Ecoinflow
SawEnMS

Guide for defining zones and finding locations for energy meters

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Guide for defining zones and finding locations for energy meters

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This guide is a part of the Ecoinflow SawEnMS handbook and is intended to provide useful extra information for sawmills that want to divide their sawmill into energy zones and find good locations for energy meters. This is useful for finding a suitable level of detail when doing an energy review, both when using existing energy meters and when new ones need to be installed at appropriate locations.

Abstracts

ENGLISH ABSTRACT

Generally, there are only a few measurements of energy use made on a regular basis for companies in the sawmilling industry sector. This can be an obstacle for the implementation of an energy management system, EnMS.

In order to be able control the energy use and follow up the energy efficiency improvements it is necessary to group the energy users into manageable sizes with good enough resolution in size. For the total use, it is sufficient to have e.g. the bill from the electric company, and from the supplier of steam, and the amount of bio mass put into the boiler. If the aim is to know where the greatest saving potential is or if a change has had the foreseen impact, it is necessary to have smaller groups. The division into zones at the sawmill can most easily be made according to the production steps. What is important is that the zones are manageable and possible to measure. Before buying meters, it is necessary to consider the area of use. Make sure the meter is easy to use and is able to measure the interesting parameters. Also the ruggedness is important, like if the meter is waterproof, shockproof, battery life etc.

It is also essential that the data transfer to your EnMS or other computer for further evaluation and storage is easy and fast, so that logging can continue almost uninterrupted when the logger is full and needs emptying. This goes of course also for the fixed installed meters. Make sure that the data format is usable in visualisation and calculation programs of your choice. The memory capacity of mobile meters is very varying between meters. Make sure it is possible to store enough data with enough resolution for your purpose.

The time between samplings as well as the time for measuring the production steps requires knowledge about both the process and the measuring device. The best is to measure during more than one whole cycle, e.g. more than one drying batch, more than one saw batch etc., with high resolution. It is always possible to aggregate measurements if there are much data, but difficult to separate them if there are too little data.

The meters should be placed and grouped so they measure the needed data and only the needed data. The grouping of energy users should be well thought of before installing fixed meters. Mobile meters can be positioned in different places, and tested where they are of most use.

FRENCH ABSTRACT

Guide pour définir les zones et trouver les meilleurs emplacements pour les compteurs électriques - RESUME

Généralement, seules quelques mesures de consommation d'énergie réalisées de manière régulière spécifiquement pour les entreprises du secteur de l'industrie du sciage sont disponibles. Cela peut être un obstacle pour la mise en œuvre d'un système de management de l'énergie (SMEn). Afin d'être en mesure de contrôler la consommation d'énergie et de suivre les améliorations en matière d'efficacité énergétique, il est nécessaire de regrouper les postes de consommation d'énergie par secteurs selon une taille adaptée. Pour l'utilisation globale du site, il suffit de connaître par exemple la facture du fournisseur d'électricité, du fournisseur de vapeur, et la quantité de biomasse introduite dans la chaudière. Si l'objectif est de savoir où se trouve le plus grand potentiel d'économie ou si un changement a eu l'impact prévu, il est nécessaire de partager le domaine étudié en plus petits secteurs. Pour réaliser une division en zones de la scierie, il est possible de suivre les différentes étapes de production. Ce qui est important, c'est que les zones soient gérables et mesurables indépendamment. Avant d'acheter des appareils de mesure, il est nécessaire de tenir compte de la zone d'utilisation. Assurez-vous que l'appareil est facile à utiliser et est capable de mesurer les paramètres intéressants. De plus, la robustesse de l'appareil doit être prise en compte lors du choix du matériel (étanchéité, résistance aux chocs, durée de vie de la batterie, etc.) . Il est également essentiel que le transfert de données vers votre SMEn ou vers un autre ordinateur pour une évaluation plus approfondie et pour le stockage, soit facile et rapide. Ainsi, l'exploitation peut continuer de manière quasi- ininterrompue même si l'enregistreur est plein et doit être vidé. Il en est de même aussi bien sûr pour les compteurs fixes. Assurez-vous que le format de données est compatible avec les programmes de visualisation et de calcul de votre choix. La capacité de mémoire des compteurs mobiles est très variable d'un compteur à l'autre. Assurez-vous qu'il est possible de stocker suffisamment de données avec une résolution suffisante en fonction de l'objectif recherché. Le temps entre échantillonnages ainsi que le temps pour mesurer les étapes de production nécessitent des connaissances sur le processus et l'appareil de mesure. Le mieux est de mesurer pendant plus d'un cycle entier (par exemple plus d'un batch de séchage, plus d'un lot de sciage etc.) avec une grande résolution. Il est toujours possible de globaliser les mesures s'il y a beaucoup de données, mais il est plus difficile de les séparer s'il y a trop peu de données. Les compteurs doivent être placés et regroupés afin qu'ils mesurent les données nécessaires et seulement celles-ci. Le regroupement des postes de consommation d'énergie doit être pensé avant d'installer les compteurs fixes. Les compteurs mobiles peuvent être placés à des endroits différents, et testés là où ils sont les plus utiles.

