's role in international climate efforts

The government report, no. 13 (2014-2015) states:

“EU emphasizes flexibility and a cost-effective approach in the implementation of their climate targets, while the EU's climate targets are part of a larger and longer-term restructuring to become a low carbon society. Internationally, the EU, like Norway, strongly advocated that all countries must contribute to emissions reductions if we are to limit global warming to under two degrees” (Regjeringen 2014).



Energy Management System

«Actions for agile and simple implementation»

In October 2014 EU had a conference and established new and improved climate targets. The target affect reducing greenhouse gas emission by approximately 40% below the level in 1990, increasing the share of renewable energy by 27%, increasing energy efficiency by 27%, reform of EU emission trading system and new governance system. The goal is to reach these targets by 2030 (Commission 2015).

Further,

“The goal becomes binding at EU level and shall be implemented within the EU without the use of international mechanisms. The goal is based on that it provides a cost-effective path towards the EU target of an emission reduction of 80-95% by 2050, as outlined in the roadmap to become a low-carbon economy (Roadmap for moving to a low carbon economy in 2050)” (Regjeringen 2014).

3.3.2 Norwegian climate targets

Now the Norwegian Government have decided to follow EU’s climate targets by 2050, and they say they will:

- *“Continue an ambitious national climate policy*
- *Norway's national emissions should be reduced up to 2030*
- *Have a long-term goal for Norway to become a low carbon society in 2050”.*

Norway’s emissions development:

“In 2013, Norway's greenhouse gas emissions was 53.9 million tons of CO₂ equivalents, which amounted to 0.1% of global emissions when shooting in forests and other land, are excluded. Except in 2009, when the decline in economic activity led to lower emissions, has not been lower emissions since 1995. Since 2010, emissions have gone down every year. Emissions in 2013 were still 3.7% over 1990 levels.



Energy Management System

«Actions for agile and simple implementation»

In 2013, industry accounted 22.5% of emissions. These emissions have been significantly reduced since 1990, partly due to the introduction of new climate technologies. In 2013 the petroleum industry was for 26%, and there has been an increase in emissions partly because of several fields in production.

The transport sector accounted in 2013 for 32% of emissions. If you keep fishing and non-road motorized equipment outside, transport sector was responsible for 26%. Emissions from transport have increased by 27% from 1990 to 2007, but has since been stable, despite traffic growth.

This is due to lower emissions from new cars and increased use of biofuels. The reduction in emissions from new cars is not only due to technological innovation, but also changes in car fees in environmentally friendly direction and major fee and user advantages for electric vehicles”.

Norway’s existing measures:

“Government policy is based on the climate agreement, jfr. Innst 390 S (2011-2012), and the amplification of it, see. Sundsvold’s Declaration. Norway's national emissions should be reduced by 2030, and the government's long-term goal is for Norway to become a low carbon society in 2050. The realignment is important to use the opportunity to new business development, and create green competitiveness.

Sectorial economic instruments in the form of fees and participation in the European emissions trading system is the main instruments in Norwegian climate policy.

Climate policy reduces national emissions significantly.



Energy Management System

«Actions for agile and simple implementation»

Some mitigation will have positive effects beyond reducing greenhouse gas emissions. An example of it is that some mitigation, including reduced fuel use in buildings, increased proportion of electric vehicles and increased share pedestrians and cyclists, also helps reduce air pollution by reducing emissions of pollutants such as sulfur dioxide, particulates and nitrogen oxides. This will include also give less acidification and have a positive health effect”.

Further, the government says that there is very important to have increased focus on research and environmental technology, for that reason Norway’s Government will strengthen these areas with several topics like:

- *“Reduced emissions in the transport sector*
- *Development of low-emission technologies in industry and clean production technology*
- *CO2 sequestration*
- *Strengthen Norway's role as a supplier of renewable energy*
- *Environmentally friendly shipping”.*

(Regjeringen 2014).

3.3.3 Norwegian Environmental legislation

In Norway, there are a number of laws when it comes to protection of the environment and nature. The standardization of environmental data is produced for a European level. However, the standards methods for the data collection are made from EU directives and when it comes to Norway, from the Norwegian Environmental legislation. To fulfill collection of environmental data thus the Norwegian Environmental legislation one uses the standards made. The acts for the Norwegian Environmental legislation include:



Energy Management System

«Actions for agile and simple implementation»

Act of 13 March 1981 no.6 relating to protection against pollution and waste (Pollution Control Act) seeks:

"To protect the environment from pollution and to reduce existing pollution, reducing the amount of waste and to promote a better treatment of fall". It shall further "ensure proper environmental quality so that pollution and waste do not lead to health hazards, goes beyond being or harm nature and its capacity for self-renewal".

The provisions concerning this is Act § 1.

Act of 28 June 1957 no.16 Outdoor Recreation will contribute too:

"Cherish outdoor recreation natural basis and ensure all men right to access and passage, etc. in nature so that opportunities to exercise outdoors as a health and wellbeing and is environmentally friendly leisure activity maintained and promoted".

Purpose of the Act provision is contained in § 1.

Act of 19 June 2009 no.100 on the management of biodiversity (Biodiversity Act) have a purpose in § 1:

"That protect biological, geological and landscape diversity and ecological processes taken care of by conservation and sustainable use, also allowing it provides a basis for human's organizations, culture, health and well-being now and in the future, as the basis for Sami culture".

In the Act of April 9 1976, no.21 on the implementation in Norwegian law Environmental Convention between Norway, Denmark, Finland and Sweden Environment Convention of 19 February 1976 given the force of law in Norway.



Energy Management System

«Actions for agile and simple implementation»

In the preamble to the Convention states that governments of Norway, Denmark, Finland and Sweden consider it very important to protect and improve the environment. In article 1, gives the following definition of environmentally harmful activities:

"Discharge of solid or liquid waste, gas or other substance for reason or building or facility in waterways, lakes or the ocean and use of soil, seabed, building or facility. Otherwise causing or may cause disruption of the environment through water pollution or other impact on water conditions, sand operation, air pollution, noise, vibrations, temperature changes, ionizing radiation, light, or other equivalent".

Law of 11 June 1976 no.79 (Product Control Act) seeks to in § 1 to:

- A) "Preventing products and consumer services involving health, including ensuring that consumer products and consumer services are secure,*
- B) Prevent products from causing environmental damage, including in the form of disturbance of ecosystems, pollution, waste, noise and the like,*
- C) Preventing environmental disturbance by promoting efficient use of energy in products".*

It appears from the Act § 2, that it includes:

"Production, including testing, importation, sale, use and other handling of products and consumer services".

Law of 27 June 2008 no.71 (Planning and Building Act) § 1, a purpose to:

"Promote sustainable development of the individual, society and future generations".



Energy Management System

«Actions for agile and simple implementation»

Promise of 9 June 1978 no.50 on Cultural (Cultural Heritage Act) seeks the cultural heritage:

"Shall be protected both as part of our cultural heritage and identity and as part of a comprehensive environmental and resource".

The provisions stated in the Act § 1.

We also own legislation relating to the management of wild and wildlife habitats (Law of 29 May 1981. 38 about hunting and trapping of wildlife) and on the right to regulate motor traffic on uncultivated land and waterways with a view to protecting the natural environment and well-being (Law of 10 June 1977 no. 88). Violation of provisions of environmental legislation may result in criminal liability (Miljøvernlovgivning 2010).

3.4 Management method

3.4.1 Organizational structures

An organizational structure is an organization's architecture. The structure is designed so that workers can live and work inside and outside from it.

It is the organizations hierarchy that makes the organizations structure; this is shown by starting with the top manager (director) and down to the ground workers. In other words, who is the leader of who? In hierarchies, one can also see which functions different parts of the organization have, like financial sections, marketing sections and production sections. This again depends on the organization structure. However, this type of structure is the outer facade of the organization; it does not show the inner facade. This means that there shall not be any task descriptions or procedures explained in this structure.

The most important focus when it comes to studying an organizations structure is to get an understanding of the workers attitudes, however without a practical management system; the organizational structure can lose its function. The management system must be able, like the organizational structure, to address all cultural factors that may affect the operations of the organization. Nevertheless, the organizations structure tries to make stability and innovation for the organization.

Henry Mintzberg argues that there are five main parts in an organizational structure. This show figure 3.3 on the right.

- The operational core
- Middle line / middle management
- Strategic Apex / senior management
- Techno structure
- Support staff

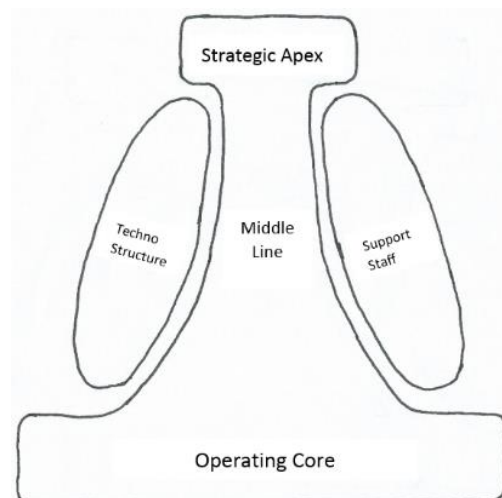


Figure 3.3 – Organization structure, drawn by author (Notatene 2015)



Energy Management System

«Actions for agile and simple implementation»

- The operating core

The operating core is where the basic work of the organization take place. This core consists of production workers, service providers, professionals or other who promote the organizations customers.

- Middle line / middle management

The middle line is right above the operating core and it is here the guiding, controlling and resource providing happens. Here is where the supervisors and first-line leaders have their place.

- Strategic Apex / senior management

Here is the top leaders of the organization. At this level, jobs are mainly within the surroundings, this means where goals and strategies are made. If the organization were private, there would be one CEO, a chairman, and board members at this level.

- Techno structure

In this part of the organization, there are analyst that standardize the work of others by examining the results of the different processes. In industries, this is usually quality control departments.

- Support staff

In the last component of the Mintzberg's organizational structure model, we have support staff. Here works the personnel who indirectly provides the operational core. This could be drivers, cafeteria personnel, secretaries, switchboard, etc. (Notatene 2015).



Energy Management System

«Actions for agile and simple implementation»

Further, the organizational structures creates five organizational configurations or forms.

- Simple structure
- Machine bureaucracy
- Labor bureaucracy
- Divisional structure
- AD-hoc

There are two levels the simple structure revolves on, one strategic apex and one operational level. The cooperation between these two levels and the workers in these levels works by direct supervision. This is like a “man-wife” relationship, which means that there are one person, for the most part, that have total control over what shall happen in daily operations. For the most part in all start-up companies, the simple structure is dominating, and as the time go the company slowly change form.

The benefits of the simple structure is the ability to adapt and be flexible, this is since one person have the ability to change the whole company. However, such benefits can also have structural defects. The simple structure is very dependent on one person and this can make the business either to move forward, or into a stand still. Another disadvantage is that one person can “dig” the company into acute problems, and neglect long-term decisions.

The machine bureaucracy is the classical example of McDonalds. In the strategic apex he most important decisions is decided. Further, the daily management is controlled by own managers at each restaurant and procedures that analysts from the main office have made. In contrast to simple structure, the machine bureaucracy has a huge staff and a huge techno structure. This means that there are many levels between the apex and the operational core.

The machine bureaucracy is a very effective and viable structure when it comes to for example production of care. Nevertheless, the main problem is that it is difficult to motivate and satisfy the workers in the operative core. It is also possible that the middle managers and the top managers have difficulties between them.



Energy Management System *«Actions for agile and simple implementation»*

In the labor bureaucracy, the operating core is the biggest and the techno structure is the smallest compared to the other structural elements. The labor bureaucracy is said to be flat, which means that there are not many levels between the strategic apex and the operational core. Academic schooling of the members in the organization makes it easier to control how the primary tasks shall be. It is very important in the labor bureaucracy that the workers always get feedback on their work; this makes it possible for the workers to always use their knowledge. This is one of many advantages; however, the disadvantage is that this leads to problems in coordination and quality control.

Furthermore, the labor bureaucracy are often slow to respond to changes in the environment, since the professional and independent workers lack adaptability when it comes to change.

The divisional structure are built with many divisions that represent all the structures mentioned before. The main work in this structure is performed in different quality controlled departments; however, the strategic apex again manages these. The divisions operate in different markets, but these divisions are concerned to achieve different measurable goals. Theory says that the divisionalised structure has an ability to respond quickly without any financial damage. Nevertheless, there are also some negative aspects in this structure; like there always will be a game of cat-mouse between the different managers.

The last organizational configuration is AD-hoc. AD-hoc is an open, loose, flexible and self-renewing structure that mainly bounded in horizontal coordination. The structures of AD-hoc is found at both the operational and administrative level. The most usual view on AD-hoc is that it have power structures, unclear goal,s and conflicting responsibilities allocations. These topics are not flattering for an organization, therefore AD-hoc is most likely in an organization where there always is action and turbulence and where changes needs to be done quickly. Such organizations could be advertising agencies, consulting firms, etc.



Energy Management System

«Actions for agile and simple implementation»

Consequently, when it comes to implementation of a system in an organization, it is important that the organizations staff knows which kind of structure they have; this will benefit them on how to attack when it comes to implementations of new systems. (Jackobsen 2012).

3.4.2 Management systems

A management system is to support decision making in an organization. Management systems is the basis for how to choose good work methods. Through these work methods, the organization will be more predictable, and risks and errors will be reduced.

When it comes to performance in management systems, it is important that every organization concretize goals and later measured. Further, the results measured are followed up in relation to the goals that the organization set. Performance is always about control; however, the leaders plays a huge role. The leaders must establish and follow up good written goals. Further, the leader must analyze, learn and facilitate communication in the whole organization.

Even though there are many different shapes and sizes of organizations throughout the world, both private and public, there does not exist an own standard for how to structure a management system.

The most likely reason for this is that whatever kind of organization one might have, there are certain key components every management system follows:

- Policy
- Planning
- Implementation and operation
- Performance assessment
- Improvement
- Management review

(ISO 2012).

Energy Management System

«Actions for agile and simple implementation»

A management system is to provide an organization with a goal to achieve greater heights, by encourage standardization and reduce variation. There will also be important to help staff understand how they should fit in to the organization and what they shall do in the organization.

In a management system, there is important that the system is understandable for everyone in the organization, all workers needs to know how the system works, by having a simple, clear, and a comprehensive approach. The same goes for an EMS, the whole system needs to be understandable for everyone in the organization.

The Deming's management system model is a well-known model used to get system of the management in the organization. The Deming's approach for a management system, called PDCA, stands for Plan-Do-Check-Act. Figure 3.4 shows us how this approach works.

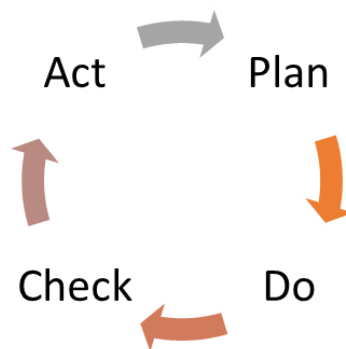


Figure 3.4 – Plan, Do, Check and Act, made by aithor

When an organization have a management system that works and knows how to benefit from the system, the organization will always have an understanding on how to do further implementations and improvements in the organization. In addition, when knowing the organizations structure together with the management system, the organization will no longer struggle to achieve new ways of improving their companies work, effectiveness, cost reductions, energy consumption and energy efficiency.



Energy Management System

«Actions for agile and simple implementation»

3.4.3 Energy management system (EMS)

The principle of energy management have been in business interest from the beginning of the 70's, the concept of EMS were supported by every organization, but in the 80's there were a plunge in energy prices. This made businesses wonder if it was necessary to continue with EMS. The answer is, of course, we need EMS. However, EMS is said to just be good business if it is run by professionals (Turner 2007).

EMS is the interaction between people, technology and organization. EMS is a management system that ensures continuous work in the organizations right direction, when it comes to sustainability, energy efficiency, and use of renewable resources. Further, EMS is to implement organizational, technical and behavioral actions, in an economical safe way to reduce the consumption of energy. This including energy production and reducing the consumptions of basic and added materials.

EMS is systematically work towards energy efficiency. Traditionally work many organizations unconnected with the word energy efficiency. The focus varies with energy prices, where high-energy prices, make more investments and cost savings, while efficiency requirements is forgotten, during periods of low price.

The focus of EMS is the continuous awareness of energy and always try to reduce the energy consumption. This will make it possible for the organization to continue improvements in a cycle with, policymaking, action planning, implementation, control of results and preparation of new policies based on the results. This shows figure 3.5 below, called Deming's circle:

Energy Management System

«Actions for agile and simple implementation»

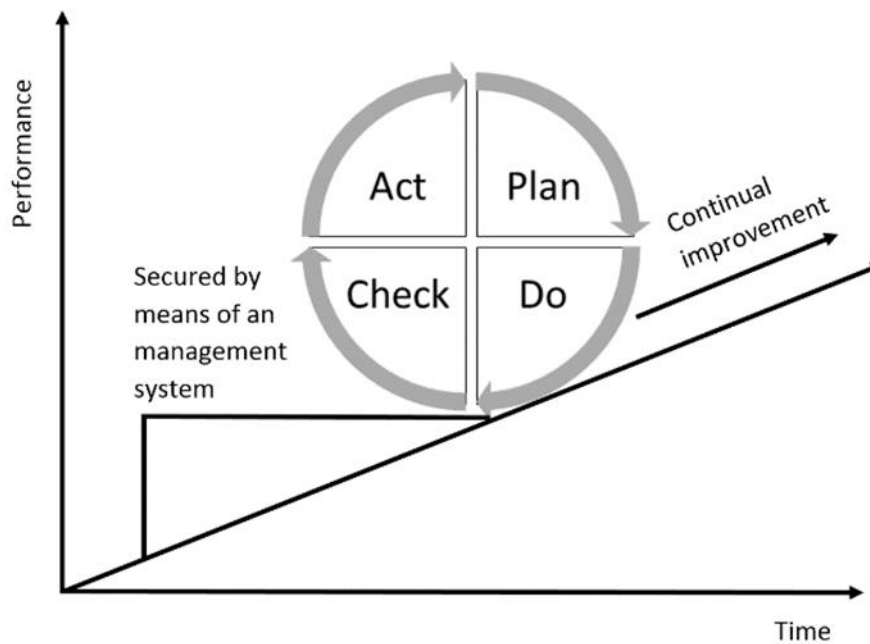


Figure 3.5 – Deming’s circle on EMS, (nepas 2007)

The goal of EMS is not the implementation of the system itself, but the results that the system can give the organization. For this to succeed, the corporation between the information the system gives and the workers in the organization, needs to be flawless. The workers need to know what kind of information they get from the system and then use this information for new and improved goals for energy reduction.

EMS can have different kind of positive effects, and there are different things that the organization quickly will get an understanding of once the organization initiates the implementation.

- One will know how much energy the organization uses in different departments
- One see immediately when and where the energy consumption is reduced or increased
- One will have full overview of the energy in a structural matter

These three points also have some effects like, energy consumption reduction, lower energy costs, increased profits, etc.

Energy Management System

«Actions for agile and simple implementation»

Energy management mean less energy consumption in the organizations, this means that if every organization uses less energy there will also be less petroleum field development, which again leads to less on-site pollution. Furthermore, if organizations uses less energy there will also be less thermal pollution and cooling water discharge, this means the EMS will eventually improve the environments quality, one just need to implement it first (Turner 2007).

