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Environmental Management in China
Case – ISO 14001 Implementation for The Switch

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Title

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Commissioned by The Switch Engineering Oy

Abstract

The purpose of this thesis was to integrate ISO 14001 -based environmental management system with the existing ISO 9001 -based quality management system in a Finnish company operating in China. China operations were chosen as the pilot and the plan is to extend the system later to other operations.

The study was carried out as an action research, using literature review and participation observation as methods. The systematics of the ISO 14001 standard was studied as well as the influence of the operating environment; legal and cultural differences of environment management and expectations of interested parties. New procedures were taken in use as soon as they were created and the author participated in their implementation and training.

The main question of the study was whether the same systematics can work in China and in Finland. The study shows that the differences in legislation and especially in the local infrastructures, makes the ISO 14001 standard much more location specific standard than the ISO 9001 standard. The same procedures can be used but they need to give enough possibilities for local decision-making. If the organization has severe environmental impacts, special legal requirements at local level or the infrastructures between locations differ significantly, the number of local procedures unavoidably increases.

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Tiivistelmä

Opinnäytetyön aiheena oli integroida ISO 14001 mukainen ympäristöjärjestelmä olemassa olevaan laatu- ja ympäristöjärjestelmään suomalaisen yrityksen Kiinan toimintoille. Kiinan toiminnot valittiin pilottikohteeksi, mutta järjestelmä on tarkoitus laajentaa myöhemmin kattamaan myös muut toiminnot.

Tutkimus toteutettiin toimintatutkimuksena ja menetelminä käytettiin valmisaineistoja sekä observointia. Työssä esitellään ISO 14001 -standardin systematiikka sekä toimintaympäristön vaikutukset, kuten lainsäädännön ja kulttuurin erilaisuudet ympäristöjohtamisen kannalta sekä sidosryhmien odotukset. Uudet toimintatavat otettiin käyttöön sitä mukaa kun ne luotiin ja työn tekijä osallistui niiden käyttöönottoon ja koulutukseen.

Tutkimuksen pääkysymys oli voiko ympäristöasioiden hallinnassa käyttää samanlaista systematiikkaa sekä Kiinassa että Suomessa. Tutkimus osoittaa, että erot lainsäädännössä ja erityisesti paikallisessa infrastruktuurissa tekevät ISO 14001 standardista huomattavasti enemmän paikkaan sidotun mitä ISO 9001 standardi on. Samoja toimintatapoja voidaan soveltaa, kunhan ne antavat mahdollisuuden paikalliseen päätöksentekoon. Kuitenkin, mikäli organisaatiolla on vakavia ympäristövaikutuksia, erityisiä lakiperusteisia vaatimuksia paikallisella tasolla tai infrastruktuuri on merkittävästi erilainen toimipaikkojen välillä, paikallisten toimintatapojen määrä väistämättä kasvaa.

Kieli

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56

Liitteet

14

Liitesivumäärä

36

Asiasanat

ympäristöjärjestelmät, ympäristövaikutukset, tuulivoimalat, Kiina

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ABBREVIATIONS

CAPA	Corrective Actions and Preventative Actions
CEO	Chief Executive Officer
CFO	Chief Financial Officer
EIP	Electronic Information Product
EMS	Environmental Management System
GWEC	The Global Wind Energy Council is the wind industry trade association
ISO 14001	Environmental management standard by the International Organization for Standardization
ISO 9001	Quality management standard by the International Organization for Standardization
MEP	Ministry of Environmental Protection of the People's Republic of China
MIIT	Ministry of Industry and Information Technology of the People's Republic of China
MSDS	Material Safety Data Sheet
MSW	Municipal Solid Waste
NABU	NABU, Der Naturschutzbund Deutschland. Nature and Biodiversity Conservation Union. One of the oldest and largest environment associations in Germany (founded in 1899)
OEM	Original Equipment Manufacturer
PBB	Polybrominated biphenyl (used as flame retardant)
PBDE	Polybrominated diphenyl ether (used as flame retardant)
PM	Particular Matter
PRC	People's Republic of China
QMS	Quality Management System
R&D	Research and Development
RMB	The Renminbi is the official currency of the PRC.
RoHS China	Commonly used nickname for the order of MIIT No. 39, "The Measures for Administration of the Pollution Control of Electronic Information Product"
RoHS	Restriction of Hazardous Substances (EU Directive 2002/95/EC) The directive applies to equipment as defined by the WEEE directive
SME	Small and Medium size Enterprise
WEEE	Waste Electrical and Electronic Product European WEEE refers to EU directive 2002/96/EC weather as China WEEE refers to China's regulation for the management of the recycling and disposal of waste electrical and electronic products (WEEE), released by MIIT
WTO	The World Trade Organization is the global international organization dealing with the rules of trade between nations.

1 Introduction

Discussions over climate change, the fear over food safety, news and pictures of severe eco catastrophes that could have been avoided have raised consumers' consciousness on the environmental matters. This has woken not only the governments to strengthen their legislation but also investors, who have started to prefer investments in businesses with sustainable production.

The environmental concern is global. China is the world's top merchandise exporter [1, pg. 4] and the world's largest greenhouse gas emitter. For a developing country like China, the balance between sustainable development and economic growth can be a huge challenge. According to World Bank statistics China has 20 of the world's 30 most polluted cities [2] and severe environmental accidents happen frequently [3]. Reasons to this are many, like rapid urbanization, large population and high intensity and inefficient use of energy.

According the Ministry for Foreign Affairs of Finland China is on one of the most important non-EU investment destinations for Finnish companies [4]. Unlike China, Finland is considered one of those nations where environmental protection and awareness are on a high level. Therefore, a Finnish company investing and operating in China may confront many different codes of conducts it has to adjust itself to, not only on everyday business but also in issues related to environmental management.

In order to systematically manage and improve the environmental aspects of the production processes, many organizations worldwide have implemented Environmental Management System (EMS) as part of their everyday management. The company must consider both its internal processes and understand legal and cultural differences. This thesis studies those factors and describes the needed actions in order to integrate the ISO 14001 -based EMS with existing Quality Management System (QMS) in a Finnish company operating in China. The main target was to create the management system

through which the company can follow up, control and improve its environmental performance, and thus support sustainable development.