GERMAN ABSTRACT

Anleitung für die Definition von Betriebsbereichen und für das Auffinden von Orten für die Energieverbrauchsmessungen - Kurzfassung

Im Allgemeinen werden nur in wenigen Betrieben der Sägeindustrie regelmäßig Energieverbrauchsmessungen durchgeführt. Dies stellt ein Hemmnis für die Einführung von Energiemanagementsystemen (EnMS) dar. Um den Energieverbrauch kontrollieren zu können und um Erfolge im Bereich Energieeffizienz nachweisen zu können, ist es erforderlich, die verschiedenen Energieverbraucher unter Erhalt einer ausreichenden Auflösung des Verbrauchs zu übersichtlichen Gruppen zusammenzufassen. Zur Ermittlung des Gesamtstromverbrauchs ist die Energierechnung des Energieversorgunghsunternehmens, für den Dampfverbrauch die Rechnung des Dampflieferanten oder bei Eigenerzeugung die Menge der eingesetzten Biomasse ausreichend. Wenn das Ziel jedoch ist festzustellen, wo die größten Energieeinsparpotenziale liegen, oder ob eine durchgeführte Maßnahme den gewünschten Erfolg gehabt hat, dann ist es erforderlich, die Energieverbraucher in kleine Gruppen aufzuteilen und deren Verbräuche zu messen. Die Einteilung in Betriebsbereiche gelingt am leichtesten, wenn man nach den einzelnen Produktionsschritten gliedert. Wichtig ist, dass die Gruppen handhabbar sind und deren jeweiliger Verbrauch durch Messung bestimmbar ist. Bevor Energieverbrauchsmessgeräte beschafft werden, ist es erforderlich, genau zu bestimmen, wofür sie eingesetzt werden sollen. Es sollte sichergestellt sein, dass die Geräte einfach zu handhaben sind und dass sie die gewünschten Parameter ermitteln können. Die Geräte sollen für die rauen Bedingungen im Sägewerk ausgelegt, d.h. wassergeschützt, schockunempfindlich langlebig, etc., sein.

Es ist ebenfalls wichtig, dass der Datentransfer zum EnMS oder zu anderen Computern für die weiteren Auswertungen leicht und schnell erfolgen kann, und zwar so, dass die Aufzeichnung von Verbrauchsdaten praktisch unterbrechungsfrei weiterlaufen kann, wenn der Datenlogger voll ist oder die Daten abgerufen werden sollen. Das gilt gleichermaßen für mobile und für fest installierte Messsysteme. Das Datenformat sollte kompatibel sein mit den für die Visualisierung und die Berechnung der Verbräuche verwendeten Software. Die Speicherkapazität der auf dem Markt befindlichen Geräte variiert beträchtlich. Es sollte sichgestellt sein, dass ausreichend Daten gespeichert werden können, um die für den jeweiligen Zweck erforderliche Auflösung zu erreichen.

Zur Bestimmung der Interwalle zwischen den Messungen und für die Zusammenfassung der Verbräuche von Gerätegruppen sind sowohl Kenntnisse über den Produktionsprozess als auch über die Messtechnik und die verwendeten Geräte erforderlich. Am besten misst man nicht nur einen Zyklus, also nicht nur eine Trocknung oder einen Sägeauftrag sondern mehrere, wenn möglich mit hoher Auflösung. Eine Agrregation oder Komprimierung von Daten ist immer möglich, aber eine nachträgliche Erhöhung der Auflösung jedoch nicht.

Die Geräte sollten so plaziert und gruppiert werden, dass sie wirklich die zur Beantwortung der jeweiligen Fragestellung erforderlichen Verbräuche messen und nicht noch irgendwelche zusätzlichen Verbräuche. Die Gruppierung der Energieverbraucher sollte gut überlegt sein, bevor Messgeräte fest installiert werden. Mobile Geräte können dagegen an verschiedenen Stellen dort plaziert und getestet werden, wo man den größten Nutzen aus ihnen ziehen kann.

LATVIAN ABSTRACT

Anotācija latviešu valodā

Parasti kokzāģēšanas industrijas sektorā uzņēmumos enerģijas patēriņa mērījumus regulāri veic tikai atsevišķos gadījumos. Tas var būt šķērslis, lai ieviestu enerģijas pārvaldības sistēmu (EPS).