Further, in EMS there are four concepts that are within context, energy efficiency, energy management (EM), EMS, requirements for EMS in ISO 50001:2011. The context within these concepts is that energy efficiency is the basic concept that involves the measures to improve the energy performance. This called performance as in how well the system is performing to achieve the targets for energy properly. Outside energy efficiency, we have EM, which means that the company works systematically trough energy efficiency to achieve control and continuously improve energy performance.

Further step out we have EMS, the company at this level works systematically EM by establishing an energy policy and energy targets, as well as processes and procedures to achieve the goals. Outmost we have the standards for EMS, which sets global common requirements for EMS (nepas 2007), (Enova 2012e). This shown in figure 3.6 below.

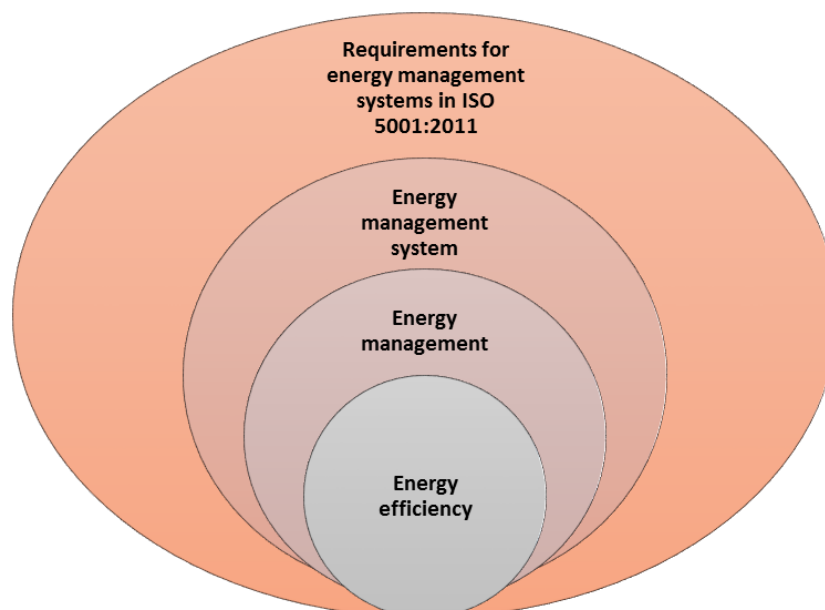


Figure 3.6 – Concepts within context, energy efficiency, EM, EMS and ISO 50001, (Rasmussen 2014)



Energy Management System

«Actions for agile and simple implementation»

The last couple of years there have been need to implement EMS, the most important topics for the organization is the need of reducing costs and the need of national goods, this means climate, greenhouse gas emission, energy consumption, etc. When it comes to the need of reducing cost in an organization, EMS have repeatedly proven that the system will help to reduce costs in the organization. The system have proven that it will in a short amount of time, reduce the energy costs with approximately 5-15%. In addition, savings of 30% is normal, and form research there are seen, that organizations have saved as much as 70% by implementing EMS.

When it comes to the national goods, EMS in an organization can help a whole country face their biggest problems, like global warming, greenhouse gas emission, oil import and export, etc. Therefore, by implementing EMS the organization will reduce their energy use, which again will reduce acid rain, limit global climate change, limit ozone depletion, etc.

There is also important that every organization think more about using renewable resources. Instead of using coal one can use damp (water), or the organization can implement solar power on their roofs, there are many areas that an organization can change by implementing EMS, it can be expensive at first, but in the long run the organization will benefit from it (Capehart 2006).



Energy Management System

«Actions for agile and simple implementation»

3.5 ISO standards

3.5.1 General information about ISO standards

Standards is an essential part of everyone's life. Standards are everywhere and are used almost everywhere we go. The use of standards are not a walk in the park, standardization is a highly difficult and challenging part of a projects development.

During our lifetime, we all have been in one way or another, experienced whit standards. Just by looking at or using a paper, one have experienced a standard. A4 paper size is an example of a standard used in every country on earth, and is set as a standard for everyone to use. The same goes for screwdrivers, screws, etc.

Standards are created, so that it is easier for an industry to make products safer, easier to produce, less costly, etc. Production and life assessment at a company have increased speed in development; however, production of ISO standards uses the same production method as were used for 50-100 years ago. This make users uncertain and concerned of the shape, of the ISO standard.

For a standard to be good and up to date there are some topics that one need to follow, this can be difficult to achieve, however it is important to follow these properties:

- *A standard has to be ready when it is needed*
- *A standard has to be relevant to the market*
- *A standard has to add value to a business and help save money*
- *An International Standard has to be applicable worldwide*
- *A standard has to be compatible subject have to be consistent (Kresse 2004).*

ISO standards are documents that provide requirements, guidance and specifications that will allow organizations, companies and countries to ensure that products, materials, processes, etc. are fit as they supposed to. ISO do not have standards for everything, however they have managed to developed standards for traditional activities.



Energy Management System

«Actions for agile and simple implementation»

There is not mandatory to follow the standards that ISO give out, however it is important to take standards into implementation of different systems, the standards are great guidelines in how to implement systems and make them work properly. It is the countries governments that require or demand that the ISO standards must be used (ISO 2015a).

Standardization work, is provided through national standards, European standards and International standards. The national standards are specific for the countries benefits, regulations and laws, and the same goes for the European and international standards.

For Norway, there is a national strategy for standardization. The goal for this national strategy is to provide simplifications between for example the making of a product and the machine work better together. When a standard is specific for Norway, the name of the standards starts with NS. If the standard is just for Europe, the names starts with EN. If the standard are for both Norway and Europe, the names starts with NS-EN. When it comes to ISO, the standard says that it can be used in every country in the world (Standard 2015).

Furthermore, ISO have made three management system standards, ISO 9001:2008, ISO 14001:2004 and ISO 50001:2011. These standards shall provide opinions when it comes to different aspects in an organization. In relation to the implementation of a management system, the standard can influence the way the organization shall run. This comes from their common approach for continuous improvement, the Deming's approach PDCA. Further, the standards assume that all employees always should continuous helping improvement in a given area in their organization, with monitoring and follow-ups regularly (ISO 2013).



Energy Management System

«Actions for agile and simple implementation»

3.5.2 ISO 50001:2011 Energy management systems

For development of an ISO standard that considered EMS the United Nations Industrial Development Organization (UNIDO), came with a request to ISO for development of such standard (ISO 2011b).

As mentioned earlier ISO 50001:2011 is a part of the ISO category management systems. The standards intention is to make an organization reduce their environmental effects, reduce energy costs, save in maintenance and infrastructure, and reduce energy consumption through an EMS. McKane determine that:

“The purpose of an energy management standard is to provide an organizational framework for industrial facilities to integrate energy efficiency into their management practices, including fine-tuning production processes and improving the energy efficiency of industrial systems. Energy management seeks to apply to energy use the same culture of continual improvement that has been successfully used by industrial firms to improve quality and safety practices. An energy management standard is needed to influence how energy is managed in an industrial facility, thus realizing immediate energy use reduction through changes in operational practices, as well creating a favorable environment for adoption of more capital-intensive energy-efficiency measures and technologies” (McKane 2010).

Furthermore, the standard gives no boundaries of which kind of organizations that can follow it, all small and large organizations can use the standard. ISO claims that:

“All organizations regardless of geographical, cultural and social factors can use the standard”.

The standard should give every organization the opportunity to establish standardized systems and processes, these systems should enable the organization to manage their energy performance, energy efficiency, energy use, and energy consumption.



Energy Management System

«Actions for agile and simple implementation»

There are no requirements from the standard that mention what kind of goals the organization should consider.

The standard is a manageable standard with a reasonable amount of pages. The standard have four chapters, which include, scope, normative references, terms and definitions, and energy management requirements. The most important chapter in this standard is, energy management requirements, which tells us the general steps for implementation of the EMS. In this chapter the standard, inform which part of the organization that have responsibility on what, and how to proceed in the different stages of the implementation.

ISO 50001:2011 are not just for organizations that want to be certified, but also for organization that want to follow global and national goals for EMS. The standard is beneficial for organizations that want to measure their EMS (ISO 2011a).

“ISO 50001:2011 can make a positive difference for organizations of all types in the very near future, while supporting longer term efforts for improved energy technologies” (ISO 2011b).

The most important thing to consider if an organization doubt implementation of this standard is that, the organization could integrated it alone or with other management systems that the organization uses. Therefore, there are no reason not to implement the standard in any organization.

3.5.3 ISO 14001:2004 Environmental management systems

ISO defines their standard ISO 140001:2004 to be:

“A part of the overall management system that includes organizational structure, planning activities, responsibilities, practices, procedures, processes and resources for developing, implementing, achieving, reviewing and maintaining the environmental policy”.



Energy Management System «Actions for agile and simple implementation»

As the standard ISO 50001:2011, this standard all organizations can implement it, small or large. Every type of organization in every country can use this, hospitals, industries, hotels, etc. In addition, this standard have no requirements of what the organization should have as goals or other types of demands. The implementation of this standard is to show that the organization have fully documented EnMS. It is the organizations responsibility to follow any requirements or demands that their country recommend. ISO 14001:2004, were established to help organizations to minimize their impact on the environment.

EnMS is a profitable investment for an organization, the organization could get control over their use of raw materials, and the organization could benefit from having an EnMS when it comes to their profile outwards to their customers. When the organization have a functional EnMS, the organization will make more money with less damage to the environment.

The benefits from ISO 14001:2004 is that the organization reduces their waste and energy use, there could be easier for the organization to cut costs that runs the efficiency of the organization. Further, the organization could get more customers due to their green work, which again can make stakeholders more interested. ISO 14001:2004 have now become the world's most important and most used standard, and now there is a new revision for update in 2015 (ISO 2004).

3.5.4 ISO 9001:2008 Quality management systems

ISO 9001:2008 are the standard organizations uses to follow quality management. The standard is the only in its family that an organization can certify, however the standard do not require this. As the standards above every organization ca use this standard, small or large.

ISO 9001:2008 is the most certified standard; the reason for this is that the standard includes several principals, not just for the organization but also for the customer. As the other standards, ISO 9001:2008 focus on a continual improvement, this to ensure that the organization always improve their goals and requirements towards a better organization.



Energy Management System

«Actions for agile and simple implementation»

The focus of ISO 9001:2008 is that the organization always ensure that their customers get quality products and good service. ISO 9001:2008 is not a requirement to have in an organization, but the organization need to follow their countries demands and regulations in terms of if they need to implement or certificate their organization to this standard.

Nevertheless, this standard can be useful to implement even if there are no requirements saying so. The standard will help the organization to save money, increase profit, and satisfy customers, this is the optimal standard for both organization and customer (ISO 2008).

3.5.5 New audits for ISO 9001:2008 and 14001:2004

International Organization for Standardization (ISO) have now made new audits for ISO 9001:2008 and ISO 14001:2004, these will be available from October 2015, hence called ISO 9001:2015 and ISO 14001:2015. The focus have now change in these two standards, now the focus is more on efficient process management, addressing change and the need for change management, and facilitating sustainable development.

These changes will be more helpful for organizations when implementing new standards and integrating different management systems. The standards will have a three-year transitional period for the organizations who already are certified after them, before the management systems need to be up to date with the new audits (DNV 2011).

The main difference in ISO 9001:2015 is:

- There will be a risk-based approach as background for management systems. This instead of the “one size fits all” requirement in the standard. This will make the organizations to be challenge when it comes to their risk analysis.
- There will be a broader view of management of risks and opportunities. This means that organizations needs to systematically monitor and make decisions throughout the organizations context.
- The standard increase the emphasis on the leadership and top management regarding to take more responsibility for quality management efficiency.



Energy Management System

«Actions for agile and simple implementation»

- The point where reinforcing control of remotely deliver processes, products and services, are now no longer in the standard, however, it is covered by the externally supplied processes.
- Further, there will be more focus on planning and control of changes; this will be including different requirements for changes in processes and other changes of the management system.
- The point, requirements for documented procedures is modernized, and the point has now the new name documented information.

The new standard also have some new topics:

- There will not be requirements for a quality handbook.
- The preventive measures are no longer a part of separate requirements, however, it have been an integral and an essential part of risk and management systems.
- There will not be a management representative role anymore; hence, it leaps with an enhanced management involvement.

The main difference in ISO 14001:2015

In ISO 14001:2015, there are five new elements taken into order.

- There are three new concepts in this ISO, supply chain, value chain and product life cycle, these subjects combine make the organization to have wider responsibility towards the physical and legal boundaries of the company.
- Further, planning and leadership of the value chain needs an explicit assessment when it comes to upstream and downstream processes. Upstream could be production and transportation of raw material, and downstream could be landfill.
- When it comes to products and services, it is important to identify specific environmental aspects.
- It is emphasized that a processes in the value chain in relation to environmental aspects needs to be controlled and influenced.
- The last main difference is that there needs to be evaluation of significant aspects and risks from the value chain as input to the design and development, or modification of products and services.



Energy Management System

«Actions for agile and simple implementation»

The focus in these standards have changed to emphasize more on sustainable development. This means that there is not just the management system that highlights the improvements within quality and environment. This it will probably have an positive effect on sustainable development, through minimizing waste, reduce energy consumption and other natural resources, improving health and security, achieve long term goals and ensure compliance with relevant laws and regulations (DNV 2013).

3.5.6 Context and similarities between ISO 9001, 14001 and 50001, and their structure

The standards ISO 9001:2008, ISO 14001:2004 and ISO 50001:2011, is based on the same management system model/approach, this so that organizations always can continue with improvements. The capability between these standards makes it easier for organizations to integrate for example EMS or EnMS into their quality management efforts. One can also integrate just one of these standards alone. ISO 50001:2011 adds data-driven sections related to energy planning, operation control, and measuring and monitoring energy in the organization, which none of the other standards do.

An organization use ISO 14001:2004 when the focus is the organizations environmental impact, while ISO 50001:2011 is more likely to be used when the organization will manage their energy. The ISO 50001:2011 gives a more concrete framework that enables the organization to seek greater focus on energy efficiency.

ISO 9001:2008 is the standard most organizations follows daily, this is the tool organizations use to control errors in production and management. The system prevent errors to occur while identifying errors before they occur. Therefore, this standard is helpful to have in general in an organization, and for implementation of other standards (Fossendeliv 2014).

Energy Management System

«Actions for agile and simple implementation»

Structure:

The three standards mentioned revolves on the similar structure or approach, the Plan, Do, Check and Act (PDCA) approach. This approach is:

“A simple tool that ensures constant monitoring of your organization’s effectiveness”.

The PDCA approach will ensure development, continuous improvement, and control of the management system, which the organization uses.

For ISO 9001:2008 the goal is to work towards improvement for the organization, the reason for this is that improvement in an organization will give greater competitiveness among other organizations. In figure 3.7 we can see how the PDCA approach for ISO 9001:2008 works.

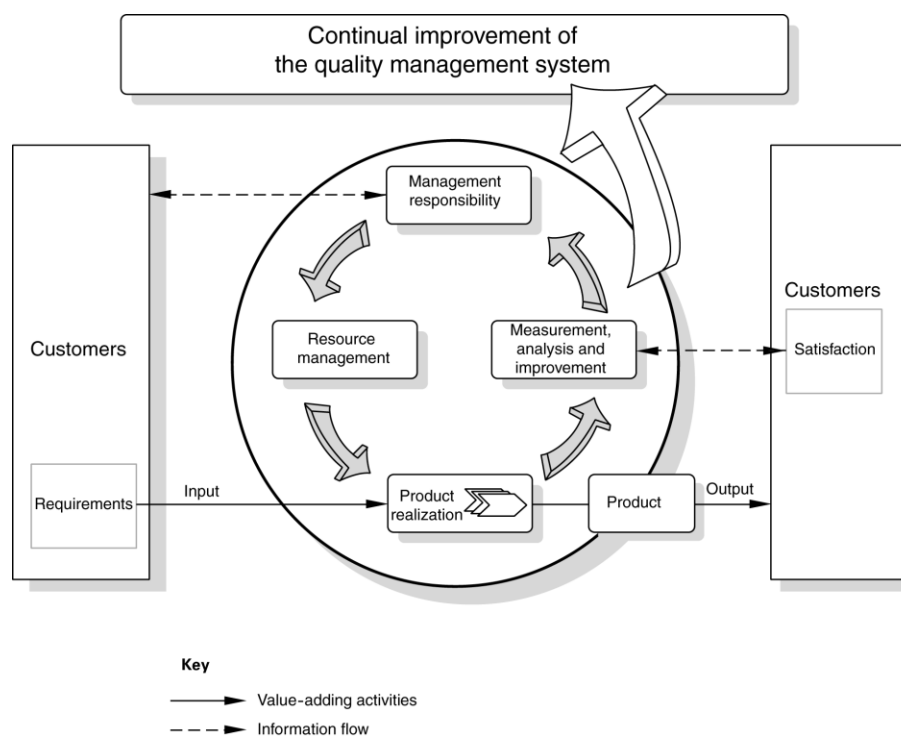


Figure 3.7 – PCDA approach for ISO 9001, (ISO 2008)

Energy Management System

«Actions for agile and simple implementation»

The PCDA approach for ISO 14001:2004 is to provide a framework to the organization's environmental policy, plans, and actions. From figure 3.8 we can see how the PDCA approach for ISO 14001:2004 works.

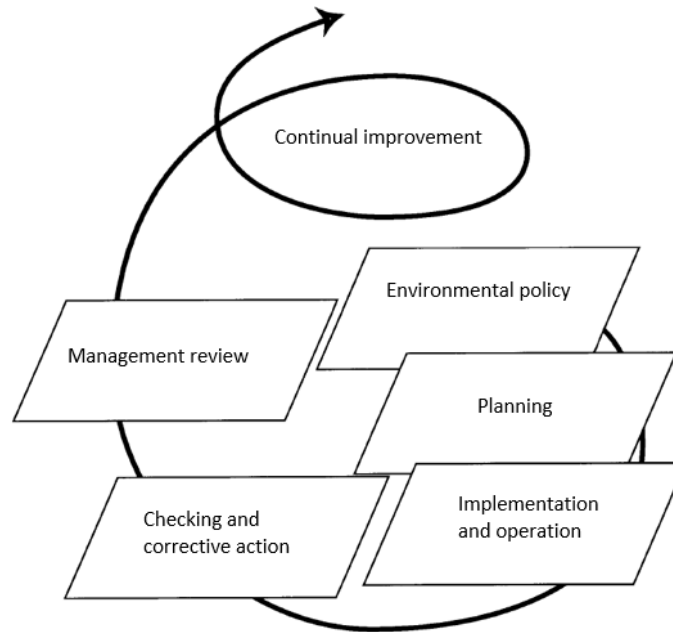


Figure 3.8 – PCDA approach for ISO 140001, (ISO 2004)

For ISO 50001:2011 is the goal by this approach, to help the organization to continual achieve improvements in energy performance. Underneath in figure 3.9 we can see how the approach works for an EMS.