2 Target organization

The thesis is commissioned by The Switch, a Finnish new technology company. During the study, an environmental management system (EMS) according to ISO 14001 standard was taken in use in their China operations.

The Switch was established in the year 2006, when Verteco, Rotatek Finland and an American company Youtility combined their forces. On the wind power sector, the founders focused to the development and to the creation of the permanent magnet generators and full-power converters. The other major operators did not use those techniques at that time. Today those techniques are widely used in the new wind turbine models.

The Switch is headquartered in Vantaa, Finland. The Switch is divided into operation units, which are

- High Power Converters (Vaasa, Finland)
- Electrical Machines (Lappeenranta, Finland)
- Controls and Converters (Hudson, New Hampshire, USA)
- China operations (Lu'an, Beijing and Hangzhou, China).

In addition, The Switch has several sales offices. At the end of 2010, the company had about 270 employees around the world and net sales of EUR 130 million with 5,000 MW of installed wind power capacity.

The main products The Switch supplies are the megawatt-class permanent magnet generators (PMG) and full-power converter packages (FPC). The Switch also manufactures industrial applications like solid rotor motors for high-speed applications and permanent magnet motors and generators for low- or medium-speed applications. [5.]

Wind turbine manufacturers form the biggest customer sector. These customers use the products and systems of The Switch as part of their own machines or systems in renewable energy applications. Because the main customers and partners are currently Chinese, the presence in China is important. In 2008, The Switch opened a production plant in Lu'an, China. Some other functions like marketing, sourcing and after sales are located in Hangzhou or in Beijing. Most of the products are manufactured in Finland, but for some products, mass production has started also in China. In addition, if the demand exceeds own production capacity, production is contracted out to partners.

One of the values of The Switch is "Care for environment" and in this value The Switch says, "We are constantly mindful of the fragile balance between ecology and productivity". On February 3, 2011 President of the Republic of Finland, Tarja Halonen granted the 2010 Internationalization Award of the President of the Republic to The Switch. This award can be presented to a company or community that has actively participated in developing international Finland. In her speech [6], The President said; "It is gratifying that the companies have in recent years taken a more active role in carrying of environmental and social responsibilities. This is also one of the criteria for Internationalization award".

On March 2011, The Switch and American Superconductor Corporation announced that AMSC intends to acquire The Switch at 190 MEUR. Closing of the transaction was expected by August 31, 2011 but was later extended to the end of September 2011, with the option for two additional 30-day extensions [7].

3 Environmental management standard ISO 14001

3.1 Background

ISO 14001 has become the world's best-known environmental management systems standard. The first version of ISO 14001 was published in 1996. It was adapted quickly in Europe. At that time, Europe had the largest number of certified companies according to the ISO 9000 series, which is a standard very

similar in structure and procedure to the ISO 14001. [8, pg. 7 - 8.] In recent years, ISO 14001 standard has become quite popular in developing countries too.

Environmental problems were noticed long before this international standard was published. The creation of Environmental Management Systems (EMS) goes back to the 1980s and 1990s when the intense environmental activism convinced industry leaders of the need for them. At first different corporations developed their own policy statements and EMS. Haufler writes in her study that e.g. government regulators saw those systems to be inadequate as there was no standard against which the performance could be assessed. That gave cause to some governments to develop their own national standards in order to increase comparability and accountability. [8, pg. 7 - 8.] The best known were the British Standard BS7750 (published in 1992 and withdrawn in 1997) and the European Union's own regional Eco-Management and Audit Scheme, better known as EMAS (introduced by EC Regulation 1836/93, repealed by regulation [EC] No 761/2001).

The different approaches to environmental management and the upcoming UN Conference on Environment and Development in Rio made the political environment ready for negotiations over international EMS standard. There was a need to have a common standard against which the environmental performance could be assessed. In addition, trade politics had its influence on the situation. Especially the U.S. government was afraid that EMAS could become a technical barrier to free trade. The U.S. government and some influential industry interest groups supported the International Organization for Standardization (ISO) to develop international EMS standard as it had developed the ISO 9001 quality standard with great success a few years earlier and it was seen to have a wide enough perspective as a non-governmental network. [8, pg. 8.]

The work of International Organization for Standardization is contributed through member institutes in 160 countries. These institutes may represent the private sector or they are part of the governmental structure of their countries or

are mandated by their government. [9.] In Finland, members of the Finnish Standards Association (SFS) include both professional, commercial and industrial organizations and the state of Finland, which is represented by the ministries, whereas China is represented by Standardization Administration of the People's Republic of China (SAC), authorized by the State Council of the PRC. These different approaches have left their mark to the ISO 14001 standard.

The standard needed to be suitable for every enterprise or organization in every country, and accepted by the industry, not only by governments [8, pg.7]. The ISO solved this problematic with process approach and launched the standard, which provides “a framework for a holistic, strategic approach to the organization's environmental policy, plans and actions” [10]. Unlike technical standards, it does not provide answers to the questions “how to solve it” or “how to do it” nor does it give any common timeframes or limits. Gleckman and Krut quote the statement of Joe Cascio, IBM executive and then Chairman of the US Technical Advisory Group on 14001, where he said that he “did not care how much waste an ISO-certified firm dumps into a river. What is important is that the company's EMS knows that it has happened”. [11, pg. 54.] Though this approach has been used as an argument against the ISO 14001, it is clear that improvements are hard to implement if the current situation is not known. Each organization should build its' EMS from its own perspective and challenge itself to do even better than required.

3.2 The main principles of ISO 14001

Being aware of the possible environmental impacts allows the organization to react in time and most preferably be proactive. The main idea of the ISO 14001 is to improve environmental protection systematically starting from the present situation. Therefore, it is important to gain the general impression of all operations and their environmental performance at the early stage of the project by performing a so-called initial environmental review. This initial review is not required by the standard but it is recommended for an organization that has no

EMS experience. Organization should study its past and current environmental performance, find out the knowledge over applicable legislation or other requirements and estimate possible environmental aspects and impacts. The Initial Environmental Review is not considered as a formal internal audit though it provides a possible task list for the EMS implementation.

The standard is based on the same methodology as ISO 9001, which is so called PDCA cycle for Plan, Do, Check, Act also known as Deming cycle. In the ISO 14001, those elements are called planning, implementation and operation, checking and management review. In addition, the ISO 14001 gives high importance to environmental policy. These five elements presented in the ISO 14001 are intended to result in continuous improvement of environmental performance (Figure 1).