Lai spētu kontrolēt enerģijas izmantošanu un sekot energoefektivitātes uzlabojumu efektivitātei, ir nepieciešams grupēt enerģijas patērētājus viegli pārvaldāmās kopās ar pietiekami labu izšķirtspēju. Attiecībā uz kopējo enerģijas patēriņu ir pietiekami, piem., ar rēķinu no elektroenerģijas piegādes uzņēmuma vai no uzņēmuma, kurš piegādā ūdens tvaiku, vai ar biomasas apjomu, kuru padod apkures katlā. Ja mērķis ir zināt, kur ir vislielākais ietaupījuma potenciāls vai novērtēt veikto izmaiņu ietekmes atbilstību plānotajām, ir nepieciešams, lai enerģijas kontrole tiktu veikta mazākās grupās. Iedalījumu zonās kokzāģētavā visvieglāk ir veikt saskaņā ar ražošanas posmiem. Svarīgi ir tas, ka zonas ir pārvaldāmas un tajās ir iespējams veikt mērījumus. Pirms iegādāties mērīšanas iekārtas, ir nepieciešams apsvērt to pielietošanas zonas. Pārliecinieties, ka mērīšanas iekārtas ir viegli pielietojamas un ir iespējams novērtēt interesējošos parametrus. Arī iekārtas robustums ir svarīgs, piemēram, lai iekārta būtu ūdensizturīga, triecienizturīga, ar pietiekamu akumulatora darbības laiku uc.

Būtiski ir arī tas, ka datu pārnese uz EPS vai citiem datoriem vēlākai datu izvērtēšanai un uzglabāšanai ir viegla un ātra, lai datu uzkrāšana varētu turpināties gandrīz nepārtraukti arī tad, kad datu uzkrājējs ir pilns un to vajag iztukšot. Tas pats attiecas arī uz fiksēti uzstādītiem skaitītājiem. Pārliecinieties, ka datu formāts ir izmantojamas Jūsu izvēlētajām vizualizācijas un aprēķinu programmām. Atmiņas ietilpība mobilo mērīšanas iekārtu vidū ļoti svārstās atkarībā no iekārtas. Pārliecinieties, ka uz tās ir iespējams uzglabāt pietiekami daudz datu, ar pietiekami labu izšķirtspēju Jūsu vajadzībām.

Mērījumu veikšanas intervālu izvēlei nepieciešamas zināšanas gan par mērierīcēm, gan par ražošanas procesu. Labāk ir izmērīt vairāk nekā vienu pilnu ciklu, piemēram, vairāk nekā vienu žāvēšanas partiju, vairāk nekā vienu zāģēšanas partiju utt., vēlams ar augstu izšķirtspēju. Vienmēr ir iespējams apkopot mērījumus, ja datu ir pārāk daudz, bet grūti nošķirt datus, ja to ir pārāk maz.

Mērierīces jānovieto un jāsagrupē tā, lai tās uzmērītu tikai un vienīgi nepieciešamos datus. Enerģijas patērētāju grupēšanai jābūt labi pārdomātai pirms fiksēto mērierīču uzstādīšanas. Mobilos mērītājus var novietot dažādās vietās, un ir iespējams pārbaudīt, kur tie dod visnoderīgāko rezultātu.

NORWEGIAN ABSTRACT

Guide for å definere soner og finne plasseringer for energimålere - SAMMENDRAG

Vanligvis er det bare noen få målinger av energibruk som gjøres på en jevnlig basis på sagbrukene. Dette kan være et hinder for å kunne gjennomføre energiledelse, EnMS, på en god måte.

For å kunne kontrollere energibruken og følge opp energieffektiviseringstiltak er det nødvendig å gruppere energibrukerne på sagbruket i håndterbare størrelser med god nok oppløsning / inndeling til å få en god oversikt av energibruken. For den totale energibruken er det tilstrekkelig å ha f. eks regningen fra den strømleverandøren, fra leverandøren av varmtvann (dersom dette ikke produseres selv), og mengden av biomasse som går inn i fyrkjelen. Hvis målet er å vite hvor det største sparepotensialet er, eller om et energitiltak har hatt forutsett effekt, er det nødvendig å ha mindre grupper / bedre oppløsning av energibruken. Inndelingen i soner ved sagbruket kan lettest gjøres ved at den relateres til produksjonstrinnene. Det som er viktig er at sonene er håndterbare og mulig å måle. Før du kjøper måleutstyr er det nødvendig å vurdere bruksområdet. Kontroller at apparatet / utstyret er lett å bruke og er i stand til å måle energibruken på en tilfredsstillende måte (blant annet med hensyn til usikkerhet). Det er også viktig at apparatene er robuste, eksempelvis at måleren er vanntett, støtsikker, har god batterilevetid etc.

Det er også viktig at dataoverføringen inn i energiledelsessystemet (hvis det er en egen software for dette) eller til en annen datamaskin for videre evaluering og lagring er enkel og rask, slik at logging kan fortsette nesten uavbrutt når loggeren er full og må tømmes. Dette gjelder selvfølgelig også for de faste installerte meterne. Kontroller at dataformatet er anvendbart i visualiserings- og beregningsprogrammer som du benytter. Minnekapasiteten på mobile metere kan være svært varierende. Sørg for at det er mulig å lagre nok data med en hensiktsmessig oppdeling av energibrukerne.

Tiden mellom prøvetakinger, så vel som tidspunktet for måling av produksjonstrinnene, krever kunnskap om både prosessen og måleinnretningen. Det beste er å gjøre målinger med høy oppløsning under mer enn en hel syklus, f. eks mer enn ett tørkeparti, mer enn parti på saglinjen etc. Det er alltid mulig å aggregere målinger dersom det er mye data, men det kan være vanskelig å skille dem hvis det er for lite data.