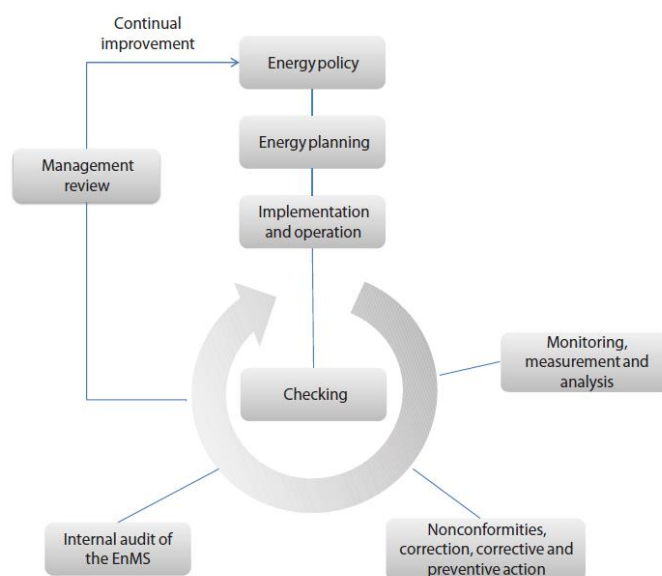


Figure 3.9 – PCDA approach for ISO 50001, (ISO 2011a)



Energy Management System

«Actions for agile and simple implementation»

ISO have also made a comparisons list between the three standards, below we can see how these standards interrelates.

Content	ISO 9001	ISO 14001	ISO 50001
Core concept for establishing guidelines	Based on clients' quality requirements	Based on relevant environmental aspects	Based on energy consumption of the whole organization, or a particular production process. For compliance with ESOS your ISO 50001 system must cover all your organization or groups energy consumption.
Policy	Meet the clients' requirements	Environmental policy illustrates how the organization handles environmental matters, commitment to environmental protection, as well as associated objectives and targets. Typically, the policy will include the organizations commitment to preventing pollution, regulatory compliance and continuous improvement.	Energy policy illustrates the strategy of the organization on energy management. The policy provides the framework for setting up associated objectives and targets to enhance energy performance
Strategy	Setting up quality objectives, targets and quality management plans.	Compliance to relevant environmental regulatory requirements. Setting up environmental objectives, targets and implementation plans.	Conducting energy reviews to identify significant energy use activities and set up energy baseline as well as energy performance indicators. Compliance to relevant regulatory requirements and setting up energy objectives, targets and implementation plans.
Baseline	No such requirement	No such requirement	Energy baseline is foundation to establish the system

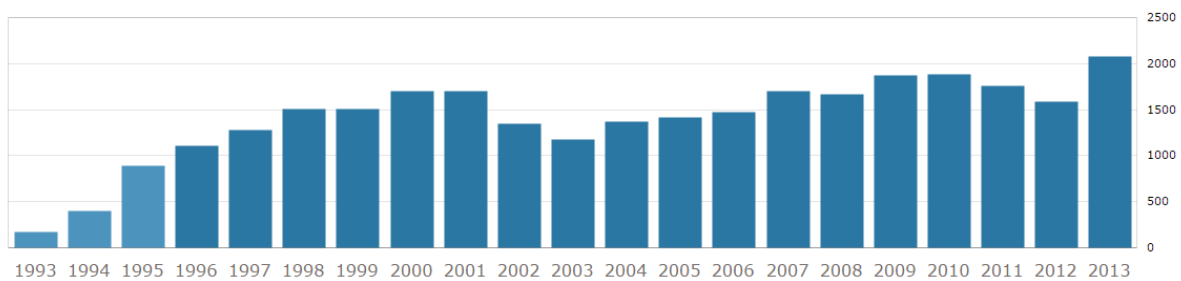
Table 3.1 – Comparison between ISO 9001, 14001 and 50001 (LTD. 2014)

3.5.7 Certification

Certification is not a requirement from international laws or laws in Norway. However, there can be demands that say that an organization need to be certified. Certification is a voluntary part an organization can do, if they want to be internationally recognized. Certification, will take time and it will be expensive, thus many organizations chooses not to certify their organization. In Norway, “Det Norske Veritas” are one organizations that help other organizations through the certification process (ISO-sertifisering 2015).

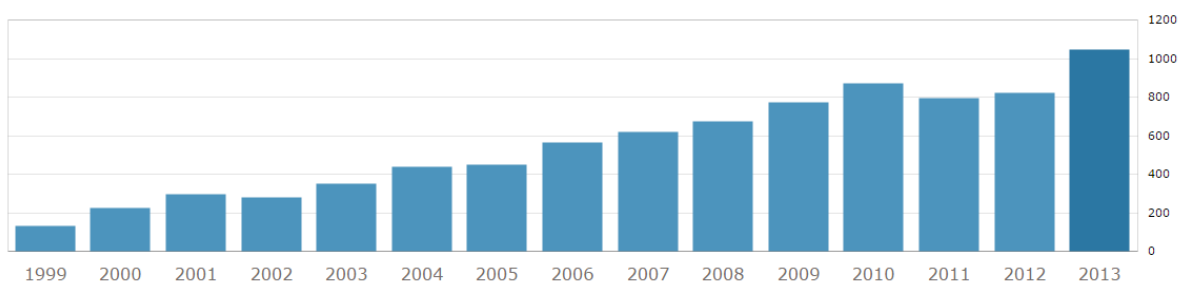
In Norway, among ISO 9001:2008, ISO 14001:2004 and ISO 50001:2011, there are most organization that have certified ISO 9001:2008. As we can see in graph 3.2, in 2013 there were approximately 2000 organizations certified. In graph 3.3, one can see that there were in 2013 approximately 1000 organizations certified to ISO 14001:2004, and in graph 3.4 one can see that there were approximately 14 organizations certified to ISO 50001:2011 in 2013.

ISO 9001:2008 *Quality management systems:*



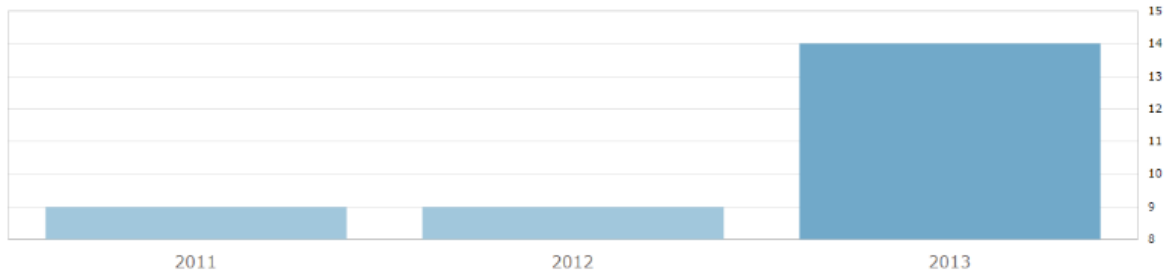
Graph 3.2 – ISO 9001:2008 certificates in Norway, (ISO 2015b)

ISO 14001:2004 *Environment management systems:*



Graph 3.3 – ISO 14001:2004 certificates in Norway, (ISO 2015b)

ISO 50001:2011 *Energy management systems*:



Graph 3.4 – ISO 50001:2011 Certificates in Norway, (ISO 2015b)

As we see from the tables, there are not many certificates in ISO 50001:2011. Why? Is a good question. From research, in 2013 there were in Sweden 94 organizations certified, in Denmark there were 45, but in 2012 there were 85 organizations certified, and in Germany there are over 2500 organizations certified. How can it be such large differences? (ISO 2015b).



Energy Management System

«Actions for agile and simple implementation»

3.6 Enova

3.6.1 Background

In Norway in 2001, Enova were established, this to contribute industries reduction of energy use and energy production. The Norwegian Oil- and energy department are Enova's owner's, and have approximately 80 employees.

The goal of Enova is to make Norwegian industries more environmental friendly by reducing energy consumption, trough development of new energy technology, this trough economic support and guidance.

Enova shall contribute to long-term changes when it comes to supply and demand for renewable resources. For Enova it is important to cooperate with both private and public sectors to be able to reduce the use of energy and increase the production of renewable energy sources. Enova claims that:

“With energy management and specific energy measures your business can save significant amounts of energy”.

The main goal is to increase the security of supply and reduce greenhouse gas emission.

3.6.2 State Aid

Enova have financially support from the Norwegian energy fund. This fund shall contribute to achieve goals and requirements that the Norwegian government have for our society. The fund is founded by the society, by implementing an own cost premium at households energy bill, and the rest is founded from the *"Fund for climate change, renewable energy and energy conversion"*. This fund has approximately 40 billion NOK in 2014, but in 2015, the fund will increase with around 5 billion NOK (Enova 2012b).



Energy Management System

«Actions for agile and simple implementation»

From the government report, no. 13 (2014-2015) is it stated:

“Enova manages important instruments for change in several key emission sectors. The government has reinforced the climate compromise by providing increased funding for the Climate and Energy Fund, to strengthen its focus on energy and climate technology. Enova's energy conservation support to private households are reorganized and expanded” (Regjeringen 2014).

3.6.3 Enova and energy management

In the process of making an energy guideline to simplify the implementation process of an EMS, Enova did research on how they could contribute to simplify the standard ISO 50001:2011. By looking at Danish GO'Energy, Swedish “Energimyndigheten”, Dutch NLAgency and Irish SEAI, Enova manage to get access on different checklists and guidelines. This made it easier for Enova to make their own implementation guide, which simplified ISO 50001:2011.

Enova claims that the standard ISO 50001:2011 is an ambitious road to follow, and that there are for many organizations just possible to implement some parts of the standard. Enova have therefore established an own guide to use, when it comes to implementation of an EMS in an organization. Enova's own word is that their guide is:

“A supplement to the standard, ISO 50001:2011 Energy management systems Requirements with guidance for use, the "Energiledelse i Industrien ". The document is intended as a simple guide to energy management at a level that also smaller enterprises should experience as within reach” (Enova 2012a).

Enova is an aid for organizations that want to introduce EMS. For an organization to claim support from Enova, the organization needs to follow the standard ISO 50001:2011 requirements.



Energy Management System

«Actions for agile and simple implementation»

To get support from Enova, the organization need to find a program to implement, further, applications needs to be sent to Enova. When Enova gets the application, they will process the application and eventually approve it. When the application is accepted, Enova will help the organization to implement the chosen program, by guiding and guidelines. When the implementation is finished, the organization will get paid support of 1 M NOK, and a last report and other documents is given the organization.



Energy Management System

«Actions for agile and simple implementation»

3.7 Implementation

3.7.1 Implementation of a management system

Implementation of a management system is to follow the PDCA approach, the whole point by this approach is to:

- Plan

Here the organization shall define clear tasks and strategies to achieve wanted objectives. The organization shall formulate policies and other factors, so that the organization know how they should adhere these factors.

- Do

Under this section, the organization manage what to do and how to do it. This means that it is important to organize and ensure that, every process of the work is efficient.

- Check

Here the organization checks, monitors or measures if everything goes according to the plan that the organization have made.

- Act

In this last section, the organization can make adjustments on what the organization must adjust, in terms of how to achieve improvements (Kiland 2012).

Nowadays this is the most known approach on how to implementing a management system, all from quality, environment and energy management systems. The first stage of a regular management system is to make a policy for the organization. Here formal and value statements will be enlightened, the commitment of the organization, and requirements and goals to achieve and follow.



Energy Management System «Actions for agile and simple implementation»

Further, planning of the management system starts. Here the organizations interests of the policy statement will be enlightened, what is the organizations goals to achieve the policy, this is very important to understand. Then the implementation of the management system will start. The implementation stage will perform the stages before and here it is important to know how to execute the system. What will the organization do and how. Then it will be important to monitor and check the execution of the stages done before in the process. Finally, the top management will review the whole process. New routines, goals and audits will come to place and improvements will be processed and enhanced.

3.7.2 Implementation of an EMS using ISO 50001:2011

The ISO 50001:2011 is a standard with thirty-two pages, there are mainly six sections within the implementation of an EMS, further in the sections there are some steps to follow. Implementing EMS by using ISO 50001:2011 is not a walk in the park, but like other management system standards, ISO 50001:2011 revolves on the PCDA approach. This means if an organization already have a management system, the implementation of this standard will go much smoother.

The first and most important for implementation of an EMS is the support and commitment from the top management. It is always important to know that one always have the ability to perform improvements. The way of getting the support of the top management is to create and present a case, this with long-term impacts such as objectives, financial performance, growth, environmental performance, etc.

Further, it will be important to develop an energy team. The team need to be able and compatible to take decisions. This team will have one leader and several other members depended on the organizations size. For a small organization, there is usually just a few members, and this does that the responsibility for the most part lies with one person. Nevertheless, this person needs to have more than just general knowledge and he/she needs to understand what great responsibility means.



Energy Management System *«Actions for agile and simple implementation»*

When the team is formed and the support from the top management are in place, the work starts. Now it is important to make an overview for the EMS implementation, steps like how to structure the processes and how to keep documentation and recordings are essential.

Before the final PDCA initiatives is in order it is important that the organization gain as much information and understanding as possible on the energy use and demand. To get an overview of this there could be done a review, this by analyzing, determine and identifying all energy use and consumption. The energy review is important when it comes to the EMS planning, the information gathering are done by a person with great knowledge, and the measurements are collected through energy bills, energy meters and other available sources. This energy review must be analyzed and interpreted, so that full understanding of improvement opportunities occurs for the organization.

When this is done the PDCA stage starts. Primarily it starts with planning the energy; this is done by defining objectives, goals, actions and plans for the organization. It is also important to make a review on every activity that affect the energy performance. Further, knowledge or skills on energy fundamentals and energy techniques, is important that the energy team members possess. It is essential that the organization have full understanding and access to all legal requirements and other forms. This is important so that the organization could describe its energy use, consumption and efficiency in relation to the requirements.

In the planning stage there are also important that general understanding of renewable energy are helpful. At last, the organization needs to set up some energy performance indicators, and an energy baseline. The energy performing indicators goes mainly on how the organization shall be able to monitor and measure the energy performance. This means that the organization needs to have a plan on how they will be able to collect this data. The baseline is that the organization sets a starting point on energy use and consumption, and after a period, measures the data against each other to find if there are any changes.



Energy Management System *«Actions for agile and simple implementation»*

The next stage in the implementation is the Do-stage. This are also called the implementation and operation stage. Once the plans of the EMS are in place, the facility planning, organization improvement activities, project planning and management, and integrating EMS into operational procedures are tasks that one preform in the Do-stage. Throughout the stage, the organization needs to ensure that the workers have full understanding on energy use, so the organization needs to educate, train and make the workers competent on this subject.

Communicating and documenting is also important after the planning stage, the organization needs to communicate internally on how the energy performance of the organization is, and therefore it will be important to document every requirement, information or plan on paper or an electronic device so that the elements of the EMS is described.

The checking stage of the implementation implies monitoring, measurements, evaluations, internal audits and control of records. For this to work it is important to track progress in time and document every energy consumption and savings. It is this stage of implementing an EMS that is most important, this since everything that is done must undergo huge metric reviews. Further, internal audits are important, this will able the organization to renew plans, requirements, targets etc. so that the organization maintain their goals and objectives for the energy performance.

The final and last stage in the implementation of an EMS by using ISO 50001:2011 is Act, also called management review. The organizations top management will review, at planned intervals, the effectiveness of the EMS. If the top management fined any “poor” information, the energy team will modify these goals and adjust relevant plans. The management review will able continues improvements and will give more opportunities for continuous success in energy savings, consumptions and greenhouse gas emission (ISO 2011a).

3.7.3 Implementation of an EMS using Enova’s “Energiledelse i industrien”

Enova’s guideline, revolve around the same principals as ISO 50001:2011, the main topics are:

- Objectives
- Organization of efforts
- Mapping of energy consumption
- Preparation of an action plan
- Energy management and key indicators
- Evaluation of efforts
- Simple routines

As mentioned earlier, Enova’s guideline have the same basics as ISO 50001:2011, the PDCA approach. So if the organization have success form other management systems before starting the implementation of the EMS, the organization will benefit from this when implementing a new system. As we can see in the figure 3.10 below, Enova’s PDCA approach is much like the implementations stages in the standard ISO 50001:2011, but Enova guidelines are more simplified and have more information on what the organization should do, in each stage.

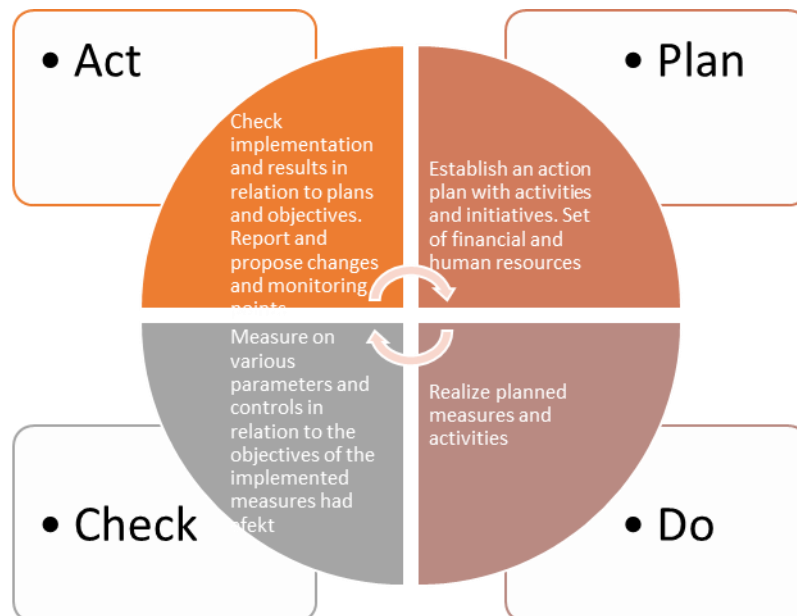


Figure 3.10 – PCDA approach for «Enedringsledelse i industrien», (Enova 2012e)



Energy Management System

«Actions for agile and simple implementation»

- Objectives

In this section, the organizations should energy policies be formulated. Here it is important to formulate what the organization will achieve with their energy work. The actions shall relate to both internal and external parties, with liability on how the organization shall do energy work. The implementing process of the EMS will be most effective when there are established good formulated goals. Such goals can for example be how many kWh/tons energy produced, how many kWh/tons that shall be renewable and how much waste heat that can be recycled.

- Organization of efforts

The organizations effort shall imply what the organization, will their energy work to achieve. Here it will be important to look at both internal and external targets.

The internal targets will first be who is in charge of the EMS. The person chosen shall always peruse good effective solutions and sustainable production for the organization. It will be important that the person chosen have as much experience as possible, and are willing to learn as much possible, related to EMS. It is important that this person have all authority and all needed tools to fulfill all tasks.

Further, there is important to have a personnel group. This can be groups in different areas or a group combined with staff from different areas in the organization. Such group can be combine with, operators, operating personnel and technical department, production and quality managers, and purchasers.

Finally, there will be important to establish a personnel group that will be in charge of work towards the organizations goals. This could be a group combine with, project managers, a representative from the production and a technical manager.



Energy Management System

«Actions for agile and simple implementation»

As Enova say:

“It must be clearly defined what role the management should have. It may be beneficial to have the management represented in the group - alternatively that project manager meets with the top management”.

Further, in this step, it can be beneficial to have external assistance. The reason for this is that the organization do not always have the expertise needed. This can be beneficial both when it comes to energy actions, how to manage the process, and when it comes to the establishment of the EMS.

- Mapping of energy consumption

This step is important to follow when it comes to how the organizations could achieve their goals. To achieve the goals, the organizations need to map their energy consumption. When the mapping of energy consumption is finished, there will be easier for the organization to know where their biggest priority must be. Further, there will be beneficial for the top manager to know where to prioritize. To get as much as possible from such mapping, there is important to be familiar with all production facilities and constructions in the organizations. It is therefore, to see mapping procedure from different angles.

