NON-PEER-REVIEWED PAPER

A sawmill-adapted energy management system

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Abstract

To increase the use of Energy Management systems (EnMSs) in the sawmill industry, we have developed a handbook that guides sawmills on how to implement a practical and usable EnMS. The EnMS has been tailored to fit the sawmill industry by including relevant examples, advice and tools that can be used directly. The tailor-made tools include a division of the sawmill into suitable departments, a visualising aid for the energy use of the departments, and a list of energy saving measures that are common in sawmills.

By implementing an EnMS in a company, a framework is in place for working with energy management. Energy saving potentials that were previously hidden become visible, and the personnel gain knowledge on their processes that they previously did not have the tools to discover.

The sawmill-adapted EnMS consists of seven steps that shall be repeated regularly to achieve a more and more enhanced EnMS. The steps can be seen as an infinite spiral of enhancements to reach a higher level of energy efficiency. The sawmill-adapted EnMS is not intended as a complete EnMS that can be ISO 50001 certified. However, by following all of the steps in the guide, the sawmill will have a good starting point for EnMS certification.

Introduction

The sawmill-adapted EnMS covered in this paper is a part of the European project Ecoinflow (ecoinflow.com), a project involving more than 40 sawmills from seven European countries (France, Germany, Italy, Latvia, Norway, Sweden and the United Kingdom). The main objective of Ecoinflow is to reduce the annual energy use in the European sawmill industry by 1 TWh by implementing tailor-made EnMSs. An important task in this work has been to develop a handbook for sawmills as guidance when working with EnMSs. A first version of the handbook was finished in November 2013, and the handbook is now being used in the project to spread the knowledge on EnMSs.

There is a high potential to achieve energy savings in sawmills by implementing EnMSs. In Sweden, a national program for energy efficiency showed that 2–20 % of the electrical energy could be saved by implementing an EnMS in eleven sawmills (Swedish Energy Agency, 2011a). Some of the main barriers for energy savings in sawmills are lack of infrastructure and profitability of selling surplus energy products, such as bark and chips. Other barriers are lack of knowledge on optimal utilization of the energy input, and low awareness about the energy saving potential. Implementation of an EnMS enables a higher awareness of the current energy use, and better understanding of the potential of future energy savings.

To increase the awareness of where the energy use takes place, and where the greatest potentials for savings are located, it is necessary to better collect and monitor the energy use in sawmills. This can be done by installing meters for systematic measurements. Measurements, however, are of no use if the personnel do not know how to handle the information. The information flow through communication and knowledge

transfer are important factors to be successful in implementing an EnMS. Currently, there are few measurements of energy use on a regular basis in sawmills. If the energy use is followed-up at all, it is often made by considering only the total use of electricity, oil or natural gas. Should the energy analysis also include the use of bioenergy, and the energy use be divided across the departments of the sawmill, a lot of energy could be saved. When the energy use is not divided across the departments, the sawmill personnel have limited control over the processes, and it is difficult for the production workers to see their part in the energy saving activities. It is also likely that many energy saving potentials are hidden in the summarised energy figures.

By implementing an EnMS in a company, a framework is in place for working with energy management. Energy saving potentials that were previously hidden can become visible, and the personnel gain knowledge on their processes that they previously did not have the tools to discover. From personal experience we know that many sawmills do not realise the economic savings that can be made by increasing the energy efficiency, and if they do, they often do not know where to start. Most sawmills in Europe do not prioritize energy efficiency and feel that they do not have the capacity to conduct energy efficiency projects according to the international standard ISO 50001.

To increase the use of EnMSs in the sawmill industry and to show the economic potential of making energy efficiency measures, we have developed an EnMS handbook. The handbook guides sawmills on how to implement a practical and usable EnMS. The EnMS has been tailored for the sawmill industry by including relevant examples, advice and tools that can be used directly. The tailor-made tools include a division of the sawmill into suitable departments, a visualising aid for the energy use of the departments, and a list of energy saving measures that are common in sawmills.