Målerne skal plasseres og grupperes slik at de måler kun de nødvendige energidata. Gruppe-ringen av energibrukerne bør godt gjennomtenkt før de faste installasjonene gjennomføres. Mobile meter kan plasseres på forskjellige steder og testes der hvor det er mest hensiktsmessig å foreta målinger.

SWEDISH ABSTRACT

Guide för att definiera zoner och hitta placeringar för energimätare - SAMMANFATTNING

Vanligtvis endast ett fåtal mätningar av energiförbrukningen görs regelbundet vid sågverk. Detta kan vara ett hinder för att genomföra energiledningssystem EnMS, på ett bra sätt.

För att kontrollera energianvändningen och följa upp energieffektivitetsåtgärder, är det nödvändigt att klassificera energianvändare i sågverket i hanterbara storlekar med tillräcklig upplösning / division för att få en bra överblick över energianvändningen. För den totala energiförbrukningen är tillräcklig för att ha f. Ex proposition från elleverantören, från din varmvatten (om den inte produceras själva), och mängden biomassa som går in i pannan. Om målet är att veta var det är besparingspotentialen, eller om en energiåtgärder har haft planerade effekt är det nödvändigt att ha mindre grupper / bättre upplösning av energiförbrukningen. Indelningen i zoner på sågverket kan enkelt göras genom att de därmed sammanhängande produktionssteg. Vad som är viktigt är att zonerna är hanterbara och möjligt att mäta. Innan du köper mätutrustning är nödvändigt att beakta tillämpningen. Se till att apparaten / utrustning är enkel att använda och kan mäta energianvändning på ett tillfredsställande sätt (även med avseende på osäkerhet). Det är också viktigt att enheterna är robusta, så att mätaren är vattentät, stötsäker, har bra batteritid etc.

Det är också viktigt att dataöverföring i energiledningssystem (om det finns en separat mjukvara för detta), eller till en annan dator för vidare utvärdering och lagring är enkel och snabb, så att loggning kan fortsätta nästan oavbrutet när loggern är full och måste tömmas. Detta gäller även för fasta installerade mätare. Se till att dataformatet är användbar i visualisering och beräkningsprogram som du använder. Minneskapacitet på mobila sensorer kan vara mycket varierande. Se till att det är möjligt att lagra tillräckligt med data med en lämplig fördelning av energianvändare.

Tiden mellan provtagningar, liksom tidpunkten för mätningen av produktionsstegen, kräver kunskap om både processen och mätanordningen. Det är bäst att utföra mätningar med hög upplösning i mer än en hel cykel, f. Ex mer än en torkpartiet, mer än fest på såglinjen etc. Det är alltid möjligt att aggregera mätningar om det finns en hel del uppgifter, men det kan vara svårt att skilja dem om det finns tillräckligt med data.

Mätarna kommer att placeras och grupperas så att de mäter bara de nödvändiga energiuppgifter. Grupperingen av energianvändare bör väl genomtänkt innan de fasta installationerna förda. Mobila mätare kan placeras på olika platser och testade där det är mest lämpligt att bedriva forskning.

Introduction

In many companies in the sawmilling industry today, only few measurements of energy use are made on a regular basis. This can be an obstacle for the implementation of an energy management systems (EnMS). Since sufficiently detailed measurements of the energy use is a vital part of an EnMS, both for analysing the current situation and for finding opportunities for energy efficiency measures, know-how on appropriate zone divisions and locations for power and heat meters is needed.

Appropriate zone divisions also support the use of benchmarking within the industry, since it allows sawmills, which may be very different in terms of productions processes and layout, to compare themselves with other sawmills in a reasonable way.

This information was first published early in the Ecoinflow project as deliverable D2.2 (May 2013). This guide is an updated version targeted at sawmill staff working with EnMS or energy monitoring. Instructions for performing an energy review are found in the SawEnMS handbook.

Division into sawmill zones

Sawmills use energy of three main categories: electricity, thermal energy (heat) and transport fuel. The thermal energy is provided by biofuels, oil or natural gas, but also by electricity. All of these types of energy should be measured to be able to map the energy use and find improvements for energy efficiency.

There are also mills that produce and sell electricity and heat. These parts of the sawmill energy should also be included in the energy mapping. The sold biofuel, e.g. saw dust, bark and chips, is not included explicitly in this context if it is not included as an input.

To get a better overview of the energy use and to follow up the energy efficiency improvements at the sawmill, it is necessary to group the energy users into manageable sizes with good enough resolution in size. For the total use, it is sufficient to have e.g. the bill from the electric company, and from the supplier of steam, and the amount of biomass put into the boiler. If the aim is to know where the greatest saving potential is, where a change has been made, or if a change has had the foreseen impact, it is necessary to have smaller groups. Since a sawmill has hundreds of electrical motors, it is not possible to measure each of them and they must be grouped.