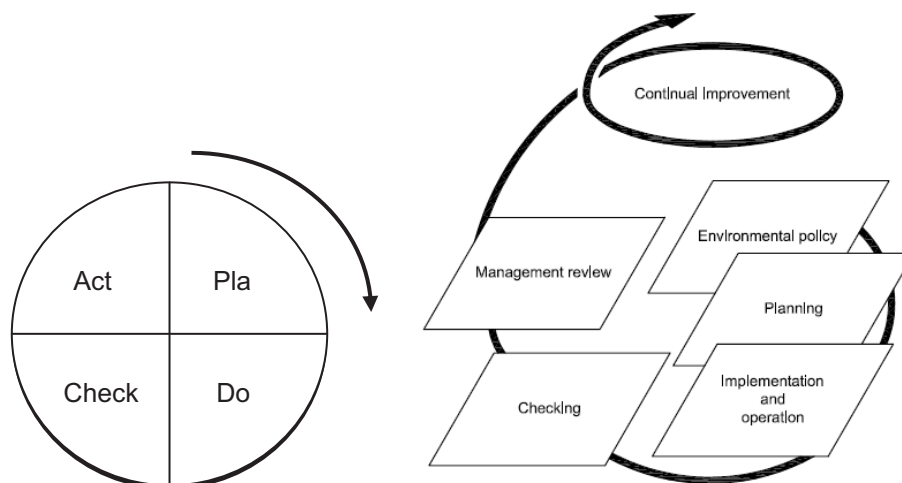


Figure 1. The methodology known as Plan-Do-Check-Act (PDCA) and the same approach in ISO 14001 -standard [12].

The first element of the ISO 14001 is environmental policy. The standard gives some requirements of what it should contain, the main requirement, however, being the commitment to continual improvement and prevention of pollution. This commitment needs to be formally expressed by top management, normally named as the company's environmental policy. An ideal environmental policy contains the key commitments, is easily understood and, as the standard defines, is appropriate to the nature, scale and environmental impacts of the company's activities, products and services. From practical point of view, the

policy should not be longer than one sheet (A4) of paper. Otherwise, the core of the policy might come unclear.

The planning element requires the organization to identify the environmental aspects in its activities that it can control directly and the ones it can influence, and to take actions according to the significance of these aspects. As the standard uses the word “influence”, the organization needs to consider also those aspects that are not directly under its control. This can also be described as “looking one step back and one step forward” method. The transportation methods of the goods and the selection of purchased components and their suppliers are examples of those aspects.

The ISO 14001 defines environmental aspects as elements of an organization's activities, products and services that can interact with the environment. Changes to the environment that result wholly or partially from those environmental aspects are called environmental impacts. Significant environmental aspects are those that have the most severe environmental impacts from the organization point of view. The standard requires organization to identify the environmental aspects it can control and the ones that it can influence. To do so, a systematic identification procedure is needed. The standard gives to the organization quite free hands on how to identify the environmental aspects and their significance, but in its appendix A, it encourages the organization to establish the criteria and a method for determining significant environmental aspects beforehand.

As an example, University of Jyväskylä [13] made its Initiative Environmental Review by using the method where they reviewed separately every department and service provider. They listed the activities of the selected part of organization, named the aspects of each activity, described the impact of each aspect, defined how potential the impact is to cause environmental harm (high, medium or low potential) and made suggestions for improvement. This method is good for organizations that do not have actual manufacturing processes. However, if the organization has many environmental aspects, as is the case in

many industrial sectors, it might be difficult to determine which of the identified aspects are the most significant.

Another method that could be used is similar to Failure Mode and Effects Analysis (FMEA), method used widely e.g. in product design, where severity (S), occurrence (O) and detection (D) of the potential failure are rated, in order to calculate risk priority number (RPN). This type of approach is good for organizations that have clear environmental risks in their operations and that have implemented data collecting systems and measures into their processes so that the limits for each level can be set. An organization may also have other evaluation criteria against which they wish to evaluate the impact as long as the criteria is appropriate to the nature of the business. In order to promote continual improvement, the organization is required to establish an environmental program in which among other things the significant environmental aspects are noted. The environmental program has to include clear objectives and targets that are measurable, achievable and realistic and time bound.

The ISO 14001 requires complying with applicable legal requirements, but as the standard does not set any common limits, two ISO 14001 certified companies located in separate countries may have very different ways to control their environmental impacts and still they keep the laws as possible limits e.g. for emissions may not be the same. The legislation changes from time to time in every country, in some countries it may differ even between different regions of the country. The organization needs to be aware of applicable laws and adjust their behavior accordingly. The legal requirements are not the only thing that needs to be taken into account. An organization may have other, voluntary requirements they have to comply with, like requirements of trade associations, agreements with customers, voluntary principles or codes of practice, agreements with community groups or non-governmental organizations etc. Those should also be taken into account within the EMS. An organization should not make any environmental promises without full commitment.

Implementation and operation element of the ISO 14001 requires the organization to implement methods to control environmental impacts. The actions and methods to do so are to be set by the organization itself. This could mean written procedures, process descriptions, the use of the best available techniques and trainings. Implementing any new procedure into action can cause resistance among employees [14, pg. 88]. There is no exception when implementing the EMS. Training only the new procedures may not lead into the desired outcome. Employees need to have sufficient understanding over environment-related issues, not just procedures to follow. Environmental awareness improves motivation to consider environmental aspects in work as well as in everyday life. The standard requires the organization to take in use methods for internal and external communications. It also requires that the organization has to decide “whether to communicate externally about its significant environmental aspects, and shall document its decision”. The ISO 14001 leaves this decision to the organization. The idea is to voluntarily increase openness, which helps lessen the possible irrelevant concerns of the interested parties.