First, it will be important to gather as much information as possible about the production, and see how the energy distribution throughout the organizations building. In addition, energy prices and any other costs needs to be calculated.

As Enova say:

“The first mapping is unlikely to be completely accurate, but through annual repetitions and an ongoing effort to constant improvements a one will achieve stronger insight into your own energy” (Enova 2012e).



Energy Management System

«Actions for agile and simple implementation»

- Preparation of an action plan

The action plan is to help organizations managers to underlie monitoring of the EMS. This plan do not need to be a huge and difficult, it can just be a document that says who is responsible for what, what are the expected costs, etc. and the action plan should always be updated. Enova have made an own template on how to established a functional action plan. In addition, there are seven steps that Enova claim an action plan need.

First, there is important to have status for energy use, here there should a star and end point, for example 20XX-20YY. Then it is important to have key figures for different parameters. This could for example be specific energy use, water consumption, CO₂ consumption, etc. Further, the action plan must have energy consumption and water consumption for previous year, the same goes for the next stage, where there is important to have purpose distribution from the past year. In the two last stages is important to determine which areas that need further work, and which areas the organization need to prioritize. If the organization have this in their action plan, the action plan will be fulfilled, from Enova's standpoint (Enova 2012d).

- Energy management and key indicators

As Enova say:

“Continuous monitoring of energy use is important both to uncover, less appropriate habits, errors in operation, and errors in technical installations”.

Therefore, there would be easier to consider monitoring at two levels, top management and operating level. First at the top management, it is most likely the overall energy consumption from year to year will be defined and monitored. The top management will most likely have experience and overview over these areas. At the operating level, the monitoring will relates to energy in various departments and processes. This could for example be monthly use of energy in kWh.



Energy Management System

«Actions for agile and simple implementation»

- Evaluation of efforts

The evaluation stages is important to follow precisely. This will in long-term benefit the organization. An annual evaluation will give green light for new initiatives and goals; it will also be easier to look forward for further energy work. Here it is most important to give status on, development in energy use, which projects are conducted, results from these projects, further plans for energy efficiency and effectiveness, etc. This will help to submit the management with basis for how to plan and prioritize coming years.

- Simple routines

In this last step, it is important to have some ground routines for the energy work, throughout the years. This will benefit the organization by helping to have focus on energy work. All the stages above (Objectives - Organization of efforts - Mapping of energy consumption - Preparation of an action plan - Energy management and key indicators - Evaluation of efforts), must be maintained continuously throughout the year, for further work towards an excellent EMS. Enova have made a checklist on how to start implementing and continue work throughout the year with EMS. See table 3.2 at the next page on how the checklist is performed (Enova 2012e).



Energy Management System
«Actions for agile and simple implementation»

Checklist - How is the organizations progress in relation to the establishment of EMS?

	Status			Responsible	Deadline
	Yes	No	Partly		
Goals					
Evaluation of the effort, Do you have an Energy policy in place					
Have you defined goals for energy work					
Organizing					
Have you designated an energy responsible					
Is it established energy group					
Is it made an assessment of the extent to which various parts of the staff may have special influence on energy					
Is energy work organized in relation to external and internal stakeholders and it is made of the need for expertise					
Mapping of energy consumption					
Is it conducted an initial survey of energy					
Preparation of energy action plans					
Is it surveyed and analyzed and prioritized possible measures for energy efficiency and conversion					
Is it established an action plan					
Is allocated budget and resources to ensure the realization of the Action Plan					
Are all concerned and relevant parts of the organization familiar with the action plan					
Energy management and benchmark numbers					
Is it established relevant key figures and parameters to follow developments in both energy efficiency as the composition of energy					
Are there established procedures for monitoring and ownership of key figures					
Evaluation of efforts					
Conducts you an annual evaluation and status of energy management system					
Is status note approved by management and followed it up by updated energy policy, objectives, action plan and access to resources also coming years					
Simple routines					
Is it set up meeting schedule for energy group coming years					
Do you place the agenda for team meetings to ensure that energy and priority projects monitored					

Table 3.2 – Checklist for establishment of EMS, (Enova 2012e)



Energy Management System

«Actions for agile and simple implementation»

3.7.4 General challenges with implementation of a management system

Implementing a management system can cause different problems for an organization; however, there are some challenges that are more common than other is. The most common challenge with implementation of a management system is the top management, and the leadership's commitment to the project. The reason for this could be that the top management do not believe in the system, the top management does not get enough information about the system, or there could be too many project in the organization at the same time. Further, managing performance and lack of measurements of the system, is the next major challenging part in an implementation process. When it comes to managing performance, it is important that the organization work towards a framework. The framework should have one master plan, divided into many smaller responsibilities. If the organization do just have one large framework, with no boundaries, there will be difficult to measure the performance of the system.

Lack of measurements is a challenge throughout the whole implementation process. A reason for this could be that the developed of the measurements are poor, since the organization have poor actions to measure. The organization have actions to measure, but there are no relevant measures to the actions. The measurement process needs focus and commitment from every worker in the project for the implementation to go smoothly. This will help the organization to set new and improved actions for further work with the management system (Rajendran 2015).

3.7.5 General challenges with implementation of an EMS

Since the beginning of work towards a clean and environmental friendly world, have efforts towards a sustainable, environmental and energy thinking increased in recent years. In addition, there are many organizations, large and small that have taken the leap of implementing EMS. For this reason, from research throughout the years, there are found some general challenges with implementation of an EMS.



Energy Management System

«Actions for agile and simple implementation»

The most common challenge with implementation of an EMS is that organizations create large manuals on how the implementation process should be. These manuals can be difficult to follow for the organization, since the manuals are of such large scale. Therefore, the manuals have a tendency to become large piles of paper, rather than helpful guidelines.

It is important that every organization, with little or no experience about EMS, get an understanding of what the system is about. ISO mentions in the standard ISO 50001:2011, that educating the employees is important, and that the team that work with the implementation of the system, must be educated. The team must also inform and make sure that the whole organization understands or are educated in the field. The challenge is that organizations lack educated employees, and then the implementation of the system gets harder than it should be (BSI 2013).

From another view, ISO 50001:2011, revolves on the PDCA approach. This works well when organizations that already have systems implemented with the PDCA approach in advanced. For organizations that do not have such systems, or have not used the approach before, it can be confusing when they see the different stages. Organizations can for example believe that “Plan” mean something else than the standard set out for it to be, and then the implementation is done another way than it is supposed to (Parrish 2012).

Another major issue is that there are not good enough support from the top management; the reason for this could be that the focus is located at the wrong area of the organization. This also connected to information of financial and qualitative benefits that an EMS could improve. Another problem can be that the organization have too many systems, there are no place for the EMS, and this can lead the organization to lack belief in the system.

In addition, a regular problem by implementing an EMS is that the organization do not have enough time, in the beginning the organization thinks it have time to proceed, however when it comes to the project, the implementation takes more time and effort than originally thought it would take. This can make the organization to drop or extend the implementation process (Srivastava 2014).



Energy Management System

«Actions for agile and simple implementation»

3.8 Software

3.8.1 General information

When implementing an EMS, there is important to document, monitor and improve energy performance. To be able to have control over every aspect of energy in the organization, there are software that organizations can install, so that monitoring of energy in the organization goes smoothly.

The PDCA approach is used to implement EMS, and within these steps, there are different tasks the organization should consider doing. So when the organization comes to the Checking-step (monitoring, measurement and analysis), the organization can install and use software.

ISO 50001:2011 do not require an organization to use software, however the standard notes:

“Measurement can range from only utility meters for small organizations up to complete monitoring measurement systems connected to a software application capable of consolidating data and delivering automatic analysis. It is up to the organization to determine the means and methods of measurement” (ISO 2011a).

There are many different energy-monitoring systems (software); these are mainly built-up on the standard ISO 50001:2011. The software’s goal is to allow the users better control over their energy and to improve their energy efficiency. Usually such programs have predesigned process patterns, so that the user do not have to go through any specific learning to use the program.

Some benefits by using an energy monitoring system:

- The organization always have the ability to access current and historical data
- The organization could have forward-looking investments for the EMS

The last point is beneficial when it comes to ISO 50001:2011, this since much of the preliminary work is already done (Metrawatt 2014).



Energy Management System

«Actions for agile and simple implementation»

3.9 International, what can Norway learn from other countries

3.9.1 Germany

In Germany there is an own law made to promote production of electricity, using renewable energy sources. This law is called "*The Renewable Energy Sources Act*", or in German "*Erneuerbare Energien Gesetz – EEG*". The purpose of this law is to facilitate sustainable development of energy supply. This will help to reduce greenhouse gas emission, which further will protect the environment. The goals of this law is to provide renewable energy sources in Germany's electricity demand.

"This shall account for:

- *40% to 45% of the share in the gross electricity consumption by 2025*
- *55% to 60% by 2035*
- *80% by 2050".*

In Germany, the government support every organization that will certify ISO 50001:2011. As of 2011, Germany's Federal Government made a promise that every organization who certify after ISO 50001:2011 will get:

"Reduced energy taxes for energy-intensive operations and allowances in accordance with the German Renewable Energy Sources Act will only be granted to companies which can substantiate certification in accordance with ISO 50001:2011".

The government made it mandatory as of 2013, to implement EMS through the "*Integrated Energy and Climate Protection Program (IEKP)*" (Metrawatt 2014). This program set the parameters for a European climate and energy policy. This program include:

"Ambitious climate protection targets, as well as targets for the expansion of renewable energies and increases in energy efficiency. With the key elements of an integrated energy and climate program set out in this document, the German Government is implementing these fundamental European policy decisions at national level by means of a concrete program of measures.



Energy Management System

«Actions for agile and simple implementation»

The guiding principles remain the three objectives of security of supply, economic efficiency and environmental protection”.

This means that Germany will follow EU climate policies, which is security of supply, economic efficiency and environmental protection (Ministry 2007).

Germany also has an EMS guideline, which organizations can follow. This guideline is not much simpler than the standard, but it have more explanations and corrections than the standard. Germany also benefit from using checklists, these checklists are prepared from the guideline, however, this list is much more extensive than Norway’s, Denmark’s and Sweden’s checklists. The checklist is revolve on all points from the implementation process in the standard, i.e. plan, do, check act, and further; energy policy, planning, implementation and operation, review (monitoring, measure and mapping) and management review.

Below in table 3.3 we see an extract of the checklist. Under each point is a number of issues produced, so that organizations can easily see if everything is on schedule under the implementation process.

No.	Required Elements	Implementation Yes/No	Comments
A	Energy policy		
B	Planning		
B.1	Identifying an reviewing energy aspects		
B.2	Legal obligations and other requirements		
B.3	Energy objectives, targets and programs		
C	Implementation and operation		
C.1	Resources, tasks, responsibility and authority		
C.2	Awareness, training and competency		
C.3	Communication		
C.4	Documentation of EMS		
C.5	Control of documents		
C.6	Operational control		



Energy Management System
 «Actions for agile and simple implementation»

D	Review		
D.1	Monitoring and measurement		
D.2	Assessing the compliance with legal obligations		
D.3	Non-compliance, corrective and preventive measures		
D.4	Managing records		
D.5	Internal auditing of EMS		
E	Management review of the EMS		
E.1	General		
E.2	Output of the management review		

Table 3.3 – Summary of checklist from the German implementation guide, (Kahlenborn 2010)

3.9.2 Denmark

In 2001, Denmark was the first country in Europe with an EMS standard, DS 2403:2001. The rest of Europe came along and in 2009, and the European EMS standard EN 16001:2009 were established. In 2011 the standard have changed name to ISO 50001:2011. Denmark claims that ISO 50001:2011 is most suited for large organizations and that for small and medium sized organizations, the standard can be too big. Therefore, Denmark made a simplified guide, which small and medium sized organizations could benefit from, a guideline that further could help with certification of ISO 50001:2011. The name of the guideline is “*Eneregiledelse Light*” (ELL).

The concept of this guideline is to ensure that every organization will have the opportunity to implement an EMS. The guideline will help organizations to measure and have control over their energy use and consumption. In the guideline there are established a detailed list of which focus areas the organizations could or must focus on, these areas are for example lighting, pumps, cooling, IT, vacuum systems, etc. (Styrelsen 2013).

The elements of the ELL guideline is much like the guideline from Enova. The reason for this is that Enova used Denmark’s ELL guideline as a template for their own guideline. The ELL guideline in Denmark is also very similar to the EL guideline that Sweden use. However, the structure is a little different in which stages that comes first.



Energy Management System

«Actions for agile and simple implementation»

The ELL guideline's structure is:

- Organizing
- Organization mapping
- Objectives
- Action plan
- Energy management
- Ongoing improvements

In the ELL guideline, there are also a checklist, this to make it easier for the organization to follow the progress of the implementation. In addition, Denmark made an evaluation key; in Danish, this is called the *“Evalueringsnøgle til energiledelse”*. The evaluation key is developed so that the organization can see how long they have come with implementation of the EMS. It is said that:

“The key can be used when the company starts to build an energy management system and during the process while energy management is established”.

The organization do not need to know everything there is to know about EMS to use the evaluation key; the key is formulated with general known words and concepts that everyone in a corporate world, will understand.

“The key is the energy manager's tool to assess both the starting point and continued progress in the process of establishing an EMS. Although the topic of phased evaluation key is not as detailed as in the ISO standard, the relationship between the individual points are clear”.

In 6 appendix – “Evalueringsnøgle til energiledelse”, one can see the different levels in the evaluation key. It is said that by following the key, the organization ensure the most important elements in the EMS is followed. ELL also use checklists, so that the organization can follow each step of the implementation process as time goes.



Energy Management System

«Actions for agile and simple implementation»

Enova copied the checklist from ELL, so by looking at table 3.2 at the end of chapter 3.7.3 Implementation of an EMS using Enova's "Energiledelse i industrien", we can see how the Danish checklist works (Styrelsen 2010). "Energistyrelsen" in Denmark have also made a consultation draft to the Danish Government, this says that "Energistyrelsen" want to make implementation of EMS mandatory for large organization (TSA 2014).

In addition, since Denmark is an EU country, the efficiency directive from October 2012 should contribute to targets for reducing greenhouse gas emission. This means that the priority is to identify energy savings potentials in the country (Energistyrelsen 2014).

3.9.3 Sweden

Sweden as well as Denmark had the leading role when it came to EMS standards and EMS work in their country. From research throughout the years, there have been proven that companies have seen EMS as beneficial, when it comes to saving money. The Swedish energy agency have made a program called PFE, which stands for "Energy Efficiency in Energy-Intensive Companies".

"The program for energy efficiency in energy-intensive industries (PFE), will help to increase energy efficiency in Swedish energy-intensive companies in the manufacturing industry. The program was initiated with the law on energy efficiency in industry (2004:1196) when Swedish legislation was adapted to the EU Energy Tax Directive. The program allows companies to get tax credit of 0.5 cents/kWh for electricity used in the manufacturing process. The Swedish Energy Agency is the regulatory authority for the program. Tax Agency manages the tax reduction".

For an organization to be a part of this program, there are requirements to certificate the organization to ISO 50001:2011.

"The certification is a requirement to be part of the Program for Energy Efficiency, PFE. The review will be completed during the first two years and further followed-up twice a year.



Energy Management System

«Actions for agile and simple implementation»

Before certification starts, however, the companies do a thorough survey and analysis of energy use in their own company. This applies also to show how to concretely intends to save energy and how to put their goals” (Kåberger 2014).

In Sweden, there are currently no state requirements for implementation or certification of an EMS. However, if an organization choose to be a part of some program, there are different requirements set. Sweden do have an energy audit support that will work in various ways, so that the start of implementing EMS will be more relevant. Further, for small and medium organizations there have also been developed tools for introducing a simplified EMS, for example “*Energi Light*” (EL). EL have made a simplified EMS guideline that can serve organizations a gateway, for later to be certified according to the ISO 50001:2011 standard. In addition, EL will support any organization that do not have the resources to continue certified EMS work, this with tools that can help the organization to keep track on their energy consumption. The EL guideline is a self-study approach on how to get right basic information on EMS, and to gain the organization insight on how an EMS work (EnergiNorge 2010).

Sweden have also made an simplified implementation template for EMS called “*Stegvist införande av systematiskt energiarbete*”, this template works through three levels, for level 1 and 2, there are simple checklists to tick before the organization can start with the next level. See tables 3.4 and 3.5 on the next page.

Level 1 called “*Start-up and implementation of systematically energy work*”, contains:

- Start from the existing organization
- Appoint an energy manager
- Develop an energy policy
- Map out energy and produce an action list
- Set goals for work
- Develop an action plan for measures to be implemented
- Follow up energy and develop key Involve employees
- Follow up the work carried out



Energy Management System

«Actions for agile and simple implementation»

Checklist level 1	Tick
We have appointed an energy manager	
We have an energy policy	
We have done an energy audit	
We have produced energy targets and action plan	
We have developed key performance indicators and monitor our energy use	
We have involved our employees	
We follow up and evaluate the work carried out	

Table 3.4 – Checklist for level 1 in Swedish guide for simple implementation, (Nilsson 2014)

Level 2 called “Developing energy work to the entire organization”, contains:

- Develop Energy Organization
- Developing energy monitoring and energy audit
- Energy Patrolling
- Training and internal communication
- Internal audit

Checklist level 2	Tick
We fulfill all stages of Level 1	
We have a complete organization for the energy work (formed an energy group)	
We have integrated energy issue in current operations (purchasing, engineering, economy, environment and quality)	
We have implemented staff training	
We have clear routines for how we communicate energy issue	
We have appointed an internal auditor and have a plan to hold annual internal audit	

Table 3.5 – Checklist for level 2 in Swedish guide for simple implementation, (Nilsson 2014)

Level 3 called “Introduce and certify an energy management system”, contains:

- So held the work alive
- Committed management
- Clear goals and strategies
- Dedicated organization
- Continuity of operations
- Simple system for information and control
- Financing
- Coverage of new technology
- Systematic monitoring and evaluation (Nilsson 2014)



Energy Management System

«Actions for agile and simple implementation»

The energy politics in Sweden consists with EU goals for sustainability, competitiveness and security of support. This means that Sweden will reduce their dependence on oil and increase their energy supply. To achieve these goals, Sweden will continue their work with what they call the electricity certificate system.

“An electricity certificate is an electronic proof that it has been produced 1000 kWh renewable electricity”.

To ensure the production of renewable energy, Norway and Sweden signed an agreement that they would have a common market for electricity certificates. This agreement came to affect in 2012. The meaning of this agreement is:

“To help increase renewable energy production from water, wind and biofuels. By 2020, the scheme trigger a total annual production of 26.4 TWh in Norway and Sweden, which equals about 10% of current consumption in the two countries.

The scheme works in practice that the support to development of increased renewable production capacity is collected through power bill” (EnergiNorge 2013).

Sweden are also willing to increase their wind power, solar, biogas and other renewable fuels, and use tax relief on CO₂ emission and emissions trading to overcome the goals EU have set for 2050 (EnergiNorge 2010).

4 Case

4.1 Intro

This chapter present the thesis case, Brynild Gruppen (BG). Furthermore, general knowledge on BG, their organizational structure and work methods. In addition, the results from the two interview rounds is presented.