The easiest way to divide the sawmills into zones is according to the production steps. One example can be seen in Figure 1. There are of course more ways to group energy users than this way. What is important is that the zones are manageable and possible to measure and that all energy users are included in a zone.

If you look at the kiln dryers in Figure 1, they are divided into “Batch kilns” and “Progressive kilns”. As there might be more than 40 batch kilns on a large sawmill they are most probably different in make, year of manufacture, isolation, energy use, productivity, size, heat recovery etc. so the real division should be more detailed than the one shown in the figure. This goes for all groups where you want to control the energy use.

In the example the chipper is found in the “Supportive processes”, but it can also be found in the “Saw house” or in “Bio fuel production”. It all depends on the layout of the company and how the processes are organised in other ways.

Many machines also have dust extracting devices, which are not mentioned in the zone plan. A very important thing to remember about them is that they extract a lot of indoor air, which in many cases has been heated first. The main energy loss from dust extraction is therefore not the fan motor, but the heated air that is extracted from the premises.

This is an example of how the division can be made. Other divisions are possible, and each sawmill must make their own division into zones, to fit their needs. The processes in the example can in turn be separated further. Sometimes it is desirable to measure the energy with higher resolution in machinery, e.g. sawing may consist of many machine groups and, perhaps, 20 motors.

However, there is no use dividing the energy users into too small units to begin with, as it is the largest users that must be found first, and too small zones makes it too tiresome to measure.

Log measuring station		
Log reception	Log sorting	Log yard

Saw house			
Log intake	Sawing	Conveyors	

Green sorter		
Green sorting	Cut saw	Sticker stacker

Kiln dryers	
Batch kilns	Progressive kilns

Final sorter			
Destacker	Final sorting	Stacking	Packaging

Preservation plant			
Destacker	Impregnation	Stacking	Packaging

Planer				
Destacking	Planing	Rip saw	Stacking	Packaging

Other processes		
Finger joint	Painting	Biofuel production

Forklifts and tractors		
Log tractors	Forklift, green	Forklift, dry

Office	
Lighting	Heating

Warehouse	
Lighting	Heating

Boiler		
Fuel feeder	Pumps	Fans

Supportive processes			
Chipper	Ventilation	Pneumatics	Hydraulics

Figure 1. Example of energy zones.

Meters and data loggers

The meters and loggers mentioned below are examples and must not be seen as recommendations from the project participants. There are also other suppliers of both meters and loggers. The prices are very approximate from 2013.

Before buying meters, it is necessary to consider the purpose and how they shall be used. There are meters for fixed installation as well as mobile units. Make sure the meter is easy to use and is able to measure the interesting parameters. Some meters are very powerful, and can measure and calculate a lot more parameters than needed. They are often more complicated to use, so the measurement can be more of a burden than a help. Also the ruggedness is important, for example if the meter is waterproof, shockproof, battery life etc.

It is also essential that the data transfer to your IT system for further evaluation and storage is easy and fast, so that logging can continue almost uninterrupted when the logger is full and needs emptying. This goes of course also for the fixed installed meters. Make sure you are able to reach all the data you need in a convenient way. Also make sure that the data format is usable in visualisation and calculation programs of your choice.

The memory capacity of mobile meters is very varying between meters. Make sure it is possible to store enough data with enough resolution for your purpose. As the memory is limited to a fixed number of measurements there is a balance between sampling interval and resolution.

The following sections provide examples of mobile and stationary heat and electricity meters and data visualisation software that have been used in energy metering projects. The purpose is only to give an idea of the options – there are of course other supplier and more models available.

Examples of mobile heat and electricity meters

One example of a mobile heat meter is the TransPort PT878 from GE Sensing. It is a portable ultrasonic liquid flow meter that measures the flow and temperature from the outside of the pipe, without interrupting the flow, see Figure 2. The price is in the area of 7,000–8,000 €.

Examples of mobile units for measuring electric energy are Fluke 435, Fluke 1735 and Chauvin Arnoux CA8332B. The prices for these meters are in the area of 4,500–5,000 €, 2,500–3,000 €, and 1,500–2,000 €, respectively. They measure the energy on 1 to 3 phases, and are able to store a large number of samples.

Figure 2. Example of mounting a mobile ultrasonic flow and heat meter.

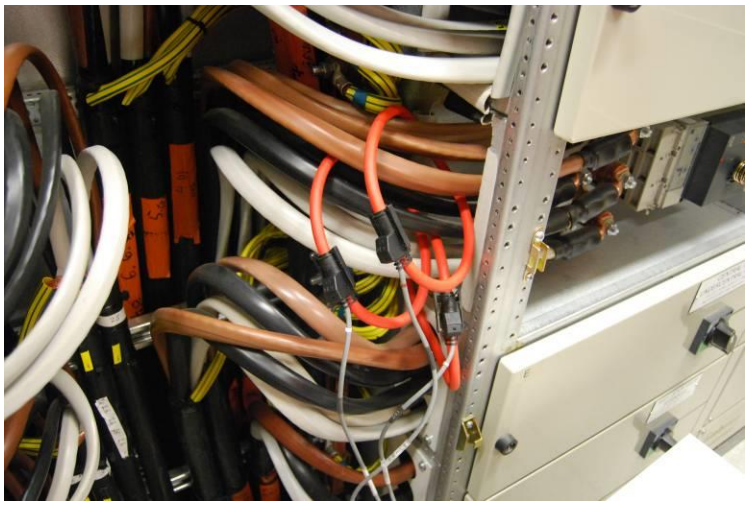

Figure 3. Mounting of current probes of a mobile meter in the electric central signal box.