The checking element requires the organization to monitor and measure its processes against environmental policy, objectives, targets, legal and other requirements it has set to itself or it is required to comply with. The organization needs to report the results. The required procedures like controlling records, dealing with nonconformity(ies), taking corrective and preventative actions and conducting internal audits are similar to those of the ISO 9001. The only difference is the point of view and that the organization needs to define the methods itself. For example, the standard advises in appendix A that “persons conducting the audit should be competent and in a position to do so impartially and objectively”. The standard does not state how the competence should be obtained. These first party i.e. internal audits are the organization’s own way to control that the system fulfills the requirements of the applied standard or other conditions the organization adheres to or has set to itself. The organization can decide the audit procedures itself. It can be done according to a preplanned checklist or the audit can be outsourced for instance to a specialized consulting company. If the organization is heading for certification, the audits should be

done against the requirements of the standard. Later methods that are more flexible might give more value for continual improvement.

The last element of the ISO 14001 is called management review. The standard emphasizes management responsibility and requires the top management to review and set actions in order to ensure the continuing suitability, adequacy and effectiveness of the EMS. The management is emphasized to show example and to allocate the needed resources in order to promote continual development.

Section 4.6 in ISO 14001 states: "Top management shall review the organization's environmental management system, at planned intervals." The standard contains informative annex A, in which the top management is clarified as "person or group of people who direct and control an organization at the highest level". For a small company this definition is clear but for a company having multiple somewhat independently operating units, the meaning of "the top management" should be considered carefully. If the person or persons having the management review are too far from the everyday operations, the decision making in management review may easily become too theoretical or may not get due attention. On the other hand, if the reviews are held only at local level it should be considered if the local management has the needed resources and authority to carry out the needed actions.

3.3 Benefits of EMS implementation

Depending on the organization's line on business the systematic approach presented in the standard can benefit the organization in several ways. The company may improve resource and operational efficiency and thus gain economic benefits e.g. by reduced waste generation and lowered energy consumption. When environmental aspects are considered at all stages of a product or a service production, and especially in planning phase, the environmental impacts can be minimized more easily. Metal product can be designed for easy machining, which minimizes the use of raw material and

energy. R&D may focus on research to find materials and methods that do not have severe environmental impacts. Design may select components that are easy to recycle though compromising may be needed. Sometimes the product quality and environmental friendliness may clash. The longer lifetime of the component with some environmental impact that is treated accordingly, can be better than environmentally friendly component with a short lifetime.

The EMS also improves the organization's preparedness to pay attention to legal and other commitments. The organization has to implement a systematic way to fulfill this requirement. Laws and regulations, especially new ones, are easily overlooked, if there is no process assuring knowledge of their existence and impact. In a country like China, where environmental legislation is new and badly known, this is an important factor.

An organization can get competitive advantage and new business opportunities may emerge when the organization can demonstrate environmental excellence to major stakeholders. If the organization fulfills the ISO 14001 requirements, a certificate can be granted by an independent auditing organization. The certification of EMS is not obligatory by the standard, but in some industry areas, the certificate is mandatory to having a business. For instance, Nokia requires [15] its suppliers' EMS to be certified as compliant with ISO14001 or Eco-Management and Audit Scheme (EMAS) whereas KONE corporation requires [16] its suppliers to comply with its own requirements that are very much alike with those stated in ISO 14001 standard. Price and quality have always been a part of commercial negotiations whereas environmental issues are only now starting to make real significance in those. Nevertheless, the organization should always consider what kind of extra value the certificate actually gives. Especially SME's may not be willing to implement EMS because of the certification expenses. Though a customer may require ISO 14001 certification, there might be the possibility that the customer could make the audit and that way verify the compliance, especially if the production of the company does not have any severe environmental risks.

4 Purpose of the study and research methods

4.1 Tasks set and research methods

This thesis focuses on the development of Environmental Management System (EMS) in The Switch China operations according the ISO 14001 standard. The task was to integrate EMS with the existing ISO 9001 certified Quality Management System (QMS).

The top management of The Switch decided to take the EMS first in use in China operations, as most of the company's current customers are located in China. In addition, sourcing of components from Chinese manufactures and after sales plays an important role. R&D and design of the products were not considered, as those operations were not performed in China.

The first plan was created in July 2010 (Appendix 1, in Finnish). The actual project start was in October 2010 and the overall target was to have the EMS ready for certification audit by the end of March 2011. The weekly schedule is presented in Appendix 2. These schedules include those tasks that were preliminarily seen necessary in order to integrate ISO 14001 with the existing quality management system within target time.

The study was carried out as an action research using literature and participant observation as methods. Avison et al. [17, pg.1] describe action research to be "unique in the way it associates research and practice, so research informs practice and practice informs research synergistically". Action research targets to change and especially improve current methods. This method also supports the situation where a lot of background information is still being studied, when at the same time, new practices are taken in use. This method was practical in this thesis as the schedule of the project was tight and majority of the employees did not have any knowledge of the ISO 14001 requirements. In order to implement the system efficiently it is a necessity to understand not only the ISO 14001 requirement but also the operation environment, local infrastructure and environment management practices, environmental laws and regulations and

expectations of customers and other interested parties. These were studied throughout the project and noted in the EMS integration. New procedures were created mainly by the author, based on the discussions with the management and employees of the Switch and on the study of the operation environment.

During the project, two visits were made to Lu'an, Beijing and Helsinki. Vaasa and Hangzhou were visited once. Visits to China gave the opportunity to participant observation, which was essential for the study. Discussions with Quality Manager and other related persons were ongoing throughout the project. Because of the time difference (Finland + 2 GMT, China +8 GMT), e-mail was the main method for communication and giving guidance to the responsible people in China.

4.2 Study objectives

The overall objective of the study was to gain ISO 14001 standard compliance and integrate needed procedures into practice first in China operations, later in other locations. The main question asked in this study is can the same systematics work in China as in Finland. To answer that also the following questions needs to be answered:

- What are the main elements to be noticed when integrating ISO 14001 into existing ISO 9001 based QMS?
- How does the local infrastructure support the environmental activities?
- What is the market environment of the company and what are the demands and expectations of interested parties?
- What kind of environmental aspects does the wind power related technology have?
- What kind of Chinese legislative requirements are affecting this particular organization?

4.3 Research material

To ensure objectivity, the research material represents many different perspectives. The material consists of both scientific articles as magazine articles, published research studies, the Chinese and the Finnish government official communication channels etc. The material was obtained mainly through Internet. The licensed e-resources were obtained via library services of UEF (University of Eastern Finland) and NKUAS (North Karelia University of Applied Sciences).