4.2 Brynild Gruppen

4.2.1 Background

Brynild Gruppen (BG) is one of Norway's largest family owned Brand Company with roots dating back to 1895. The organizations activities are primarily related to brand development, sales and production in the categories of nuts / snacks and sweets. The most well-known brands include Little Nut Factory, Dent, Minde Chocolate and Supermix, all owned by BG. BG also has a cooperation agreement with the German company Beiersdorf for sales and distribution, among Nivea products on the Norwegian market. BG is a small company with approximately 225 employees, and turnover around 680 million NOK a year, their main market is in Norway, Sweden, Denmark and Finland. BG's headquarter and production facilities are placed in Fredrikstad municipality and approximately 30 min north of Fredrikstad in Moss municipality their main warehouse are placed. Underneath picture 4.1 shows, BG's headquarter in Fredrikstad.



Picture 4.1 – Overview of Brynild Gruppen AS in Fredrikstad, Norway (Brynild 2014)



Energy Management System

«Actions for agile and simple implementation»

BG's vision is to create joy, through taste sensations for all people, young or old. Their business model presents profitable growth in brands and targeted innovation supplying the Nordic market, with candy and snacks. BG's main assets are value creation and team spirit.

BG also have quality and environmental policies, and aims that products will satisfy customers with requirements from the government that their products will have good quality, not damage the environment and be safe for everyone. This revolves around using clean and effective processes. BG also aims to make all packaging marked with recycle symbols, so that their customers are able to contribute to recycle their packages (Brynild 2014).

The main reason for implementation of EMS at BG is to save the companies costs, this in form of the energy consumptions costs. By implementing energy management, the goal is to get an overview of the consumptions so that there is possible to come up with new and cost effective methods to improve energy use. An introduction of energy is important to develop, due to cost control for the organization, this will in long-term increase the environmental awareness.

4.2.2 Organization structure

As we can see from the organizations hierarchy figure 4.1 below, BG have divisionalised structure, but they are also an organization with mechanical work methods. This means that for the most part there are no room for flexibility, which means that BG's organization structure are stable. Moreover, this means that there are clear tasks and work assignments, the top management have the most education and experience in relation to the ground workers.

The work methods at BG is matrix, this means that the organization have divisions in their hierarchy. As we can see, there are one division for supply, one for sales, one for maintenance and one for finance. This means that the divisions work with their own tasks and assignments, while another with their tasks and assignments. The matrix form makes it easier for the divisions to switch between projects, tasks and assignments; this can make the organization structure a little flexible.



Energy Management System *«Actions for agile and simple implementation»*

Further, this divisionalised structure has the ability to respond quickly without any damage to tasks, assignments or any projects, horizontal relationships have equal attention as vertical. The divisional structure have many structures that are used, AD-hoc, simple structure, machine bureaucracy and labor bureaucracy are examples. The main work performed in the structure are in different quality controlled departments; however, the strategic apex have most responsible of managing these.

Furthermore, BG uses line responsibility. This work method works well in an organization that is slightly smaller than other is. The whole concept of such work method is that the responsibility works throughout the whole organization. The ground workers is responsible for what happens in their department (production plant, maintenance, etc.) and the top management, they are responsible for what goes on in their department.

However, if there is something going on the “ground floor” that the ground workers cannot take care of, they must contact the leaders above them. If these leaders cannot take responsibility of the problem, they must contact the leaders above them. Finally, when the "problem" is too large that no one can do something about it, it ends up with the CEO. The CEO of the organization has the overall responsibility, and ultimately take all decisions in the organization.



Energy Management System

«Actions for agile and simple implementation»

Underneath we can see the hierarchy over BG.

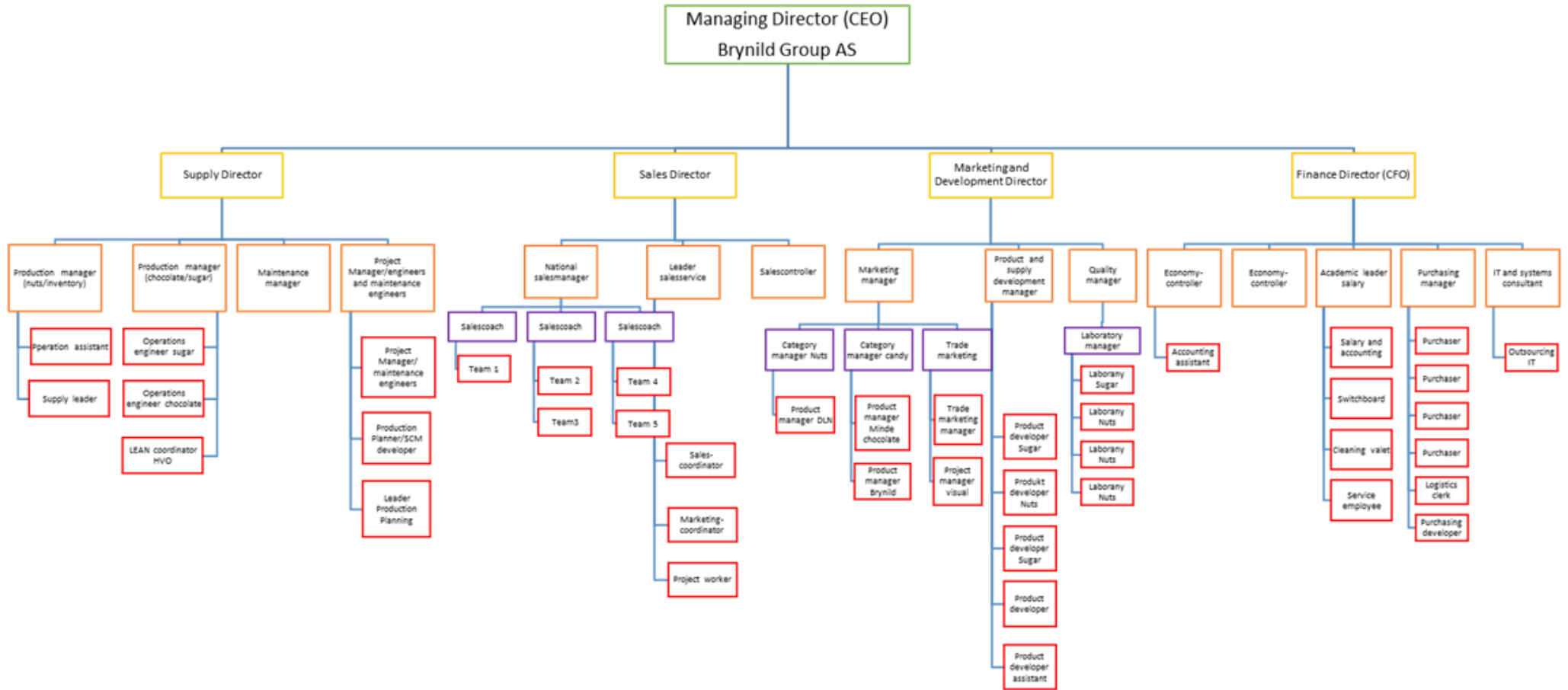


Figure 4.1 – Hierarchy for BG, organization structure, made by author



4.3 Interviews at BG

4.3.1 General information of the interviews

As mentioned earlier, in the thesis there has been conducted a survey by interviews and supplementary methods such as telephone and e-mail with key people within the EMS implementation process at BG. Respondents were mainly from BG, however, it was important to interview a consultant of the topic and that also works with guiding BG through the implementation process. Below is a summary of the individual interviews with important answers. It has been important to keep every respondent anonymous from the interview agreement and informed consent document, 3 Appendix – Informed consent (for interviews).

The first interview round has been difficult to present, because the questions were made early in the thesis, and this can affect the questions importance. Nevertheless, the interviews are presented separately. All interviews are presented in 4 Appendix – Interview round one.

For interview round two, there are just two of the most important persons in the project at BG, which is interviewed. As in the first round, the respondents are anonymous. Furthermore, the respondents are interviewed together; answers from this interview round are presented as a complete text. The interview are presented in 5 Appendix – Interview round two. There also been conducted some new questions through e-mail correspondence with BG's consultant, this is presented with the answers from the first interview round with the consultant.



Energy Management System

«Actions for agile and simple implementation»

4.4 Results from interview round one

4.4.1 Interview with EC from COWI

EC work at COWI Fredrikstad and as an external advisor for BG when it comes to application and guidance throughout the implementation process of EMS. When it comes to knowledge on energy management EC is well aware of ISO standards that underlies different management systems, like ISO 9001, ISO 50001 and ISO 14001.

Furthermore, EC claims that it is important to have such system in an organization, this since an EMS will ensure continuous focus on energy consumption and contribute to continuous improvement within the field energy, in an organization. EC claims that a management system will “live its own life” regardless if employees leave the organization or the organization is reorganized.

Regarding data collection and software implementation, EC says that there is important to have software that always stores and collect information of the energy consumption in the organization. EC claims that energy data is centrally located in monitoring and evaluation of energy measures, and that collection of energy consumption is seen effective in other studies. Further, data is important if the organization want to analyze possible improvements of their EMS.

4.4.2 Interview with SD from BG

SD has worked at BG since 2008, SD are the person with main control over the implementation project at BG. From earlier, SD has some experience with EMS, SD attended from operations, the implementation of EMS at the Norwegian Forest Saugbrugs in 2005. In addition, SD has great experience concerning ISO standards, and with BRC standards.

Regarding data collection SD thinks that the use of software will enable historical energy consumption at various locations in the organization. This will make it easier to analyze, visualize and raise awareness of where to establish different alarms, gauges, etc. throughout the organization.



Energy Management System

«Actions for agile and simple implementation»

4.4.3 Interview with MM from BG

MM has worked at BG for about nine years and has a background from among other Bama and Mills. When it comes to knowledge on EMS, this is the first implementation MM has been involved. In addition, MM's knowledge revolve around information from BG's project. ISO standards is something MM has little experience with, however BRC standards are to MM recollection.

When it comes to software, MM will get access to most of the system, so that MM could measure and possibly come up with new and improved actions to follow, after implementation of the system. Further, MM believe that with EMS will BG easier get an overview of energy consumption, quantities, temperatures, humidity and pressure at their plant. When energy is measured, it will be easy to registered deviation and then make new and improved adjustments.

4.4.4 Interview with PM from BG

PM has been working at BG in seventeen years, PM's daily tasks is monitoring of operations, personnel and improvement projects. PM has no experience with EMS, however, there has been learned some elements from the start of the project at BG.

PM believe that implementation of software will be helpful when it comes to the daily control of the energy use and consumption, and that the data collected can be basis for improvements and to measure the effect of actions made at BG. Further, PM explain that BG have data today, but it takes time to collect it.



Energy Management System

«Actions for agile and simple implementation»

4.5 Results from interview round two

4.5.1 Mapping of EMS at BG

BG is a company that have great relationship whit the term sustainability, and there are several measures BG do to be sustainable. Some examples of this is that BG use UTZ labeling, which means that the health of cocoa workers are to consideration, further they have reduced the number of articles with palm oil, over 90% of BG's production have stopped using palm oil, and BG works to eliminate the few remaining production areas still using palm oil in the organization. BG utilize local produced rapeseed oil instead of palm oil. The usage of rapeseed oil is to make their products healthier in consideration for their consumers. In addition, cleans BG all wastewater to clean water, and BG have adopted good routines for recycling. In one way or another BG are an organization that think sustainability for production, health, environment and much more.

When it comes to renewable energy BG use for the most part clean electricity, this electricity comes from Norwegian hydropower, which stands for approximately 70% of the electricity at BG, however there are some oil and propane use. BG have also worked the last couple of years with energy efficiency projects, and now the EMS project. It was the summer of 2014, which BG started the implement process of the EMS. BG made a goal to be finished implemented by June 2015, this were too excessive and BG needed to change this to December 2015.

As a small organization do BG follow the Norwegian climate targets as much as BG possibly can, this is one of the reasons for why BG implements EMS. Further, BG have full understanding and control over the Norwegian Environmental legislation act, this act consider BG highly and follow through every point.

For BG to be able to implement EMS they need as much help as possible, the goal for BG have always been to get support from Enova, and for appliance, BG contacted the consultant company COWI in Fredrikstad. BG have also set aside 3 M NOK as budget for this project, in addition to this, they have hired personnel resources, from COWI and Pöyry.



Energy Management System

«Actions for agile and simple implementation»

The energy consultant from COWI is set to help BG in every step of the implementation; and the first step is to write the application that Enova need, to support whit the implementing of EMS at BG. Further, the energy consultant will help BG with their organizational and technical documentation site in the implementation of the EMS. BG have also contacted Pöyry for help with installation of fiber-cables, hardware, monitors and software. All these equipment are to help BG get the best overview as possible of their energy consumption. The implementation of monitors and fiber-cables started in week 27, 2015.

For implementation of an EMS is it important to have knowledge on how the system could be implemented. The management system BG follows is ISO 9001:2008. BG were certified to this standard for several years, however, for about two years ago BG decided not to certify anymore, since it were too expensive to revise. BG are now certified through the BRC standard ¹ which BG think is a more relevant standard for them to follow. In addition, even if BG is not certified to ISO 9001:2008, they still follow the standards structure and routines.

BG have not defined concrete goals for their energy work and energy politics yet, the reason for this, BG claims is because there is important to know the level of targets before they could set specific goals, and the work with finding every target are not yet finished. However, the top management have set ground targets, which say that BG want to achieve an energy reduction in the organization with approximately 5% yearly.

BG have also established a meeting agenda that indicates that the top management should meet three times a year, for evaluation of the EMS function at the organization. BG will when the time is right produce agendas that shall ensure that energy and priority projects are monitored and evaluated.

¹ BRC standard – “BRC Global Standards is a leading safety and quality certification program. BRC shall ensure that Brynild Group own products satisfy their consumers and retailers requirements for food safety and product quality is stable and predictable” (BRC 2014).

Energy Management System

«Actions for agile and simple implementation»

BG have not designated an energy responsible and an energy team to work with the implementation of the EMS, however BG have chosen to implement EMS through line responsibility. BG claims that the reason for this is since they are a small organization. Nevertheless, BG have a department in the organization that follows and works with the EMS throughout the implementation project. Underneath figure 4.2 illustrates this.

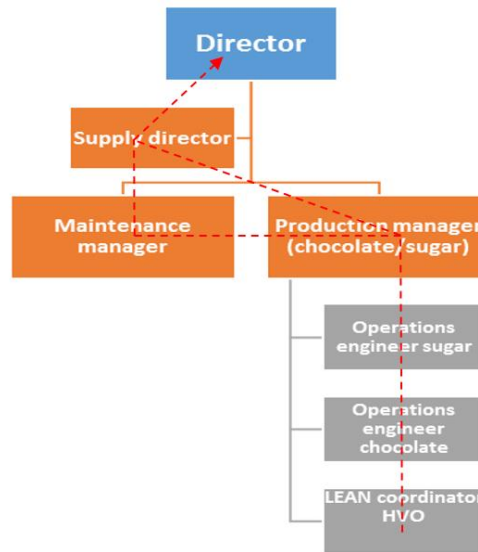


Figure 4.2 – Line distribution at BG, EMS responsible, made by author

To implement EMS, BG have decided that they are going to follow Enova’s guideline with regulations and demands from COWI, to get the implementation as perfect as possible. BG will not certify to ISO 50001:2011 *Energy Management System*, however BG will get an overview of the ISO 50001:2011 standard, since Enova uses this standard as guideline for their own guide. Since the project has not come so far, everyone in the organization do not know as much about the project. However, as the project go on, BG is aware of that all workers need to be informed about the EMS project, and BG have plans to do this gradually.

Furthermore, BG have not mapped their energy consumption, but with installation of gauges and other supply, the energy consumption will be measured as quickly as possible. The action plan is not established, but BG have started working with the plan and is probably done by fall. Benchmarking and establishment of routines are BG working on now.



5 Discussion

5.1 System for EMS in Norwegian companies as BG

Knowledge of the IPCC conclusions and Norway's climate policy helps create greater understanding of the need for EMS in Norwegian organizations. A significant part of greenhouse gas emissions nationally as well as globally, are related to the use of energy. Comprehensive prioritization of energy efficiency and increased supply of renewable energy is necessary to make transition to a low emission society.

Introduction of the system EMS in an organization is not a goal in itself. The purpose is to ensure anchoring of awareness of energy and energy consumption in daily work in an organization. Central will be to focus on energy consumption with a view to continuously reduce this, while maintaining achieved improvements. For the organization, this can lead to significantly reduced costs of energy.

The ISO standard for EMS has largely focused on sustainable development and from autumn 2015, ISO 9001:2008 and ISO 14001:2004 changes in accordance with this.

5.1.1 BG's relation to Norwegian and international goals of sustainability and climate

Although BG in Norwegian and international context has a relatively modest consumption of energy, BG care about sustainability and climate. The organization has knowledge and attitudes to the necessity of sustainable production, related to both raw materials as well as finished goods.

Findings from this study shows that the organization "think globally and act locally", but also internationally.



Energy Management System

«Actions for agile and simple implementation»

BG is particularly concerned about:

- Cocoa cultivation with UTZ label and in connection with workers' health
- Sustainable production in Mozambique of cashew nuts that are part of BG's production
- Strong reduction in the number of articles where unsustainable palm oil is contained; transition to unsustainable palm oil on the remaining articles while working with completely eliminating the use of palm oil
- To set standards for suppliers
- Primarily uses renewable energy in the form of electricity from hydropower

BG have also implemented energy efficiency projects past years, while now introducing EMS in the organization with assistance from an external consultant.

5.1.2 *BG's relation to legal environmental requirements*

The organization has knowledge of and follow up legal environmental requirements by including:

- To clean all drains to water
- Procedures for recycling
- Use of sustainable locally produced rapeseed oil to replace unsustainable palm oil
- Continuous improvement of logistics scheme
- Commitment to HSE for employees

Knowledge of Norwegian environmental legislation will be contribution to increased understanding of sustainable production and contribute to attitudes, which increases the importance of the establishment of management systems such as ISO 50001:2011 and ISO 14001:2004.

5.1.3 *Saved energy costs for BG*

For the organization are reduced energy costs a significant incentive for the introduction of the EMS. BG envisages a gradual saving for each year ahead.



Energy Management System

«Actions for agile and simple implementation»

5.2 The implementation of EMS at BG

BG is immersed in a process related to the implementation of an EMS from which they get assistance from an external consultant. The organization works according to the following schedule:

- Installation and programming through week 27
- Test period from the summer onwards
- Consumer groups and testing for summer
- Reporting to Enova takes place in parallel and will be completed 31.12.2015
- BG will continue working on expansion of the system also in 2016

BG builds its system on Enova's guideline that again revolve on ISO 50001:2011. In the following, it is examined how BG stands in relation to the implementation process as this is formed in Enova's guideline:

- Objectives for BG

Enova assumes that a corporate energy policy, should formulate what has to be done during accomplishment with the energy work, and that an objective must be linked to internal organization goals as well as obligations to external parties

BG have formulated an overall goal of reducing energy consumption by 5% annually. The organization have also as seen under section 5.1.1 BG's relation to Norwegian and international goals of sustainability and climate, objectives that are linked to the suppliers/producers of goods and services, including the organizations production system. The goals regarding EMS will become part of the management review as part of the quality system.



Energy Management System

«Actions for agile and simple implementation»

- Organization of efforts

A project owner with support from consulting firm COWI, and with BG's own project manager, organizes the project of establishing and implementing EMS. In addition, relevant personnel are involved. BG plans to use line responsibility to replace the use of an energy hunter. Due to the organizations size one does not form an energy team.