Figure 4. Mounting of voltage probes of a mobile meter in the electric central signal box.

Examples of stationary heat and electricity meters

- Electricity meter: Kamstrup 382, one unit per phase.
- Hardware for collecting the data and send it to a database: EMS10, also from Kamstrup.
- Heat meter: Multical 801, also from Kamstrup.

The approximate price for one kiln, without installation, is 2,000–2,500 €.

Sample time

The time between samplings as well as the time for measuring the production steps requires knowledge about both the process and the measuring device. It is best to perform measurements during more than one whole cycle (e.g. more than one drying batch or saw batch) with high resolution. This makes it possible to cover variations in the process, in the raw material and the environment. With high resolution in the sampling time it is possible to see peaks and other events. It is always possible to aggregate measurements if there is much data, but difficult to separate them if there is too little data.

Some meters have the feature to log both the average and the min/max values during the sample interval. With this feature it is possible to see approximately where in the process the extreme values occur without logging the exact time and later measure only the interesting part of the process with higher resolution.

The electric metering for saws must have a much faster response time than the heat metering for kilns. The kiln measurement, though, is ongoing for many days without break, while the sawing usually stops for breaks and shifting of tools. This makes it possible to calculate the needed memory and sampling interval.

It is not possible to say that “1 hour of measuring is enough” or that “5 days is too short”. It all depends on what parameters are measured, what process is measured and during what part the process, and what measurement interval is used. In Figure 5, which shows the electricity use for lighting, it is possible to see the energy use, with rather low resolution in time. The interesting part, 10 kW during the night, is very visible anyway.

In Figure 6, the electricity use of a compressor during two weeks is shown. In the figure it is possible to see the idle power, approximately 65 kW, during nights and weekends, as well as the peak power, approximately 85 kW.

To get started, it is better to do something than to do nothing. As long as the first collected energy values are considered as a snapshot and not as the whole truth, the values are a starting point for further measuring.

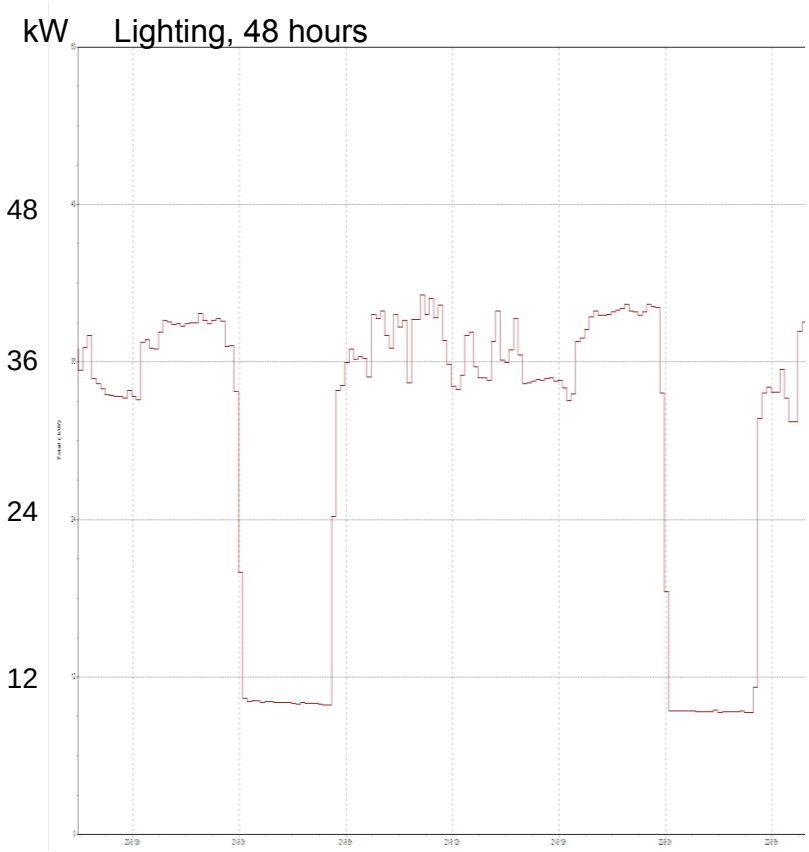

Figure 5. Energy used for lighting during 48 hours.