4.4 The structure of the report

The study is a combination of research-based thesis and practice-based thesis. The actual knowledge base of this study is ISO 14001 standard including the benefits of EMS from general point of view. As the integration was done in Chinese environment, a lot of background information needed to be studied. That part of study represents the research-based thesis. First, the two major environmental challenges of China i.e. waste management and energy consumption are introduced. Then development of wind power in China and environmental aspects of related industry are studied. Finally, the legislative system of China and EMS development are introduced.

The practice-based part describes the actual integration process of EMS. It includes the evaluation of the starting situation and the descriptions of actions and documents that were made based on the collected information and requirements. The results are presented and analyzed. Finally, the whole study is reviewed and evaluated against the objectives.

5 Studying the operating environment

5.1 Waste management and recycling

Chinese rivers, lakes and ground water in some areas are heavily polluted. The lack of pure water is damaging the ecosystem and threatening the health of communities (Picture 1). The waterways are polluted not only by the industry leaks or by agriculture but also by the leaks from unmonitored dumping fields and sanitary landfill sites [18, pg. 1].

Mix collection is still the most common way to collect municipal solid waste (MSW). As there is no formal collection for hazardous waste, it is also discarded as any MSW. Segregation of MSW is mainly arranged in big cities like Beijing, Hangzhou and Shanghai. Lu'an belongs to those cities of Anhui Province, where standardized waste processing is in practice. However, in many other areas of Anhui Province, the hygienic level of waste treatment is still under development: the needed infrastructure may exist but often they are poorly managed and waste sorting is not properly carried out. [18, pg. 1.] The general understanding of the health hazards related to waste incineration is poor, especially at the lower income group of people [18, pg. 4].



Picture 1. River water is used in agriculture though its quality is known to be weak. (Picture: Sari Pikkarainen)

While in Finland, the consumers are guided to put different recyclable articles to separate recycling bins (paper, cardboard, plastics, metals etc.) in China the waste is put to normal waste bin or to bins marked as “recyclable” or “non-recyclable”. The actual segregation, if any, is done at the special segregation facilities. Recycling in China is mainly done in another traditional way. Peddlers make their living by collecting recyclable materials (paper, plastics, cardboard, glass, metal etc.) from streets, dumpsites, landfills, bins or buying recyclable articles straight from consumers and companies (Picture 2). The collected material is then resold as raw material to other companies.



Picture 2. Peddler in Nanjing. Recyclable material is collected in traditional ways. (Picture: Raimo Lewing)

The waste processing and recycling of electronics is also done through informal recycling businesses. The used techniques in dismantling are often inappropriate causing occupational health hazards, severe environmental impacts and losses of valuable materials [19, pg. 41]. The environmental impacts come out as very high levels of heavy metals and organic contaminants in samples of dust, soil, river sediment, surface water and ground water [20, pg. 22]. The Chinese WEEE-recycling industry is one of the biggest worldwide. There are attempts to better collection, disassembly and material recovery systems but the progress is slow. The informal recycling is cheaper than formal recycling industry. [19, pg. 40.]

5.2 Energy consumption in China

China is a huge economy. The number of Chinese large-scale enterprises, with their annual business incomes above 5 million RMB (over 560000 EUR in 2011), is 434 000 [21]. In addition, People's Daily Online reported in August 2010 that according Ministry of Industry and Information Technology (MIIT) of the PCR, the number of SMEs has exceeded 10 million [22].

The economic growth is highly dependent on electricity. In 2010, China's electricity consumption grew almost 15 %, being over 4.19 TWh [23]. The high consumption levels of petroleum, natural gas and coal may lead to serious energy shortage [24]. The World Bank states that the use of energy in China is inefficient as for many industrial processes China uses 20 - 100 percent more energy than OECD countries [2].

5.3 Wind power as market area in China

In its 2010 report, U.S. Energy Information Administration (EIA) estimates that China is going to increase its coal-fired electricity 736 GW by the year 2035 [25, pg. 63]. Though China continues to use coal as its primary energy source, they are also constantly looking for alternatives to relieve the shortage of energy supplies and high priority is given to renewable energy resources [26].

China Electricity Council (CEC) reported that about 26 % of China's installed power generating capacity in 2010 represented the non-fossil sector; 213 million kilowatts hydropower, 10.82 million kilowatts nuclear power and 31.07 million kilowatts wind power [23]. Global Wind Energy Council (GWEC) report 2010 gives even higher figures, and estimated that China's total installed wind power capacity will reach around 40 GW at the end of the year 2010 [27, pg.25]. The authorized government portal site to China, China.org.cn reported in March 2011 that according to Chinese Wind Energy Association China has 34,485 wind turbines up and running with installed capacity reaching more than 44.7

GW by 2010 [28]. Whatever the correct number of capacity is, based just on these numbers the growth has been remarkable.

The use of green technology is promoted successfully; especially wind power development in China has surprised all specialists, researchers and wind power industry itself. The article at China.org.cn mentioned also that China reassesses its nuclear energy development plan following Japan's earthquake triggered nuclear crisis. Together with new energy saving and environment protection targets, it might “give a boost to the country's clean-energy industries especially wind and solar power”. [28.]

American wind energy association recommends that a potential wind power site should have a minimum annual average wind speed of 4.9 – 5.8 m/s (11 - 13 mph) [29, pg. 1]. China is plentiful of that kind of wind resources and installed more wind power capacity than any other country in the world. The Chinese wind farms are established along the long east coast of China and especially on the plains of northern China, in Inner Mongolia.

This remarkable growth is enabled by the renewable energy law [30] passed by the National People's Congress permanent committee in 2006. The law was made as the PRC congress wanted to promote the use and production of non-fossil energy. The law requires the Chinese energy companies to purchase all the electricity produced by the renewable energy sector. This contributed the rapid growth of the Chinese wind industry; market grew by 60% in the year the law was passed [28, pg. 23], and has grown ever since. By the end of 2009, China had almost 80 wind turbine manufacturers [28, pg. 24].

China's government supports renewable energy projects financially by development funds, preferential loans and tax benefits. These financial benefits are committed according the renewable energy law [30] to the projects that are listed in the renewable energy industrial development guidance catalogue and that conform to the other required conditions. One of the conditions is issued in an announcement called “Management Regulations on Special Fund for Wind Power Manufacturing Sector in China” given by the Ministry of Finance in 2008.