At BG, it is envisaged that the managing director has the overall responsibility. BG will establish a defined energy group outside the line, which will report to the supply director. Enova's guideline envisage the choice of energy hunter versus line responsibility. The work related to reducing energy costs will initially comprise the whole organization. The management will be able to see the more overarching lines where potential for reduction is located. If an organization as BG choose line responsibility, it is possible to involve more employees and assign responsibility to these in relation to the rational use of energy. Through an EMS, energy consumption is reported equally, like other key parameters in the organization.

As noted has BG engaged external experts for the best possible implementation of the EMS. The selected experts have high competence and experience from similar projects.

- Mapping of energy consumption and preparation of energy action plan

To follow up energy work, energy consumption has to be mapped. An examination of energy consumption will show how the organization can most effectively align efforts with respect to reduction in energy. In such assessment, we have especially focused on how energy is distributed, as well as energy prices and taxes for calculation of costs.

Among other, the following will be central:

- Type of energy: electricity, oil, biofuel, district heating
- Manufacturing or related construction
- Lighting, heating, cooling etc.
- Variations throughout the day, power-tops etc.



Energy Management System

«Actions for agile and simple implementation»

An energy action plan is assumed to be dynamic and have continuous development. The action plan will be a key tool for the energy work in any organization. BG is now working with consumers of energy within the organization, and necessary gauges is being installed.

At BG mapping of energy consumption will be ready after implementation of the monitoring system is completed and functional. Furthermore, completed action plan with indications of what the individual will focus on and what actions to be performed, is assumed to be completed autumn 2015.

- Energy management and key indicators

In an EMS is assumed that both managers as well as operator follow up key figures. Enova's guideline points out that an energy monitoring system (software) can be a good tool that one can evaluate to be implemented in the organization.

BG is in the process of designating a responsible for the individual key figures at the organization, and also establish procedures for follow-ups of mapping the energy consumption.

- Evaluation of efforts

The guideline from Enova intends to a periodic evaluation of energy work for the organization. This in view of which efforts have been made and which commitment shall take place in the future. Here it is possible to come up with new initiatives and goals for future work.

BG envisages to evaluation of and status for their EMS in what they call the management review, which shall take place three times per year.



Energy Management System

«Actions for agile and simple implementation»

- Simple routines

In EMS, goals, organization, mapping, action, energy control and evaluation is included. These points are assumed taken care of continuously throughout the EMS work. Enova proposes in their guideline that, in a governing document there is defined annual routines, responsibilities and procedures relating to supervision of energy and financial ratios to be described.

BG stipulates that implementation of energy consumption and priority projects become part of the regular performance management/scorecard assigned meeting structure.

5.2.1 Summary of the status of the implementation of energy management in BG

BG follows mainly the program for establishing and implementing EMS as described in Enova guideline “*Energiledelse i industrien*”. BG have a progress plan for their work with the implementation of the EMS that appears to be realistic. Based on the organizations size and view of how they are organized, stands choice of manager and members in the energy group and use of energy hunter as appropriate.

5.2.2 Success factors for BG

The organizations management take social responsibility in relation to climate change and sustainable development, environmental requirements of the legislation, and working actively to follow this up. Management's involvement helps to create attitudes across the organization.

BG have a management system based on ISO 9001:2008 and even though they no longer maintain certification, the organization follow the standard. BG considers BRC standard as more relevant for them now and the management system at BG works well. The organization's management is thus well-trimmed in relation to planning, implementation, control and monitoring. This in itself facilitates the process of introducing EMS.

The new system relating to energy are good grounded at the top management and will be followed up by this management. The new point for BG will be to establish energy on the management's agenda.



Energy Management System

«Actions for agile and simple implementation»

BG have made provisions of both personal as financial resources for the EMS project, including engagement of external expertise. BG have established a project organization with clear distribution of roles and with a good time- and activity plan.

BG has engaged qualified external expertise.

The employees of the organization will be informed and will be involved in further establishment, implementation and operation of the system. This will ensure that more employees get ownership of the system.



Energy Management System

«Actions for agile and simple implementation»

5.3 Will implementation of an EMS in an industrial company as BG affect an organization's energy costs-, consumptions and greenhouse gas emission?

An EMS system assumes that the organization must establish joint concrete objectives for energy use. These objectives revolve on mapping of energy consumption in the organization. Following up on reaching objectives are again dependent upon continuously monitoring the impact of measures that are implemented. Enova's guideline points out that software may be an appropriate tool for this, while emphasizing that if we are to achieve the objectives of reducing energy consumption, then we must have the ability to take action, follow up and have continuity in the energy work.

BG is in a process of analysis and preparation of goals. It has also been established a software implementation. The organization has set an overall target of 5% reduction in energy consumption per. year. This goal appears to be realistic. A reduction in energy consumption in accordance with the organization's overall goals will correspondingly result in reduction of the organization's energy costs.

The organization uses to a large extent renewable energy so that emissions from the organization itself is slightly affected of the reduction. However, reduced energy associated with renewable energy, leads to use of renewable energy for other purposes and to replace non-renewable energy sources such oil and propane in the organization and elsewhere in Norway. A reduced energy consumption in BG will thus contribute to reducing greenhouse gases.



Energy Management System

«Actions for agile and simple implementation»

5.4 Norway could consider

There have been research three countries in this thesis, all countries are EU members, however, there are some differences between them, and Norway can learn or take advantage from these countries when it comes to how Norway could implement EMS.

- Use of economic instruments such as tax relief for companies that introduce EMS

Research that has been done show that Germany, Denmark and Sweden have tax relief for organizations that certify their organization to ISO 50001:2011. In Sweden to get tax relief organizations needs to follow the PFE program and certify the organization to ISO 50001:2011.

- Legislations related to the use of renewable energy

Germany have the law called "*The Renewable Energy Sources Act*", which implies to promote production of electricity using renewable energy sources.

- Increased use of checklists

Germany benefits the usage of checklists, their checklist revolves on all points that the implementation process possess, and in addition, Germany's checklist are more excessive than other countries. Denmark uses the ELL guideline checklist, which also follows the implementation process of EMS. But in addition Denmark have an own evaluation key "*Evalueringsnøgelen*", that like an checklist will help the organization to get complete overview of what the organization have done, need to do, etc.

In Sweden, there are made a simplified implementation template for EMS, the "*Stegvist införande av systematiskt energiarbete*", this works through three levels, this is different from the other countries checklists. The template is divided into three levels, and after the two first levels, there are a small checklist that needs to be filled out, so that the organization can continue with the implementation.



6 Conclusion

Thesis research question:

“What actions are required to enable for an agile and simple implementation of an energy management system?”

The thesis concludes with following required actions, for how to achieve an agile and simple implementation of an energy management system:

- The organization represents knowledge and attitudes that leads to social responsibility in relation to climate change and sustainable development
- Viewing an economic potential for own organization including a better climate account
- Have full support from top management
- Have a well-functioning management system to build on
- Allocate sufficient time for the implementation of the system
- Allocate sufficient resources; personnel and economy
- Ensure that employees are given ownership of the system
- Use of manuals/guidelines with checklists



Energy Management System

«Actions for agile and simple implementation»

7 Future work

Future work can focus on if an organization as BG with same goals and objectives succeed to reduce their costs and energy consumption after implementation of an EMS?

Furthermore, there will be interesting to see if the level of knowledge among workers changes after implementation of an EMS, and if an organization as BG manage to follow the system at all time and pursue monitoring and mapping of energy and further set new goals to reach.



8 Bibliography

Books

Arbnor, I. a. B., B, (2008) *Methodology for creating business knowledge*. Third ed. SAGE Publications Ltd

Capehart, L. B., Turner, W. C., Kennedy, W. J., (2006) *Guide to Energy Management*. Five ed. The Fairmont Press.

Grønmo, S., Holter, H., Kalleberg, R (1996) *Kvalitative metoder i samfunnsforskning*: Universitetsforlagets Metodebibliotek.

Jackobsen, D. I. (2012) *Organisasjonsendringer og endringsledelse*. Fagbokforlaget

Kresse, W., Fadaie, K. (2004) *ISO Standards for Geographic Information*. Springer- Verlag Berlin Heidelberg.

Miljøvernlovgivning (2010) *Norges Lover*. Fagbokforlaget.

Turner, W. C. (2007) *Energy Management Handbook - Sixth Edition*. Library of Congress Cataloging-in-Publication Data.

Standards

ISO (2004) *ISO 14001:2004 Environmental management systems - Requirements with guidance for use*: Standard Norge.

ISO (2008) *ISO 9001:2008 Quality management systems - Requirements*: Standard Norge.

ISO (2011a) *ISO 50001:2011 Energy management systems - Requirements with guidance for use* Standard Norge.

Internet

BRC (2014) *Welcome to BRC Global Standards* [online]. BRC Global Standards. URL: <http://www.brcglobalstandards.com/Home.aspx>.

Brynild (2014) *Hvem er vi?* [online]. URL: <http://www.brynildgruppen.no/om-oss/hvem-er-vi>.

BSI (2013) *ISO 50001 Energy Management Systems Implementation Case Study London South Bank University* [online]. London South Bank University. URL: http://shop.bsigroup.com/upload/BSOL/Case-study/BSI50001CaseStudyLondonSouthbankUni_AW.pdf.

Commission, E. (2015) *2030 framework for climate and energy policies* [online]. European Commission. URL: http://ec.europa.eu/clima/policies/2030/index_en.htm



Energy Management System

«Actions for agile and simple implementation»

DNV (2011) *Endrede ISO-standarder setter fokus på bærekraftig utvikling* [online]. DNV-GL. URL: <http://www.dnvba.com/no/sertifisering/systemsertifisering/Pages/nytt-om-iso-standarder-2015.aspx>

DNV (2013) *Endringer i ISO standarder* [online]. DNV-GL. URL: <http://www.dnvba.com/no/DNV%20%20Downloads/Endringer%20i%20ISO-standarder-presentasjon.pdf>

Eivind, J. (2014) *Fornybar Energi* [online]. Wikipedia. URL: http://no.wikipedia.org/wiki/Fornybar_energi.

EnergiNorge (2010) *EUs fornybardirektiv og nasjonale handlingsplaner - Sverige* [online]. energinorge.no. URL: <http://www.energinorge.no/nyheter-internasjonale-energisaker/eus-fornybardirektiv-og-nasjonale-handlingsplaner-sverige-article8046-441.html>

EnergiNorge (2013) *Elsertifikater: Spørsmål og svar* [online]. energinorge.no. URL: <http://www.energinorge.no/temaer/elsertifikater/elsertifikater-spoersmlaa-og-svar-article8863-599.html>

Energistyrelsen (2014) *Energisyn i store virksomheder* [online]. URL: http://www.ens.dk/sites/ens.dk/files/forbrug-besparelser/EE_ny_web/faktaark/energisyn_i_store_virksomheder_dk.pdf.

Enova (2012a) *Energiledelse* [online]. enova. URL: <http://www.enova.no/radgivning/naring/praktiske-ressurser/energiledelse/418/0/>.

Enova (2012b) *Kort om Enovas formål og rammer* [online]. enova. URL: <http://www.enova.no/om-enova/36/0/>

Enova (2012c) *Potensial- og barrierestudie, Energieffektivisering i norske bygg* [online]. enova. URL: http://www.enova.no/upload_images/A319D657AFC34028B18D5C74BA4F0094.pdf

Enova (2012d) *Veileder, Energihandlingsplan* [online]. enova. URL: http://www.enova.no/upload_images/A46723ACE2C543588952C92931E34C63.pdf

Enova (2012e) *Veileder, Energiledelse i Industrien* [online]. enova. URL: http://www.enova.no/upload_images/E9C369B5C52A4340955BAC25A1B69F22.pdf

FN (2012) *Hva er bærekraftig utvikling?* [online]. FN-SAMBANDET. URL: <http://www.fn.no/Tema/Baerekraftig-utvikling/Hva-er-baerekraftig-utvikling>.

Fossendeliv (2014) *ISO 50001* [online]. Fossendeliv.com. URL: <http://fossendeliv.com/informasjon/iso-50001.php>



Energy Management System

«Actions for agile and simple implementation»

Helseth, S. (2010) *Innføring i kvalitativ/kvantitativ metode* [online] HIO - Høgskolen i Oslo. URL: http://www.su.hio.no/sufag/forelesninger/kval_kvant.ppt

Hermansen, E. (2014) *FN Klimapanel* [online]. Cicero. URL: <http://cicero.uio.no/no>.

Houssin, D. (2013) *Energy Efficiency: Accelerating uptake of energyefficiency practices* [online]. International Energy Agency. URL: http://www.iea.org/media/protected/g20/ESWG_energy_efficiency.pdf.

ISO-sertifisering (2015) *ISO-sertifisering* [online]. ISO-sertifisering.no. URL: <http://www.isosertifisering.no/>

ISO (2011b) *Win the energy challenge with ISO 50001* [online]. ISO Central Secretariat. URL: www.iso.org/iso/iso_50001_energy.pdf.

ISO (2012) *ISO Guide 72:2001 Guidelines for the justification and development of management system standards* [online]. ISO. URL: http://www.iso.org/iso/catalogue_detail?csnumber=34142.

ISO (2013) *Management system standards* [online]. ISO. URL: <http://www.iso.org/iso/home/standards/management-standards.htm>

ISO (2015a) *ISO Standards* [online]. ISO. URL: http://www.iso.org/iso/home/faqs/faqs_standards.htm

ISO (2015b) *World distribution of ISO 50001 certificates* [online]. ISO. URL: <http://www.iso.org/iso/home/standards/certification/iso-survey.htm?certificate=ISO%2050001&countrycode=NO#standardpick>.

Kahlenborn, K., Klein, Richter, Schürmann (2010) *DIN EN 16001: Energy Management Systems in Practice - A Guide for Companies and Organisations* [online]. Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU). URL: <https://www.umweltbundesamt.de/sites/.../3959.pdf>.

Kiland, I. H. (2012) *Hva er et styringssystem?* [online]. Direktoratet for forvaltning og IKT. URL: <http://www.difi.no/sites/difino/files/2012.04.12-styringssystem-og-iso27001-og-02-ved-ingvild-kiland.pdf>

Kåberger (2014) *Energiledningssystem – ett verktyg för ständig förbättring av energiarbetet* [online]. Energimyndigheten. URL: <https://www.energimyndigheten.se/.../energiledning/>.

Lawrence, E. O. (2015) *What is energy efficiency?* [online]. Lawrence Berkeley National Laboratory. URL: <http://eetd.lbl.gov/ee/ee-1.html>.



Energy Management System

«Actions for agile and simple implementation»

LTD., T. U. (2014) *ISO 50001 (EnMS) Energy Management Systems* [online]. TÜV. URL: http://www.tuv-uk.com/cps/rde/xbcr/SID-A25B9185-102594DE/tng_uk/iso-50001-guide-and-check-list-uk.pdf

Malt, U. (2009) *Strukturert intervju* [online]. Store Norske Leksikon. URL: http://sml.snl.no/strukturert_intervju

McKane, A. (2010) *Thinking Globally: How ISO 50001 - Energy Management can make industrial energy efficiency standard practice* [online]. Lawrence Berkeley National Laboratory. URL: <http://escholarship.org/uc/item/92d8q553>.

Metrawatt, G. (2014) *Energy Management Systems - ISO 50001* [online]. Gossen Metrawatt. URL: <https://www.gossenmetrawatt.com/english/seiten/energymanagementsystems-iso50001.htm>.

Ministry, F. (2007) *Key Elements of an Integrated Energy and Climate Programme* [online]. URL: http://www.bmub.bund.de/fileadmin/bmu-import/files/english/pdf/application/pdf/klimapaket_aug2007_en.pdf

nepas (2007) *Trinnvis veiledning til iverksetting av energiledelse* [online]. Nepas. URL: http://www.nepas.no/Filer/Referanser/BESS_Handbok_energiledelse_NO.pdf

Nilsson (2014) *Stegvist införande av systematiskt energiarbete* [online]. Statens energimyndighet. URL: <https://energimyndigheten.a-w2m.se/.../Download?...>

Notatene (2015) *Organisasjonsteori – Organisasjonsstruktur* [online]. notatene. URL: <http://notatene.no/?p=124>

Parrish, K., Ledewitz, j., (2012) *Early Lessons Learned from Building an ISO 50001: Conformant Energy Management System for MIT* [online]. MIT. URL: <http://aceee.org/files/proceedings/2012/data/papers/0193-000088.pdf>

Rajendran, K. (2015) *Challenges in Implementing a Performance Management System* [online]. ERMA. URL: <https://erm-academy.org/publication/risk-management-article/challenges-implementing-performance-management-system>.

Ramm, B. (2014) *Eksempelprosjekter* [online]. fornybar.no. URL: <http://www.fornybar.no/solenergi/eksempelprosjekter#vestby>.

Rasmussen, K. V. (2014) *ISO 50 001 - I en klasse for seg?* [online]. Norges miljø- og biovitenskapelige universitet. URL: brage.bibsys.no/xmlui/bitstream/id/203046/Rasmussen2014.pdf.



Energy Management System

«Actions for agile and simple implementation»

Regjeringen (2014) *Meld. St. 13 (2014-2015), Ny utslippsforpliktelse for 2030 – en felles løøsning med EU* [online]. Regjeringen.no. URL:

<https://www.regjeringen.no/nb/dokumenter/meld.-st.-13-2014-2015/id2394579/?docId=STM201420150013000DDDEPIS&q=&navchap=1&ch=1>.

Rindall, B., Råsen, S. G., Bøhle, K. (2013) *Føre var – bærekraftig utvikling* [online]. ndla Naturfag. URL: <http://ndla.no/nb/node/11045>.

SNL (2009a) *Reliabilitet* [online]. Store norske leksikon. URL: <http://snl.no/reliabilitet>.

SNL (2009b) *Validitet* [online]. Store norske leksikon. URL: <http://snl.no/validitet>

Srivastava, V. K. (2014) *ISO 50001: Implementation Challenges & Intro to its Family* [online]. URL: http://petrofed.winwinhosting.net/upload/19_Jan_2015/VK%20Srivastava.pdf

Standard, N. (2015) *Standardisering* [online]. standard.no. URL: <http://www.standard.no/standardisering/>

Styrelsen, E. (2010) *På vej mod energiledelse* [online]. DS. URL: http://www.ens.dk/sites/ens.dk/files/info/nyheder/nyhedsarkiv/energiledelse-light-vejledning-smaa-mellemstore-virksomheder/EnergiledelseVejledningLight_april2010.pdf

Styrelsen, E. (2013) *Energiledelse i virksomheden* [online]. ens.dk. URL: <http://www.ens.dk/sites/ens.dk/files/info/nyheder/faktaark/Energiledelse.pdf>

TSA (2014) *Til Energistyrelsen* [online]. web. URL: http://webcache.googleusercontent.com/search?q=cache:RVCyWeJeTAwJ:www.danskenergi.dk/~media/Hoeringssvar/2014/140617Hoeringssvar_bekendtgoerelsen_obligatorisk_energisyn.ashx+&cd=4&hl=no&ct=clnk&gl=no

Wikispaces (2009) *Naturressurser* [online]. Wikispaces. URL: <http://stend.wikispaces.com/Naturressurser>.