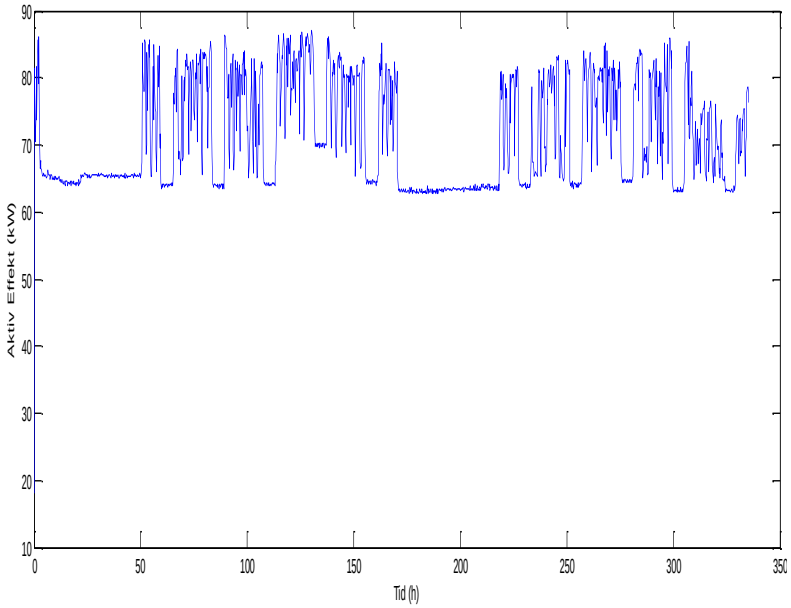

Figure 6. Energy used by a pneumatic compressor during 2 weeks.

Positioning of meters

The meters should be placed and grouped so they measure the needed data and only the needed data. Too large groups make it hard to define how much energy each user use. The grouping of energy users should be well thought of before installing fixed meters. Mobile meters can be positioned in different places, and tested where they are of most use.

The electric measurements must in many cases be made on each motor separately, which makes it hard to measure a complete sawing operation with mobile meters, since many motors are engaged at the same time (maybe up to 6 or 8). The easiest way might be to measure in the central signal box.

When buying new equipment, remember to include the energy metering in the installations Electric meters can nowadays also be included in the frequency converter and comparatively cheaply and easily be connected to a logging system, through standard data buses.

Thermal meters should preferably be placed so it is possible to measure each kiln separately. Only in lack of alternatives should the main pipe be the only measurement point.

The figure (7) on next page shows an example of division and positioning of meters for electrical and thermal energy.