The fourth qualification criteria of chapter III rules; “The wind turbine component of blades, gearboxes and generators must be manufactured by Chinese companies or Chinese controlled stock companies. Convertors and bearings manufacturing are encouraged”. [31.] Some interested groups have seen this fund for wind power manufacturing to be against the WTO rules. In December 2010, United States requested consultations with China under the dispute settlement provisions of the World Trade Organization [32].

Despite China’s internal promotion to wind power industry problems exist. In his foreword at the 2010 China Wind Power Outlook [33, pg. 7] Zhu Junsheng, President of Chinese Renewable Energy Industries Association says

With less than 10 years’ experience in wind power development and no more than 5 years’ experience in the installation and operation of large-scale wind turbine generator systems, China is still unable to guarantee the reliability of the systems or declare that the development speed of its wind power market is definitely impressive.

Though the wind energy resources are very plentiful in many parts of China, the geographical distribution of these resources is mismatched with the country’s electrical load [33, pg. 12 - 13]. The electricity grid infrastructure is weak and very distant being unable to absorb more wind power. Therefore, only a part of this capacity is able to access power transmission and distribution networks. That has caused situations where some Chinese wind farms have been working below their potential capacity and some turbines have been out of operation since day one of their construction. [33, pg. 67.]

Although wind power may never be the primary source of electricity, it is a good addition to the other traditional energy resources in all windy regions. The use of renewable wind energy has positive environmental impacts, but as in any other industry sector, there are many more or less negative impacts to be considered when evaluating the whole production chain. The public see the high towers and long blades, but the real process by which the wind is used to generate electricity is inside that turbine. From the environmental point of view that mechanism does not differ much from any other combination of a mechanical device and electronics that needs to be trustworthy in demanding conditions.

China has increased its wind energy production first with the western technology and now increasingly by its own solutions. Though the growth has been remarkable, problems exist. The conditions in windy areas are challenging, the current grid is weak and there is a geographical mismatch between need for energy and the production possibilities. The customers of The Switch, i.e. OEMs and system integrators in distributed power production, are requiring efficient and reliable solutions. There are no direct demands on environmental affairs. However, especially in Europe and in the U.S. there are environmental activist groups that are questioning the whole life cycle of the wind power production. In order to have as small carbon footprint as possible the whole supply chain needs to be selected and managed carefully.

5.4 Environmental aspects of wind power

Wind generated electricity has benefits compared to many other forms of electricity production. Wind electricity itself is produced without carbon dioxide (CO₂) emissions and without causing particulate matter (PM) into the air. Even the fact that wind turbines do not require water can be seen as a beneficial aspect in China where clean water is becoming a rarity. When wind energy is used to replace fossil energy sources, it reduces the levels of carbon dioxide (CO₂) emitted into the atmosphere. The use of fossil fuels always requires mining or drilling which may have serious effects on the environment. In addition, the storage and possible treatment of hazardous waste is a concern.

As a clean process, the generation of wind power does not cause particulate matter (PM) into the air. In Asia, coal burning is estimated to cause more than 50,000 premature deaths and 400,000 new cases of chronic bronchitis every year [34]. The energy production by fossil fuel burning in power plants is not the only reason for this problem. The smallest sizes of particulate matter, PM₁₀ and PM_{2.5}, are generated also by industrial outputs and motor vehicles (Picture 3).



Picture 3. Coal-fired power plants and large industrial areas are a common view in the horizon of Chinese roads (Picture: Sari Pikkarainen)

Wind power is generally supported by the public, but e.g. in Finland many projects are postponed because of the concerns of possible impacts to the nature itself or to local residence. Birds and bats have been in special focus. The studies to avoid conflicts between birds and wind turbines are constantly ongoing and though collisions may never be totally avoided, the researchers have found some ways to decrease the risk.

Michael-Otto-Institute within NABU - Research and Education Centre for Wetlands and Bird Protection in Germany, studied collisions for several years. In their final report they found several possibilities to make the wind farms as unattractive for red kites (*Milvus milvus*), which is one of the predators most in danger to collision in central Europe. According to the study, no harvesting or mowing of field crops should take place in wind farms before the middle of July and fallow vegetation should not be mown at all. In addition, the tower bases should be made unattractive for foraging Red Kites and should be kept as small as possible, and the wind farms should keep a distance to nest sites of at least 1000 m. [35, pg. 20.]

Wind turbines may be clamored against because residents may be concerned over the view of surroundings and fear the negative influence to the property values. The noise of the blades is considered a problem though new designs of

wind turbines have made them more silent than the first ones in the 1980's. In China, these kinds of concerns do not seem to exist in public. In China, the wind parks are mainly constructed to the sparsely populated areas, because those are also the areas, where wind resources are plenty (Picture 4). In addition, the east coast of China is a potential area for wind power parks, right next to Chinese metropolises.



Picture 4. Chinese wind parks are located mainly at sparsely populated areas e.g. in Turpan, Xinjiang. (Picture: Raimo Lewing)

5.5 Environmental aspects of the electrical equipment manufacturing

From the generator and other electronic equipment manufacturer point of view there is not much that can be done in order to minimize the negative impacts of wind power usage. In fact, the more efficient and reliable that equipment is, more this cleaner energy can be produced. When observing the whole supply chain some drawbacks can naturally be pointed out as in any industry. The impacts that should be considered are related to the quality of the components, to production and facilities, to supply chain management and to logistics.

For any company that outsources electronic components or surface treatment services, the supply chain management has a significant role, not only from economic and quality point of view but also from the environmental point of view. Surface treatment processes like zinc coating, chrome plating and electroplated coatings of tin use significant amount of energy and toxic chemicals and those processes need to be controlled with utmost care.

The most important metals in electronic products are iron, copper, aluminum, lead and small amounts of precious metals such as gold and platinum. Lately the use of so-called rare earths has been seen as an environmental disadvantage of electronics.

These rare earths, lanthanides and transition metals (atomic numbers from 57 to 71, 39 and 21) are not rare at all, but they are not found free in nature. The mining and the refining process of these rare earths uses toxic chemicals, acids, sulfates and ammonia. Earlier especially in the U.S. California and in Australia were areas where those minerals were mined. The mining at those areas was stopped about a decade ago as the mining and processing was seen environmentally risky. In addition, it was becoming uneconomical because the price of Chinese rare earths dropped. In 2009, almost 100% of the world's rare earth metals and over 97% of the rare earth oxides are produced in China [36] and many mining areas in China are severely polluted.