There have been many efforts to increase the use of EnMSs in industry. The most powerful efforts are probably national incentive programs that reward the industry in some way when implementing and certifying an EnMS. A vast majority of the companies with an EnMS that we have been in contact with have implemented the EnMS as a result of national programs or regulations. Previous projects on increased use of EnMSs in Europe include the BESS and Expanding BESS projects 2005–2009 (BESS 2009), and a Swedish national project called Energy Management Light (*Energiledning Light*, Hrustic 2011 and Swerea 2013). The BESS projects were aimed towards small and medium sized companies in Europe. The project Energy Management Light is still active and is a part of an energy efficiency package offered for small and medium sized companies in Sweden. In another part of this energy efficiency package, companies are offered to report energy use data for benchmarking with other companies in their industry sector. No project has been found aimed at producing a sawmill-adapted EnMS.

Advantages of implementing an EnMS

The most obvious advantages of implementing an EnMS are energy and cost savings. Eleven Swedish sawmills that took part in a national program for energy efficiency reported electricity savings of 2–20 % when implementing a certified EnMS, averaging around 7 % (Swedish Energy Agency 2011a, 2011b). During the programme period evaluated (2004–2009), the sawmills reported 188 electricity-saving measures, of which 49 % were discovered in the energy review (see Figure 1). The total electrical savings per sawmill ranged from 245 to 9,805 MWh/year, averaging at 3,025 MWh/year. Unfortunately, no data is available on fuel or heat savings since the focus of this programme was savings of electricity.

Companies generally experience several direct and indirect benefits from introducing an EnMS. The most common benefits mentioned by the companies in Sweden are (Swedish Energy Agency 2013):

- Economic savings thanks to:
  - Lower energy use.
  - Increased knowledge on the production process.
  - Increased level of systematic work in general.
- Reduced environmental impact. For business-to-business products, the choice of supplier can be based on the environmental performance of the product.
- Increased knowledge, awareness and control of the production process makes it easier to make well-founded decisions, e.g. when purchasing new equipment.
- Energy issues are included at an early stage in various planning processes.
- An EnMS puts energy issues on the table for the top management, which raises the acceptance and status of energy efficiency work throughout the organization.
- By working with energy issues continuously and in a structured way, energy becomes a part of the daily agenda and the awareness of its importance is raised.

Overview of the EnMS handbook for sawmills

The EnMS handbook for sawmills is developed using the international standard ISO 50001 as a basis. This sawmill-adapted EnMS consists of seven steps that shall be repeated regularly to achieve a more and more enhanced EnMS. The sawmill-adapted EnMS is intended as a tool that helps companies getting started with their energy efficiency work. It is not intended as a complete EnMS that can be ISO 50001 certified, since a complete EnMS is considered too complicated and time-consuming by the sawmills. The idea is therefore to lower the threshold for implementing an EnMS by focusing on the parts that are most important and relevant for sawmills. However, by following all of the steps in the guide, sawmills will have a good starting point for EnMS certification.

In the handbook, we guide sawmills through the process of implementing an EnMS. A first version of the handbook has been produced as a pilot version on paper. The same material plus additional templates and tools are available for project members on a webpage. The webpage also offers contact details to partners and other sawmills in the network. The handbook is available in English, French, German, Norwegian, Swedish and Latvian, and a demo version is available as