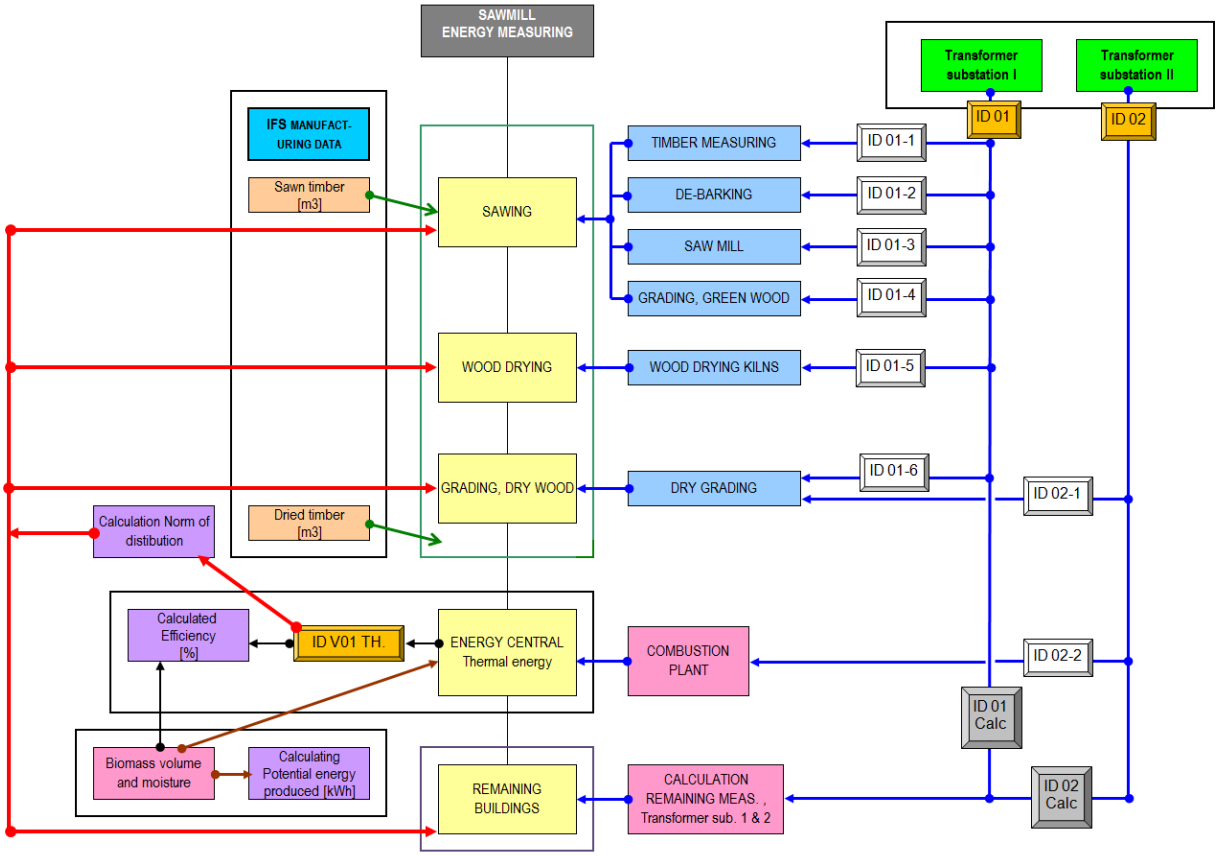

Figure 7. Example of divisions and positioning of meters for electrical and thermal energy.

The yellow boxes in the middle are the aggregated energy data; in this case data for sawing, drying, grading, energy central (boiler station) and remaining buildings. From left side are thermal energy flows shown (red) and from right side electric energy flows (blue), while production KPI are green.

One thermal meter (orange box) is installed in the example, positioned at the boiler station / energy central, and a number of cross calculations are made to compare fuel input with heat output to get a KPI for the boiler performance, while there is no sub-metering for the processes consumption. For electricity a number of sub-meters (white boxes tagged ID XX-X) are used to aggregate energy usage for each aggregated process (yellow). The remaining non-measured electricity consumption is calculated (grey boxes) and is assumed to be “remaining buildings”.

The example shows an overview and must be supplemented by more detailed maps or tables to be a complete documentation of a metering system. As example, show if timber yard lighting towers is part of remaining buildings or included in timber measuring and by that part of the sawing process energy consumption.

Example of Energy Data Management Systems

There are several terms used for systems that collect energy data and present the data for the user. We have chosen the term Energy Data Management System (EDMS) to describe these systems. We could have settled for the term Energy Monitoring System, but then the acronym could have been confused with the EnMS itself.

An EDMS for sawmills should fulfil the following needs:

- Both electric and thermal energy (favourable also transport fuel) should be collected.
- All data should be collected in one place, automatically.
- Hourly values, or even more frequent values, should be logged. It is favourable if some meters can be adjusted to collect data within five second intervals, if intermittent motors with electric effect spikes shall be analysed.
- To ensure secure data management, the collected data shall only be possible to reach with login credentials and possibly only from internal IP addresses.
- The data acquisition shall be done on several servers to assure safety of backups. At least one of the servers should be located at the sawmill itself to ensure that the data can be reached even if the sawmill is cut off from the internet.
- The raw data should be owned by and be accessible the sawmill so that the sawmill can visualise the energy flows in any way they like.
- It is in most cases required that some of the data can be entered manually. The reason for this is that some meters may not be connected to the central data hub, and some data may be difficult to measure automatically (for instance the amount of biofuel fed to the boiler). It is also favourable if the manually entered data can be entered via an app on a smartphone (or similar) to make it as easy as possible.

There are literally hundreds of systems that claim to collect energy data and then visualize it for the customer. Consequently, a full list of the EDMSs available is not practical for anyone. For the purpose of this project, we have chosen to list the EDMSs we have found in sawmills during the course of the project, see Table 1.

Table 1. List of EDMSs in sawmills found during the project.

Supplier	Product name	Website
Cebyc	Energinet	www.energinet.net
Microsoft	Excel	products.office.com
Qlik	Qlikview	www.qlik.com
Tascomp	PlantRun	www.tascomp.com
WinMod	WinMod	winmod.de/en/

In the table above, the listed EDMSs have different original purposes, and the suitability for a specific sawmill depends on the local conditions at the sawmill. To start from the top, Energinet is specifically designed for collecting and visualizing energy data. This means that data from the production is not added automatically to the system, but as we have understood it, it is possible to include this through some additional work. The next software is probably known by most people reading this: Excel. This tool can be used as simple or as sofisticated as the sawmill requires. Sometimes the simplest solutions are the best solutions. The next software, Qlikview, is presented on their webpage as a tool primarily for business analysis. In practice it can be used for analysing any data given to it as a database. The tool is multipurpose and can for example be used for energy data analysis. Qlik is one of the quickest growing suppliers of big data analysis software (the term *big data* is the current buzz word in the data analysis world). During 2014, Qlik has released a new tool called Qlik Sense that has a more modern user interface and is in some ways more flexible than Qlikview.

The two last products in the table are originally intended for data acquisition concerning the production. For example, the installation of PlantRun was originally installed for downtime monitoring at the sawmill. The energy monitoring has been integrated into the tool by request from the sawmill, in order to have all of the data available in one place. This allows the sawmill to report on energy use when stopped and specific energy use when running using the same package rather than linking data from one database to another. WinMod connects the automation system with plant data, and can also include energy data analysis if requested by the sawmill.


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