9 Appendices

1	Appendix – Project agreement.....	1
2	Appendix – Publishing contract.....	4
3	Appendix – Informed consent (for interviews).....	7
4	Appendix – Interview round one.....	10
5	Appendix – Interview round two.....	19
6	Appendix – “Evalueringsnøgle til energiledelse”.....	23



Energy Management System
«Actions for agile and simple implementation»

1 Appendix – Project agreement

Title

Project agreement

Name

Fanny Elisabeth Abotnes

Internal supervisor: Professor Kristian Martinsen

External supervisor: Mathias Holm



Master Thesis

Master of Science in Sustainable Manufacturing

30 ECTS

Faculty of Technology, Economy and Management

Gjøvik University College, 2015



Energy Management System

«Actions for agile and simple implementation»



HØGSKOLEN I GJØVIK

PROJECT AGREEMENT

Between Gjøvik University College (GUC), Faculty of Technology, Economy and Management, (educational institution),

BRYNILD GRUPPEN AS
(employer), and

FANNY ABOTNES
(student(s))

Preliminary working title of the project: Energy Management at Brynild Group

This agreement specifies the obligations of the contracting parties concerning the completion of the project and the rights to use the results that the project produces:

1. The student(s) shall complete the project in the period from January to June.
The students shall in this period follow a set schedule where GUC gives academic supervision. The employer contributes with project assistance as agreed upon at set times. The employer provides knowledge and materials as necessary to complete the project. It is assumed that given problems in the project are at a suitable level for students' academic knowledge. The employer undertakes to evaluate and comment on the project at GUC's request.
2. The costs of completing the project are covered as follows:
 - The employer covers completion of the project concerning materials, phone/fax, travelling and necessary accommodation on places far from GUC. Students cover the expenses for the completion of the written project report. Expected costs are usually agreed at the start of the project.
 - The right of ownership to potential prototypes falls to those who have paid for the components and materials etc used to make the prototype. If it is necessary with larger or specific investments to complete the project, a separate agreement will be made between the parties concerning cost allocation and rights of ownership.
3. GUC does not guarantee that the results requested by the employer will function in accordance with the employer's needs, nor that the project will be completed. The project must be considered as an examination related assignment that will be evaluated by lecturers/supervisors and the examiner. Nevertheless, students are obliged to complete the project in accordance with the agreed specifications, functional levels and timings.
4. A copy of the complete digital assignment report, complete with drawings, descriptions of appliances and programs, source code, measurements and other data which are a part of or are an appendix to the report shall be provided to GUC, who can utilize it for educational purposes or for research without cost. The assignment report or appendices shall not be used by GUC for other purposes, and will not be released outside GUC without an agreement with the rest of the parties to this agreement. This also applies to companies where GUC employees and/or students have interests. See section 9 below. Assignments with grade C or better, or where the students have signed a separate agreement, will be made available on the GUC web site.
Unless otherwise specified in accordance with section 9, the employer and supervisor accept such disclosure when signing this contract. For those assignments where these 3 sections have been approved,



Energy Management System
 «Actions for agile and simple implementation»

the assignment will be fetched from Fronter and published in GUC's archives (HiGIA) which is freely accessible via the Internet.

5. The assignment's specifications and results can be used for the employer's own work. If the student(s) in working on the assignment make a patentable invention, the relationship between employer and student(s) will apply as described in the Act on the right to employees' inventions dated 17th April 1970, §§ 4-10.
6. Beyond the publicizing mentioned in item 4, the student(s) have no right to publicize their assignment, fully or partly or as a part of other work, unless agreed with the employer. Similar consent must be made between student(s) and lecturer/supervisor regarding the material placed at disposal by the lecturer/supervisor.
7. The students shall deliver their assignments in Fronter, and the GUC Copy Service then prints three copies for delivery to the lecturing group (one copy for the external examiner, and two copies for the internal examiner and lecturing group). The students are themselves responsible for handing over a complete copy to the employer, in either printed or digital form.
8. The students shall make certain that they and the employer sign the contract. The contract is handed in to TØL's administration. On behalf of GUC, the Dean or Vice Dean ratifies the contract. When all parties have signed the contract, the department administration publishes it to Fronter. Students are responsible for providing the employer with a copy.
9. In some cases separate agreement may be made between employer, student(s) and GUC concerning issues such as ownership, further use, confidentiality, cost coverage, and economic utilization of the results. GUC recommends that employers themselves take the initiative to make such contracts as necessary.

If employer and the students wish to extend, or make a new agreement, this shall be done without GUC as partner. However, GUC requires the following point's clarified: (enter "x" as necessary)

Confidential (report) Not confidential (report) Additional contract

10. When GUC also act as employer, GUC enters into the agreement both as education institution and as employer.
11. Possible disagreements concerning understanding of this agreement are solved by negotiations between the parties. If consensus is not achieved, the parties agree that the disagreement is solved by arbitration, according to provisions in Civil Procedure Act of 13th of August 1915, no 6, chapter 32.
12. Project Participants:

GUCs supervisor (name): Kristian Martinsen

Employers contact person (name): MATTHIAS HOLM

Student(s) (signature): Fanny Abotnes date 03/02-15
 _____ date _____
 _____ date _____
 _____ date _____

Employer (signature): T. Matthias Holm date 03/02-15

TØL Dean/Vice Dean (signature): [Signature] date 10/2-15



Energy Management System
«Actions for agile and simple implementation»

2 Appendix – Publishing contract

Title

Publishing contract

Name

Fanny Elisabeth Abotnes

Internal supervisor: Professor Kristian Martinsen

External supervisor: Mathias Holm



Master Thesis

Master of Science in Sustainable Manufacturing

30 ECTS

Faculty of Technology, Economy and Management

Gjøvik University College, 2015



Energy Management System
«Actions for agile and simple implementation»



GJØVIK UNIVERSITY COLLEGE

Bachelor/ Master Thesis agreement

This agreement is a binding contract between Gjøvik University College (GUC) and the author(s) of the Bachelor/ Master Thesis.

Author's name	Fanny Elisabeth Abotnes
Course name (Bachelor/Master name)	Sustainable Manufacturing
Address:	Dragkistelia 20B, 1539 Moss
E-mail address:	Fanny.abotnes@hig.no
Title of the thesis:	Energy management system «Actions for agile and simple implementation»

Fair use rights:

The author will hereby give GUC the right to make the author's thesis available (free) at the GUC library in electronic formats.

The author is aware of and accepts the extent of copyright laws and publishing on the Internet. This agreement must be signed by all parties (author(s) and a representative of GUC) to be valid.

GUC rights and responsibilities

GUC has decided that only bachelor theses graded C or better, and master theses graded A-E will be made available in electronic format. GUC library has the right to publish the thesis, but is not obligated to do so.

If GUC decides to publish a thesis, it must be published without changes as it was delivered to the GUC library. GUC is not responsible for proofreading or any control that the version handed in is accordance with earlier versions or drafts.

GUC has no beneficial rights of the thesis other than what is expressed in this agreement.

The author's rights and responsibilities

The author must at all times follow the publishing guidelines set forth by GUC library.

By a prospective agreement with other parties concerning publishing of the thesis, the author is responsible for ensuring GUC's rights by this agreement.



Energy Management System

«Actions for agile and simple implementation»

The author guarantees that he/she owns the intellectual property rights. This also applies for any material attached to or in another way connected to the thesis. Material/ documents obtained from other sources must be referred and the original authors must be given credit.

The author guarantees that the thesis does not contain material/documents that can be in violation of Norwegian law.

If GUC should be made liable to a third party due to a breach of this agreement by the author, the author is responsible for keeping GUC from suffering any losses.

Publishing

GUC has the right to publish the thesis on the Internet, to copy, to distribute and display the work.

Termination of the agreement

GUC has an unlimited right to discontinue the publishing of the thesis.

The author has the right to terminate this agreement he/ she is obliged to inform GUC in writing. GUC will remove the thesis from the Internet no later than 6 months after receiving the notice. GUC is obligated to remove the thesis sooner if the author gives good reasons for this.

This agreement shall be executed and signed in two counterparts, and the parties will keep one each.

Gjøvik, (date)	I have read and accepted this agreement GUC, Moss, 11.05.2015
HØGSKOLEN I GJØVIK BIBLIOTEKET Postboks 191 2802 Gjøvik <i>A Laskovske</i> (Representing GUC)	Fanny Elisabeth Abotnes (Author) <i>Fanny Abotnes</i> (Author) (Author)



Energy Management System
«Actions for agile and simple implementation»

3 Appendix – Informed consent (for interviews)

Title

Informed consent

Name

Fanny Elisabeth Abotnes

Internal supervisor: Professor Kristian Martinsen

External supervisor: Mathias Holm



Master Thesis

Master of Science in Sustainable Manufacturing

30 ECTS

Faculty of Technology, Economy and Management

Gjøvik University College, 2015



Energy Management System
«Actions for agile and simple implementation»

INFORMED CONSENT:
Energy management at Brynild Group

Fanny Abotnes
E-mail: fanny.abotnes@gmail.com
Phone: 478 159 73

Project Description:

This survey is part of a master's thesis spring 2015. The purpose of the questionnaire is to retrieve the most relevant information according to the chosen topic related to energy management at Brynild Group.

Procedure and Risks:

We would like to record the interview, if you are willing, and use the tapes to write our materials. We will record the interview only with your written consent, and will ask that no personal identifiers be used during the interview, to ensure your anonymity. Please feel free to say as much or as little as you want. You can decide not to answer any question, or to stop the interview any time you want. The tapes and transcripts will become the property of project.

If you so choose, the recordings and recording-transcripts (or copy of notes taken) will be kept anonymous, without any reference to your identity, and your identity will be concealed in any reports written from the interviews.

There are no known risks associated with participation in the study.

Benefits:

It is hoped that the results of this study will benefit Brynild Group through providing greater insight into implementing energy management.

Confidentiality:

All information collected during the study period will be kept strictly confidential until such time as you sign a release waiver. No publications or reports from this project will include identifying information on any participant without your signed permission, and after your review of the materials. If you agree to join this study, please sign your name on the following page.



Energy Management System
«Actions for agile and simple implementation»

INFORMED CONSENT FOR INTERVIEWS
Energy management at Brynild Group

I, _____, agree to be interviewed for the project entitled Energy management at Brynild Group, which is being produced by Fanny Abotnes from Gjøvik University College.

I certify that I have been told of the confidentiality of information collected for this project and the anonymity of my participation; that I have been given satisfactory answers to my inquiries concerning project procedures and other matters. In addition, that I have been advised that I am free to withdraw my consent and to discontinue participation in the project or activity at any time without prejudice.

I agree to participate in one recorded interview for this project. I understand that such interviews and related materials will be kept completely anonymous, and that the results of this study may be published in an academic journal.

I agree that any information obtained from this research may be used in any way thought best for this study.

_____ Date _____
Signature of Interviewee

If you cannot obtain satisfactory answers to your questions or have comments or complaints about your treatment in this study, contact:

Fanny Abotnes
E-mail: fanny.abotnes@gmail.com
Phone: 478 159 73



Energy Management System
«Actions for agile and simple implementation»

4 Appendix – Interview round one

Title

Interview round one

Name

Fanny Elisabeth Abotnes

Internal supervisor: Professor Kristian Martinsen

External supervisor: Mathias Holm



Master Thesis

Master of Science in Sustainable Manufacturing

30 ECTS

Faculty of Technology, Economy and Management

Gjøvik University College, 2015



Energy Management System

«Actions for agile and simple implementation»

Interview 1:

Personlige data

Navn:

Sysselsetting: **Brynild Gruppen AS**

Bakgrunn: **Høgskoleingeniør, Industriellautomasjon.**

Jobbet mange år i næringsmiddelindustri, Bama og Mills.

Hvor lenge har du jobbet på BG? **Det blir 9 år nå i juni 2015.**

Hvilken arbeidsrolle har du?

Hoved dagligdagse oppgaver? **EOS/MES/OEE – EMS prosjektet og vedlikeholdsplaner for Støperi 1.**

Forhold til energiledelse

Har du noen kunnskap om energiledelse?

Ikke annet enn at man får kontroll på hvor man bruker energien som forbrukes, og lettere kan følge opp dette.

Er du kjent med standarder eller andre retningslinjer?

BRC

Er du kjent med mål som inngår i et energiledelsesprosjekt?

Målet er å få full oversikt og deretter gjennomføre lønnsomme tiltak/oppgaver/prosjekter som fører til energibesparelser.

Har du noen erfaring med implementering av energiledelse fra tidligere arbeid?

Nei.

Din bedrift og energiledelse

Hva er BG mål for implementering av energiledelse?

Få full oversikt og deretter gjennomføre lønnsomme oppgaver/prosjekter som fører til energibesparelser. Fange opp avvik raskt, og deretter raskt rette opp avviket(ene).

Har du noen forventninger til implementering av energiledelse?

Jeg forventer at vi får en veldig god oversikt over BG's energiforbruk. Innkjøpsavdelingen kan utføre avrop/bestillinger ved å følge med på tank -nivåer.

Tror du det er viktig å ha et slikt system?

Det blir et godt system for å få god oversikt, som igjen da kan brukes til å hjelpe oss å kontrollere energiforbruket.

Hva kan et slikt system påvirke?

Skape god oversikt og kostnader.



Energy Management System

«Actions for agile and simple implementation»

Programvare og datainnsamling

Vil du ha tilgang til programvare?

Det går jeg ut fra at jeg muligens får, men jeg tror at alt det med programmering og slikt vil utføres av vår leverandør på dette, Pöyry. Jeg vil da bruke dette til overvåking.

Hvilken rolle vil du ha med programvaren?

Jeg kommer til å få tilgang til det meste slik at jeg kan se at tilstanden er slik den skal være og at tiltakene vi eventuelt gjør fører til det vi har ment.

Ser du noen fordeler med data innsamling?

Får man dette presentert oversiktlig og ordentlig i skjermbilder er det helt klart en stor fordel å få oversikt over forbruk/mengder/temperaturer/luftfuktighet/trykk.

Hva kan den innsamlede dataen brukes til?

Få oversikt over forbruk/mengder/temperaturer/luftfuktighet/trykk. Ser godt resultatene etter gjennomførte tiltak/oppgaver/prosjekter. Man kan sette inn alarmgrenser på det man måtte ønske for å overvåke. Dette opp eventuelle avvik raskt.

Innflytelse og videre arbeidsrolle

Hvordan tror du at din rolle og arbeidsoppgaver vil endre seg etter implementeringen?

Oppfølging av det som gjelder vedlikehold vil bli enklere. Avvik vil oppdages mye raskere.

Tror du at det vil være mer eller mindre tid for forbedringer etter en implementering?

Det vil gjøre det lettere å prioritere riktig i forhold til lønnsomhet med de ressursene man har.



Energy Management System

«Actions for agile and simple implementation»

Interview 2:

Personlige data

Navn:

Sysselsetting:

Bakgrunn: **Siv.ing**

Hvor lenge har du jobb et på BG? **17 år**

Hvilken arbeidsrolle har du?

Hoved dagligdagse oppgaver? **Oppfølging av drift/personal/forbedringsprosjekter**

Forhold til energiledelse

Har du noen kunnskap om energiledelse?

Veldig lite. Lært noe i forbindelse med dette prosjektet.

Er du kjent med standarder eller andre retningslinjer?

Vet det finnes ISO standard for dette.

Er du kjent med mål som inngår i et energiledelsesprosjekt? Beskriv.

Ikke kjent.

Har du noen erfaring med implementering av energiledelse fra tidligere arbeid? Beskriv.

«Nei». Har tidligere arbeidet en del med reduksjon av strømforbruk (dampproduksjon) og vannforbruk. I tillegg har vi installert temperaturovervåking av 17 kjøleanlegg i MF (tidl. Brynild Gruppen) for bedring av drift.

Din bedrift og energiledelse

Hva er BG mål for implementering av energiledelse?

Har du noen forventninger til implementering av energiledelse?

Ønsker lettere tilgang til energidata for å synliggjøre forbedringsmuligheter og forbedringer.

Tror du det er viktig å ha et slikt system?

Hva kan et slikt system påvirke?

Ikke nødvendig, men gjør det lettere å regulere forbruket og initiere gode prosjekter mht reduksjon av energiforbruk. Lettere for andre enn teknisk personell å mene noe om forbruket. Får en bredere diskusjon og kanskje større fokus totalt sett.



Energy Management System

«Actions for agile and simple implementation»

Programvare og datainnsamling

Vil du ha tilgang til programvare?

Hvilken rolle vil du ha med programvaren?

Brukes for ukentlig(daglig?) oppfølging og kontroll.

Ser du noen fordeler med data innsamling?

Hva kan den innsamlede dataen brukes til?

Grunnlag for forbedringer, samt måle effekt av tiltak. Har data i dag også, men det går litt tid med til å samle det inn.

Innflytelse og videre arbeidsrolle

Hvordan tror du at din rolle og arbeidsoppgaver vil endre seg etter implementeringen?

Liten grad.

Tror du at det vil være mer eller mindre tid for forbedringer etter en implementering?

Samme som i dag. Mer motiverende med forbedringsarbeid når man får logget effekten bedre.



Energy Management System

«Actions for agile and simple implementation»

Interview 3:

Personlige data

Navn:

Sysselsetting: **Energirådgiver, COWI AS**

Bakgrunn: **Siv.Ing fra NTH 1994**

Hvor lenge har du jobbet på BG? **Jobber ikke på Brynild**

Hvilken arbeidsrolle har du? **Ekstern rådgiver**

Hoved dagligdagse oppgaver? **Energirådgivning for offentlige og private kunder**

Forhold til energiledelse

Har du noen kunnskap om energiledelse?

Er du kjent med standarder eller andre retningslinjer?

Ja, er godt kjent med energiledelse og er kjent med standardene på miljø-(ISO 14001) og kvalitet (ISO 9001)

Er du kjent med mål som inngår i et energiledelsesprosjekt? Beskriv.

Ja.

- **Energireduksjon**
- **Kostnadsbesparelser**
- **Systematikk i arbeidet med energi**
- **Etablere en organisasjon som håndterer energi uavhengig av personer**
- **Etablere holdninger mht. energi (bedriftskultur)**
- **Bærekraft**

Har du noen erfaring med implementering av energiledelse fra tidligere arbeid? Beskriv.

Ja. Deltok ved implementeringen av energiledelse som energiansvarlig på Norske Skog Saugbrugs som ble sertifisert i 2005. Videre har jeg bistått ved innføring av energiledelse ved andre industribedrifter som rådgiver. Jeg har også vært fagrevisor i sertifiseringsrevisjoner ved 3 bedrifter i deres sertifiseringsrevisjoner ihht ISO 50001, energiledelse.



Energy Management System

«Actions for agile and simple implementation»

Din bedrift og energiledelse

Hva er BG mål for implementering av energiledelse?

Har du noen forventninger til implementering av energiledelse?

Målene er ikke formelt satt opp ennå. Dette er en del av den pågående prosessen. Men som følge av Enovastøtten ligger det til grunn et krav om at bedriften skal ha en ambisjon om 10% reduksjon av energiforbruket ved bedriften.

Tror du det er viktig å ha et slikt system?

Hva kan et slikt system påvirke?

Ja, jeg tror det er viktig å ha et slikt system.

Et ledelsessystem vil sikre kontinuerlig fokus og dermed bidra til kontinuerlig forbedring. Et ledelsessystem vil også leve sitt eget liv, uavhengig om ansatte slutter eller om det blir omorganisering.

Programvare og datainnsamling

Vil du ha tilgang til programvare?

Hvilken rolle vil du ha med programvaren?

Siden jeg ikke er ansatt ved Brynild er det uaktuelt for meg å ha tilgang til programvare.

Ser du noen fordeler med data innsamling?

Hva kan den innsamlede dataen brukes til?