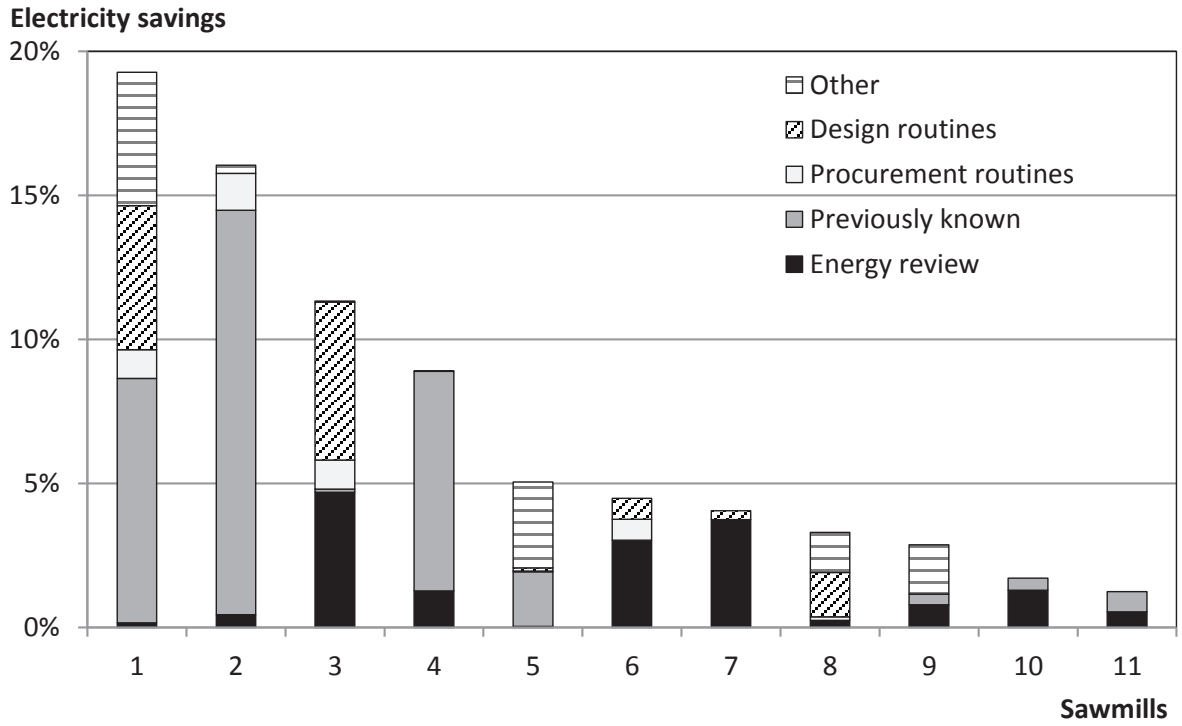

Figure 1. Relative electrical savings reported by the eleven sawmills in the Swedish programme on energy efficiency, divided by way of identification. The data comes from the Swedish Energy Agency (2011a, 2011b).

a webpage for interested people outside of the project (Ecoinflow 2014).

As an overview, the seven steps of the sawmill-adapted EnMS are as follows:

1. Appoint an **Energy management team**.
2. Decide on an **Energy policy**.
3. Perform an **Energy review** (mapping the energy use).
4. Decide on **Energy targets**.
5. Develop an **Energy action plan**.
6. Develop **Routines for energy efficiency** in everyday work.
7. Develop routines for **Internal communication**.

The steps can be seen as an infinite spiral of enhancements to reach a higher level of energy efficiency.

In the handbook, each chapter is structured in the same way to make it easy for the reader to get a grasp of the content by a swift read-through. The wording is casual to attract a wide audience, and the first section of each step gives an introduction to the step with a short description of what should be done, followed by the expected outcomes. In this way, the purpose of each chapter becomes clear from the start. The introductory section is followed by the sections "In short", "How-to", and "Pitfalls to avoid", see Figure 2. In some of the steps there are also examples and further advice for the company.

In the chapters, examples are given from other companies to inspire and help the sawmills develop their EnMS, and templates are attached so that the companies can start each step with from a basic structure. The handbook ends with some advice to the companies, a list of measures that are needed if they want to enhance their EnMS further, and a list of common measures that have previously been taken by other companies.

In order to further assist the sawmills in the implementation process, the handbook comes with a set of templates and tools that the companies can use to jump-start each step by having the basic structure already in place. For steps that require decisions and documentation, this means pre-formatted document templates that show how such documents may be structured, for example an Energy policy document. For more analysis-oriented steps, it means simple tools to handle information (e.g. Energy action plan) and gather data (e.g. Energy review). The intention is to help the companies do the right thing from the start, without taking shortcuts, and thus make the implementation process as easy and – hopefully – inspiring as possible.