The use of rare earth has been seen as an environmental disadvantage of wind power. Especially neodymium magnets, which are the most efficient, are used in demanding solutions like in wind turbine generators. Powerful permanent magnets secure high efficiency especially at low and medium wind speeds and thus make wind power production more stable.

Dent and Walmer [36, pg. 57] describe rare earths as "backbone of numerous defense and "green" technologies". Because of their exceptional characteristics like high electrical conductivity, these metals are commonly used e.g. in disc drives, personal electronic devices, power tools, electrified vehicles, in energy saving light bulbs and in permanent magnets. According Reuters [37], Xu Shaoshi, the Minister of Land and Resources of the PRC, has said on a webcast on the ministry's website that China will "strengthen the supervision and management of mineral resources mining ... and deepen control over rare earth mining capacity and extraction". China has reduced the amount of exported rare earths significantly and more limitations may come. It means that if countries outside China want to continue producing e.g. green technologies, new mining areas outside China are required. [38]. The development may have

some impact to The Switch. In order to overcome these difficulties The Switch has created strong cooperation with the Chinese state-owned Dong Fang Electrical Machinery (DFEM) Corporation, which has guaranteed availability of Neodymium materials for permanent magnets. On the other hand, The Switch has done intense research and development to reduce the amount of magnets needed for the production of permanent magnet generators. [39.]

5.6 Legislative system of China

5.6.1 History

The entire legislative system of China is relatively new. The People's Republic of China (PRC) was proclaimed on October 1, 1949 and the constitution was put in force in 1954. At the early years of the PRC, the environmental policy had been addressing issues like flood control and hydropower construction. Then during Mao's Cultural Revolution (1966-1976), the entire legal system was demolished.

The United Nations' first international environmental conference, the Stockholm Conference on Human Environment, was held in 1972. That conference marked a turning point in the development of international environmental politics. According to Ferris and Zhang [40, pg. 2], in early 1970s' the majority of Chinese officials felt that "A socialist nation does not suffer from the environmental ills of capitalism" and therefore China almost refused to attend to the Stockholm Conference.

In the same year 1972, China suffered three major water pollution accidents, one of them being in the Guanting Reservoir, which was at that time used as a main water supply for Beijing. High concentrations of As, Cr and Hg in the water caused fish to die and people drinking the water became sick. [41, pg. 568.]

China held its first national conference on environment protection in 1973 and formed the Environmental Protection Leadership Commission to manage and

coordinate national environmental tasks. In 1978, China amended its constitution to add the following statement: “The state protects the environment and natural resources, and prevents and controls pollution and other public hazards.” [42, pg. 10153.]

5.6.2 China’s environmental legislation and EMS

As described in the previous chapter the Chinese legislation is relatively new whereas the legislation of Finland goes back to the 18th century, the oldest code being (partly) effective is from the year 1734. The first actual environmental law of Finland is Nature Conservation Act, enacted the first time in 1923, and renewed in 1996. Year 1979 is considered the year when China began the real development towards its current legislative system. One of the first laws China adopted for trial implementation in 1979 was in fact the Environmental Protection Law. However, it was promulgated effective only a decade later, on December 26, 1989. [42, pg. 10153.]

After this slow start, there have been many positive indications that China is striving to improve its environmental management. China takes actively part in international environmental meetings and has ratified 17 international environmental agreements [43]. China has enacted tens of environmental protection (and related) laws that supplement Environmental Protection Law. These laws include the Prevention and Control of Water Pollution, the Prevention and Control of Air Pollution, the Prevention and Control of Environmental Pollution by Solid Wastes, Mineral Resources Law, Water Resources Law, Law on Water and Soil Conservation and so on, targeting to outline goals, policies and requirements. Furthermore, China has enacted administrative decrees regarding environmental protection. Those administrative degrees deal with noise pollution, nature reserves, prevention of and protection against radiation from radioisotopes and radioactive devices, safe administration of chemicals and other dangerous materials. A number of administrative rules and decrees on environmental protection have also been issued by departments concerned. [44, pg. 15.]

In order to implement those laws and regulations in action people's congresses and people's governments at local levels need to enact and promulgate local laws and standards on environmental protection. Though hundreds of those have already in place, some areas remain uncovered or some contents are yet to be amended or revised. [44, pg. 16.]

In addition, China promotes voluntary measures like implementation of environmental management system according to ISO 14001 standard. According The ISO survey of certifications 2009 China has over 55300 ISO 14001 certificates, which is almost a quarter of all valid certificates in the world [45]. Fryxell et al. (2004) saw ISO 14001 having an important supporting role in addressing environmental damage in China. According to their study the main drivers for certification in China was to ensure regulatory compliance, to enhance the firm's reputation and to improve environmental performance. [46, pg. 239.]

Nevertheless, during the past couple of years, China has been facing an increasing frequency of accidental pollution events and it seems that the legislative system is not helping the situation [47]. Xin Qiu and Honglin Li describe the overall situation widely in their article "China's Environmental Super Ministry Reform: Background, Challenges, and the Future". They find the current legislation being too vague, having too much flexibility and lacking feasibility. The cooperation between Beijing and the provinces is not working and the different ministries have overlapping authorities. [42, pg. 10161 - 10162.] In addition, Qiu and Li think that China's traditional Confucian philosophy has major influence both in everyday life and in politics. They refer to the Confucius quotes "everyone has his role in a hierarchy and he should behave accordingly" and "every affair, regardless of importance, should be decided by the superior". [42, pg. 10156.]

In brief the legislative system of the PRC is as follows: The National People's Congress enacts the laws, provincial and local governments take responsibility for their enforcement, the administrative departments in charge of environmental protection exercise overall supervision and administration and

the various departments concerned exercise supervision and administration according to the stipulations of the law. The system seems adequate, but because in China local environmental improvement projects are funded solely by the local government, especially local reluctance may exist. [44, pg. 16.] As local governments are more focused on developing the economy and increasing local tax revenue income, environmental quality may be often sacrificed to pursue fast gross domestic product growth [43, pg. 10161]. Though it is allowed and encouraged to do better than required by legislation it is not always possible.