Ja, det er en stor fordel med datainnsamling. Energiforbruksdata er sentralt ved mål-oppfølging og evaluering av om energiltak har hatt effekt. Om man skal styre riktig, må man ha måleverdier å styre etter. Data er også viktig om man skal analysere mulige forbedringsaktiviteter.

Innflytelse og videre arbeidsrolle

Hvordan tror du at din rolle og arbeidsoppgaver vil endre seg etter implementeringen?

Tror du at det vil være mer eller mindre tid for forbedringer etter en implementering?

Disse spørsmålene er lite relevante for meg, siden jeg ikke er ansatt i Brynild.



Energy Management System

«Actions for agile and simple implementation»

Interview 4:

Personlige data

Navn:

Syssetting: **Brynild Gruppen**

Bakgrunn: **produksjon/prosjekt/teknologi**

Hvor lenge har du jobbet på BG? **Siden mai 2008**

Hvilken arbeidsrolle har du?

Hoved dagligdagse oppgaver? **Administrasjon/Ledelse**

Forhold til energiledelse

Har du noen kunnskap om energiledelse?

Deltok fra drift ved implementering av energiledelse ved Norske Skog Saugbrugs i 2005.

Er du kjent med standarder eller andre retningslinjer?

Ledelsessystemer generelt som ISO og BRC.

Er du kjent med mål som inngår i et energiledelsesprosjekt? Beskriv.

F.eks. sikre organisatorisk bearbeiding av oppfølging av avvik.

Har du noen erfaring med implementering av energiledelse fra tidligere arbeid? Beskriv.

Din bedrift og energiledelse

Hva er BG mål for implementering av energiledelse?

Har du noen forventninger til implementering av energiledelse?

**Etablere oppfølgingssystem for å se avvik raskt, og organisatorisk kunne håndtere disse.
Kunne identifisere og kvantifisere effekt av mulige ENØK prosjekter.**

Tror du det er viktig å ha et slikt system?

Hva kan et slikt system påvirke?

Muliggjør mer effektiv energiforbruk.

Programvare og datainnsamling

Vil du ha tilgang til programvare?

Hvilken rolle vil du ha med programvaren?

Ønsker IKT løsning for å kunne logge historiske forbrukstall på ulike steder/måler.

Ser du noen fordeler med data innsamling?

Hva kan den innsamlede dataen brukes til?

Analyse, visualisering, bevisstgjøring, etablering av alarmer, o.l.



Energy Management System

«Actions for agile and simple implementation»

Innflytelse og videre arbeidsrolle

Hvordan tror du at din rolle og arbeidsoppgaver vil endre seg etter implementeringen?

Marginalt, men energi vil bli en del av all KPI oppfølging parallelt med produktivitet, kostnader, kvalitet, osv..

Tror du at det vil være mer eller mindre tid for forbedringer etter en implementering?

Det vil i et CRS/lønnsomhetsmessig perspektiv bli enda mer riktig prioritering av tiltak. Dette fordi energirelaterte tiltak vil da være med i konkurransen om tid og ressurser, noe det knapt er i dag.



Energy Management System
«Actions for agile and simple implementation»

5 Appendix – Interview round two

Title

Interview round two

Name

Fanny Elisabeth Abotnes

Internal supervisor: Professor Kristian Martinsen

External supervisor: Mathias Holm



Master Thesis

Master of Science in Sustainable Manufacturing

30 ECTS

Faculty of Technology, Economy and Management

Gjøvik University College, 2015

Interview round two

1. *Hvilke forhold har BG til bærekraft?*

I økende grad både mht.

- Arbeidernes helse, kakaodyrking (UTZ merking),
- Cashew nøtter fra Mosambique
- Redusert antall artikler med palmeolje over 90%; går over på bærekraftig palmeolje på de få som gjenstår, jobber med å eliminere også disse
- Stiller krav til leverandører
- Renser alt avløp til vann
- Innført gode rutiner for gjenvinning av avfall
- Benytter kortreist rapsolje i stedet for palmeolje til steking av nøtter
- Optimaliserer logistikk-løsninger kontinuerlig
- Opptatt av sikkerhet og annen HMS mot personell

2. *Hvilke forhold har BG til fornybar energi?*

Benytter primært strøm; norsk strøm er dekket med 70% vannkraft

3. *Hvilke forhold har BG til energieffektivisering?*

Har gjort noen ENØK prosjekter siste år
Innfører nå energiledelse

4. *Hvilke forhold har BG til Norsk klimapolitikk?*

Vi er en liten forbruker

5. *Hvilke forhold har BG til Norske lover for miljø og energi?*

Følges

6. *Har bedriften et godt fungerende ledelsessystem på plass? Hvorfor er dere ikke sertifisert etter Iso 9001 lenger?*

Fordi

- Selve sertifiseringen er dyr og tidkrevende
- BRC standarden er mer relevant
- Vi følger fortsatt ISO standarden og reviderer oss selv på det, men lar oss ikke lenger godkjenne av akkreditert revisor

7. *Har i toppledelsen tatt mål i forbindelse med EMS?*

Ja; vil også bli en del av ledelsens gjennomgang (som er en del av kvalitetssystem)



Energy Management System

«Actions for agile and simple implementation»

8. *Hvordan skal dere innføre selve systemet?*

Etter ENOVAs krav igjen basert på COWIs rådgivning

9. *Har dere en energi hunter/ansvarlig (hvem)? Hva er han/hun sine oppgaver?*

Nei, blir en del av linjeansvaret

10. *Har dere energi team (hvem)? Hvilke oppgaver har dem?*

Se 9; ikke relevant for en bedrift av vår størrelse

11. *Er alle i organisasjonen kjent med EMS og implementeringen av dette systemet?
Hvem er i så fall kjent med EMS for BG?*

Pågår gitt status på prosjektet for implementering

12. *Hvordan organiserer dere selve prosjektet?*

Prosjekteier
Støtte av COWI,
Prosjektleder
Involvering av relevante øvrige

13. *Har dere kartlagt energi forbruket?*

Nei, men forbrukerne og nødvendige målere installeres slik at vi får behovet

14. *Har dere en handlingsplan som skal bidra til å realisere de overordene målene dere har satt opp?*

Vår grovplan går slik frem til nyttår:

- Nå holder vi på installasjon, og programmering. T.o.m uke 27.
- Testperiode i sommer og utover.
- Brukergrupper og testing etter sommeren.
- Rapportering til ENOVA foregår parallelt og skal være ferdig 31.12.2015
- Brynild Gruppen kommer til å jobbe videre med utvidelse av systemet i 2016 også.

15. *Har dere utpekt en ansvarlig for de enkelte utvalgte nøkkeltallene og etablert gode rutiner for oppfølgingen?*

Pågår



Energy Management System
«Actions for agile and simple implementation»

16. *Har der etablert en handlingsplan? Hvordan er denne?*

Etablering av tiltaksplan sees på når systemet er oppe og går, vi kan da lage en plan for hva de enkelte skal ha fokus på, og hvilke tiltak som skal utføres.

17. *Er det avsatt budsjett og ressurser som sikrer realisering av handlingsplanen?*

Ja, bevilget 3 M NOK, samt satt av personressurser og innleid personell

18. *Er alle berørte og relevante deler av organisasjonen kjent med handlingsplanen?*

Ja ift. status på prosjektet, infomøte avholdt.

19. *Skal dere gjennomføre en årlig evaluering av og status for energiledelsessystemet?*

Ja, i ledelsens gjennomgang (3x pr år)

20. *Er det satt opp møteplan for energigruppen de kommende år?*

Ikke enda

21. *Har dere på plass dagsorden for gruppemøtene som sikrer at energiforbruk og prioriterte prosjekter følges opp?*

Ikke enda; blir en del av vanlig målstyring/scorecard tilordnet møtestruktur



6 Appendix – “Evalueringssnøgle til energiledelse”

Title

“Evalueringssnøgle til energiledelse”

Name

Fanny Elisabeth Abotnes

Internal supervisor: Professor Kristian Martinsen

External supervisor: Mathias Holm



Master Thesis

Master of Science in Sustainable Manufacturing

30 ECTS

Faculty of Technology, Economy and Management

Gjøvik University College, 2015



Energy Management System

«Actions for agile and simple implementation»

Evalueringssnøgle til energiledelse – Niveaubeskrivelser

Emne i evalueringssnøglen	Niveau
A. Enerkipolitik	
1. Valgt niveau: _____	1. Virksomhedens ledelse har ikke gjort sig nogle tanker om, hvordan energiforhold bør håndteres på virksomheden.
2. Kommentarer:	2. Virksomhedens ledelsen har formuleret nogle holdninger til energiforbrug og besparelser, men de er ikke skrevet ned.
_____	3. Virksomheden har en nedskreven energipolitik, der er kendt af ledere og nøglepersoner på virksomheden.
_____	4. Virksomheden har en nedskreven energipolitik, der er kendt af alle medarbejdere og som forpligter virksomheden til en løbende og relevant indsats for effektivisering af energiforbruget.
_____	5. Virksomheden har en nedskrevet energipolitik, der er kendt af alle medarbejdere og formidlet ud til virksomhedens interessenter (kunder, investorer, myndigheder m.v.). Enerkipolitikken forpligter virksomheden til en løbende og relevant indsats for effektivisering af energiforbruget.

Emne i evalueringssnøglen	Niveau
B. Kortlægning af energiforhold	
3. Valgt niveau: _____	1. Ledelsen kender måske den samlede årlige energiomkostning, men ikke hvordan det fordeler sig på el, varme og brændsler.
4. Kommentarer:	2. Virksomheden har udpeget de væsentligste energiforbrug og slutanvendelser, men har højst skønsmæssigt anslået størrelserne
_____	3. Virksomheden har kortlagt de væsentligste energiforbrug fordelt på forsyningsformer (el, varme, brændsler) og slutanvendelser, samt udpeget nogle rentable besparelsesmuligheder.
_____	4. Virksomheden har kortlagt alle energiforbrug fordelt på el, brændsler og slutanvendelser, samt love og regler på energiområdet. Virksomheden opdaterer en gang årligt denne kortlægning. Nye forbedringsmuligheder identificeres en gang om året
_____	5. Virksomheden har kortlagt alle energiforbrug fordelt på el, brændsler og slutanvendelser, samt love og regler på energiområdet. Virksomheden opdaterer en gang årligt denne kortlægning på baggrund af målte data. Der identificeres løbende nye forbedringsmuligheder og beregnes besparelsesmuligheder

Emne i evalueringssnøglen	Niveau
C. Mål og handlingsplaner	
5. Valgt niveau: _____	1. Virksomheden udarbejder ikke mål og handlingsplaner hvad angår energiforbrug og andre energirelaterede aktiviteter.
6. Kommentarer:	2. Virksomheden udarbejder enkelte konkrete mål for energiforbrug og -aktiviteter, men der bliver ikke udarbejdet egentlige handlingsplaner.
_____	3. Virksomheden udarbejder en gang om året nye konkrete mål og handlingsplaner på energiområdet.
_____	4. Virksomheden udarbejder en gang om året nye mål og handlingsplaner på energiområdet og de bliver indarbejdet i virksomhedens sædvanlige investeringsbudgetter.
_____	5. Virksomheden udarbejder løbende nye mål med tilhørende handlingsplaner efterhånden som gamle mål opfyldes. Mål og handlingsplaner følges op mindst gang i kvartalet.



Energy Management System

«Actions for agile and simple implementation»

Emne i evalueringsnøglen	Niveau
	3. Driftspersonalet følger faste fremgangsmåder til at styre energiforbruget under drift af produktionsanlæg. Der foretages planlagt energioptimerende vedligehold af alle væsentlige energiforbrugende anlæg.
	4. Energiforbruget overvåges løbende med henblik på styring af energiforbruget. Der foretages planlagt energioptimerende vedligehold af alle væsentlige energiforbrugende anlæg.
	5. Der findes faste nedskrevne fremgangsmåder for drift af væsentlige energiforbrugende anlæg og energiforbruget af disse anlæg overvåges løbende med henblik på optimering af energiforbruget. Vedligehold sker systematisk på baggrund af overvågning af nøgletal (driftstimer, virkningsgrader el.lign.).



Energy Management System

«Actions for agile and simple implementation»

Emne i evalueringsnøglen	Niveau
G. Energibevidst indkøb og projektering	15. Der foretages ingen vurdering af energiforbrug af nyt energiforbrugende udstyr i forbindelse med indkøb og projektering. 16. Energiforbrug ved nyindkøb vurderes efter en enkel procedure. 17. Energiforbrug vurderes efter en fast procedure ved indkøb af energiforbrugende udstyr. Leverandører oplyses om procedurerne. 18. Energiforbrug vurderes efter en fast procedure ved indkøb af energiforbrugende udstyr med et omfang der er afhængig af den anslåede potentielle besparelse. Der gennemføres energibevidst projektering med tilknyttet energigransker ved alle større investeringsprojekter. 19. Der foretages en totaløkonomisk vurdering indkøb med af alle energiforbrugende maskiner apparater og udstyr. Der gennemføres energibevidst projektering med tilknyttet energigransker ved alle større investeringsprojekter.
13. Valgt niveau: _____	
14. Kommentarer:	

Emne i evalueringsnøglen	Niveau
H. Overvågning og kontrol	1. Virksomhedens energiforbrug registreres og kontrolleres højst en gang årligt. Der følges ikke op på energiprojekter. 2. Virksomhedens væsentlige energiforbrug registreres og overvåges mindst en gang om måneden 3. Virksomhedens væsentlige energiforbrug registreres og overvåges mindst en gang om måneden, nøgletal beregnes og ved væsentlige afvigelser udføres korrigerende og om muligt forebyggende handlinger. Væsentlige indsatser og resultater registreres. 4. Virksomhedens væsentlige energiforbrug registreres og overvåges ugentligt og ved væsentlige afvigelser udføres korrigerende og forebyggende handlinger. Alle større indsatser og resultater registreres. 5. Væsentlige energiforbrug og nøgletal registreres og overvåges løbende. Der udføres korrigerende handlinger ved væsentlige afvigelser i nøgletal eller i udførelse af faste procedurer vedrørende energiforhold. Alle indsatser og resultater af betydning for energiforbruget registreres i et centralt register (energibevidst indkøb og projektering, uddannelser, kommunikation etc.).
10 Valgt niveau: _____	
11 Kommentarer:	



Energy Management System

«Actions for agile and simple implementation»

Emne i evalueringsnøglen	Niveau
I. Ledelsens evaluering.	1. Ledelsen ofrer ingen opmærksomhed på virksomhedens energiforbrug
20. Valgt niveau: _____	2. Ledelsen modtager mindst en gang årligt en redegørelse for virksomhedens energiforbrug og giver en tilbagemelding til den energiansvarlige.
21. Kommentarer:	3. Det undersøges en gang årligt ved intern audit om energiledelsessystemet følges. Ledelsen får halvårslige rapporter om fremdriften i centrale energinøgletal.
_____	4. Det undersøges en gang årligt ved intern audit om energiledelsessystemet følges. Ledelsen får kvartalsvise rapporter om fremdriften i centrale energinøgletal. En gang årligt evalueres energiledelsessystemets funktion og evne til at opfylde de fastsatte energimål ved et møde i ledelsen.
_____	5. Det undersøges løbende ved intern audit om energiledelsessystemet følges. Ledelsen modtager ugentligt overordnede nøgletal for virksomhedens energiforbrug, samt kvartalsvise kortfattede rapporter om opfyldelse af fastsatte energimål. Ledelsen evaluerer energiledelsessystemets funktion og succes mindst en gang hvert halve år .



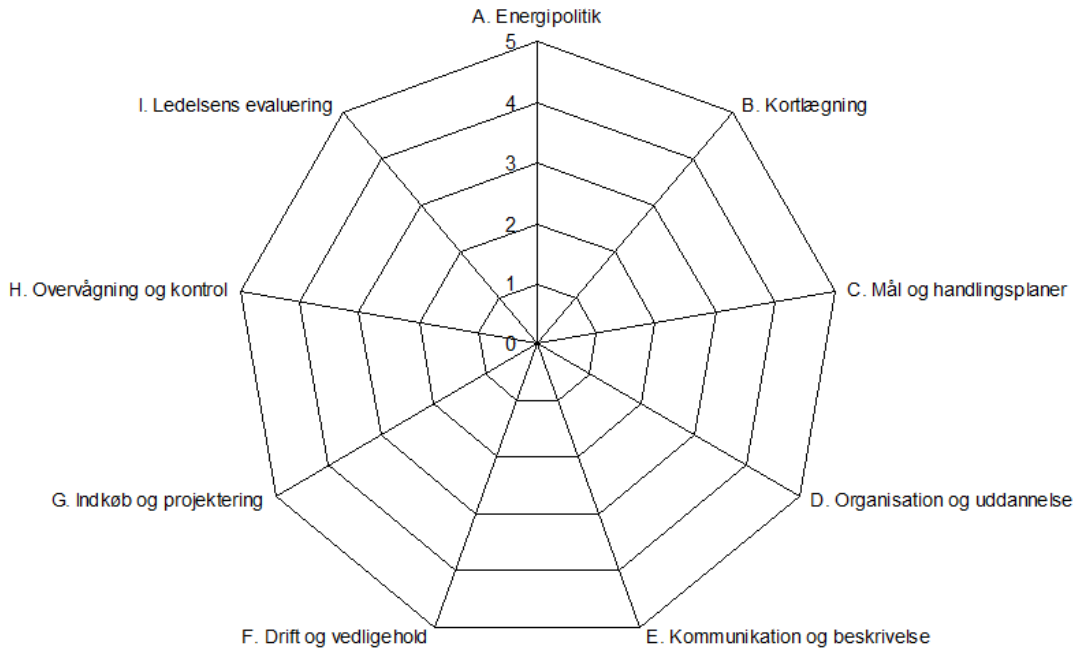
Energy Management System

«Actions for agile and simple implementation»

EVALUERING AF ENERGILEDELSE

Virksomhed: _____

- Udgangspunkt, dato: _____
- Status, dato: _____
- Slutevaluering, dato: _____



Evalueringssnøgle, version 1,
Projekt Værktøjskassen, 30. januar 2002



Energy Management System

«Actions for agile and simple implementation»

Sammenhæng mellem emneområder og Dansk Standard for energiledelse, DS 2403.

Emne i evalueringsnøglen	Afsnit i dansk standard for energiledelse
A. Energifpolitik	4.2 Energifpolitik
B. Kortlægning af energiforhold	4.3.1 Kortlægning af energiforhold 4.3.2 Lovbestemte krav og andre bestemmelser
C. Mål og handlingsplaner	4.3.3 Indsats og mål 4.3.4 Energi-handlingsplaner
D. Organisation og uddannelse	4.4.1 Struktur og ansvar 4.4.2 Uddannelse, energibevidsthed og færdigheder
E. Kommunikation og beskrivelse af energiledelsessystemet	4.4.3 Kommunikation 4.4.4 Beskrivelse af energiledelsessystemet 4.4.5 Dokumentstyring
F. Drift og vedligehold	4.4.6.1 Drift og vedligehold af væsentligt energiforbrugende udstyr
G. Energibevidst indkøb og projektering	4.4.6.2 Energibevidst indkøb 4.4.6.3 Energibevidst projektering
H. Overvågning og kontrol	4.5.1 Overvågning og målinger 4.5.2 Afvigelser og korrigerende og forebyggende handlinger 4.5.3 Registrering
I. Ledelsens evaluering	4.5.4 Intern audit af energiledelsessystemet 4.6 Ledelsens evaluering