One of the most demanding steps for a company that has not previously worked with energy management is performing an Energy review. Considering the fact that most sawmills do not have any measurements on department level, this is a major barrier for a successful implementation of an EnMS. To overcome this barrier, the Ecoinflow project helps sawmills to introduce measurements at strategic positions. Additionally, the Excel tool supporting Energy reviews, developed as a part of the handbook, intends to assist the sawmills in reviewing their overall energy use and also to start dividing it into sub processes. A reasonable level of subdivision is key to successfully analysing the base-line situation and finding possibilities

Figure 2. Excerpt from the webpage version of the EnMS handbook. The website provides quick and easy-to-follow information, but also more in-depth material for those interested.

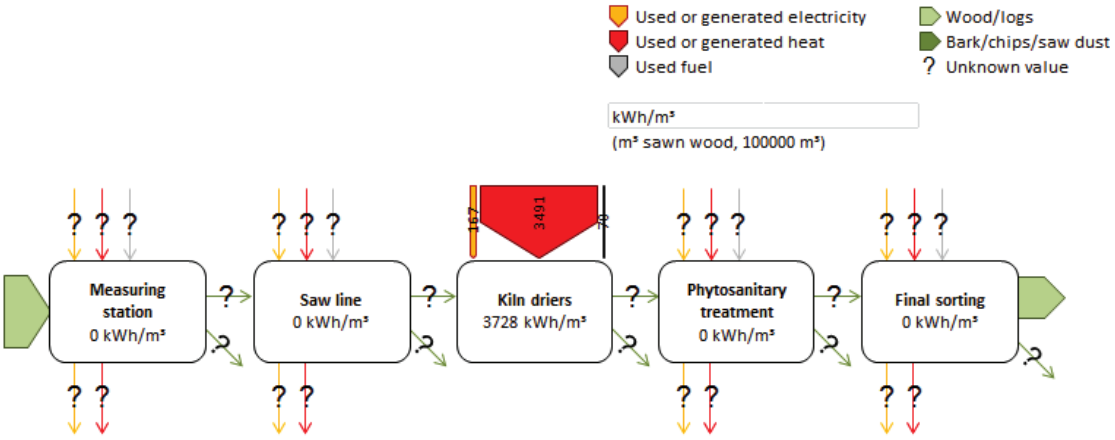

Figure 3. Part of a flow chart generated with the Energy review tool. In this example, only the total input of logs, total output of sawn wood and energy use of kiln driers are known; the other flows are not quantified and therefore illustrated with question marks.

for energy efficiency measures, but it is important to recognise that this will not happen overnight.

Each sawmill must start from its own unique position and improve the level of detail – by estimations or measurements – during the continuous work with its EnMS. The aim of the tool is thus threefold:

1. To assist sawmills in determining a relevant sub process division, by suggesting common sawmill sub processes and by showing examples.
2. To show which energy flows may be useful to quantify, but leaving data entry optional.
3. To visualise energy and material flows, by automatically generating a simple flow chart that illustrates the size of each flow, as well as flows that are still unknown (see Figure 3).

The flow charts are useful as an overview of the production and the energy use. They are also meant to inspire the personnel to learn more about the energy use by clearly illustrating missing information. The missing information should be regarded as potential points for improvement that will awaken curiosity to start to gradually measure the energy use in a more detailed way. The level of ambition at the sawmill sets the amount of details in the estimated and measured energy figures. The sawmill itself decides how much they want to implement of the suggested steps. The general experience is that when the company gets started, a more and more refined EnMS gradually evolves as the personnel gains more and more knowledge. This results in a more satisfied personnel, and savings in both energy and monetary terms.

Conclusions

In this paper, we have presented a sawmill-adapted EnMS consisting of seven steps that shall be repeated regularly to achieve a higher level of energy efficiency. The system is currently being implemented at sawmills participating in the Ecoinflow project, and the EnMS will be enhanced during the course of the project in cooperation with the sawmills.

Glossary

EnMS	Energy Management System
Ecoinflow	Energy Control by Information Flow, a European project on energy efficiency in sawmills

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