Legislation does not guarantee sustainable development, neither in Finland nor in China. In China, the implementation seems to be very difficult. When the infrastructure (e.g. waste management, power supply) is weak, even the local environmental laws may be difficult to comply with. [48, pg. 1885.]

5.7 Initial review

It is important to gain the general impression of all operations and their environmental performance at the early stage of the project. Organization needs to study its past and current environmental performance, find out the knowledge over applicable legislation and other requirements and identify possible environmental aspects and impacts. This can be done by initial environmental review, which should not be considered as an audit though it provides a possible task list for EMS implementation.

The initial preview of this case started in September 2010 as desktop work and with a visit to Vaasa factory. Vaasa was selected as an excursion as similar products are manufactured there as in Lu'an. During that visit, e.g. invoices, current instructions and process descriptions, location and site maps were examined. In addition, relevant personnel were interviewed and observation round on site was conducted.

In order to get the general overview of China operations and their environmental aspects, a questionnaire called “Initial identification of environmental aspects” was created. The questionnaire was sent to a contact person of The Switch China in order to get the same information from their operations. Though the received information was vague (Appendix 3), it clarified the general situation: the volume of the production was significantly lower in China compared to Vaasa and the knowledge over environmental aspects and their impacts was weak. A more detailed review was needed at the locations.

The initial review of The Switch China operations was carried out during the visit in Lu’an and in Beijing in November 2010. The review included the size and development of The Switch China operations, initial review of environmental aspects, existing environmental management practices and procedures, legal and other requirements, evaluation of previous emergencies or accidents and the estimation of changes in operations. The review was carried out by examining appropriate documentation, site observations and discussions with relevant personnel.

5.7.1 Environmental management at The Switch China locations

Lu’an is located in western Anhui province, around 800 km west from Shanghai. The population of Lu’an city is about 6.8 million people. The Switch production plant is located at Lu’an economic and technological development zone. The premises, gross floor area 2 412 m², are rented from Lu’an Dongcheng Construction Co., Ltd. in July 2007 (Picture 5). Dongcheng Service Company manages the premises, but The Switch is responsible for the maintenance. There is also some clothing industry operating in the same building. At the time of review the personnel in Lu’an was 11. It was estimated that the number of personnel would increase slightly in 2011.

The premises are a typical industry building in that area. There is no central heating and the insulation of the building is poor. The average usage of electricity at the time was 1500 kWh/month and it was mainly used for heating and cooling of the premises with some air conditioners.



Picture 5. The entrance to the premises of The Switch Lu'an (Picture: Sari Pikkarainen)

During the planning phase of The Switch Lu'an, the report (in Chinese) called “the registration of the environmental influence of construction project” was created by a local environmental service company in March 2010. The report contains estimations of upcoming environmental aspects. According to the report, the planned operations will not have severe environmental impacts. The report was approved by the Lu'an Environmental Bureau and the permit to start the production was received. However, the report did not sufficiently cover the requirements of ISO 14001 when identifying the significant environmental aspects as the company needs to identify all environmental aspects it can control and the ones that it can influence.

In Lu'an facility, waste paper, cardboard and some plastics were sold to a peddler, who resells those to recycling companies. Recycled material did not include confidential papers as those were shredded. The metals were sold directly to a metal collecting company.

For production, only small amounts of chemical solvents were used. They were kept in a warehouse but their material safety data sheets (MSDS) were not available and the whole MSDS purpose was unknown to the employees.

The operations in Lu'an do not cause external noise or odors. As the factory is located in industrial zone, the transportations do not cause significant disturbance to the local neighbors. There have not been any actual demands, questions or concerns over environmental issues from the interested parties like neighbors, customers or investors.

The initial review of Hangzhou activities was conducted in Lu'an and the information was gathered through conversations. Hangzhou is one of the biggest cities in China with almost 9 million inhabitants. Hangzhou office is operating in serviced office at Huanglong International Business-World Trade Core Region. The tenants are not asked to do any recycling activities. There was no information over used electricity or water as they were included in the rent, based on the floor area of the office. At the time of the review, the number of personnel in Hangzhou office was five, however, the sourcing activities were expected to increase significantly due to local production growth. From the environmental point of view, it is important to select and use environmentally conscious suppliers. At the time of initial review, some general environmental issues were included in supplier evaluation and audit procedure.

In Beijing The Switch has rented office space for management, engineering and after sales purposes. There were no recycling activities in use except printers ink cartridges, which were returned to the manufacturer. Some papers were used from both sides or as note sheets but in the end all papers ended up as solid waste. According the personnel of Service & After Sales operations, customers in China have not indicated actual environmental concerns. However, some questions over handling of damaged components (e-waste) had been raised. In case of warranty, some components have been returned to The Switch, but the final destination of those was not solved. From the marketing point of view, it was seen beneficial to consider also the customer's customer when building up EMS. Chinese construction funds for the wind farms are more easily assigned to companies that use environmentally responsible suppliers. Calculating the carbon footprint of the whole supplier chain might also create new business opportunities for The Switch.

5.7.2 Initial document review

One part of the initial review was to check the QMS documentation from the environmental management point of view. At the time of the initial review, the Quality Management System (QMS) was in use and most units were already certified against ISO 9001:2008. Many existing QMS procedures were seen appropriate as platform when implementing EMS into practice, like document control, training principles, records system, internal audits, corrective and preventive action system and management reviews. Only minor changes if any were needed. In addition, some unique EMS documents were required.

The initial list of additional required documents / procedures:

- environmental policy and environmental programs including objectives and targets
- environmental aspects evaluation procedure and template
- list of legal and other relevant requirements, including how they effect on operations and how they are followed up
- external and internal communication procedures of environmental inquiries
- emergency preparedness, especially from environmental point of view
- procedures for subcontractors / suppliers e.g. environmental assessment procedures for supplier audits
- training-related instructions and presentations.

5.7.3 Summary of the initial preview

Though the Lu'an factory manufactured similar products as the Vaasa factory, the differences between these two facilities were obvious. The Lu'an factory was just starting up its mass production in full speed, and at the time of the review, the manufacturing zone was practically empty. The resources for EMS development were limited, as some other tasks needed more attention.

Furthermore, not all of the employees had access to computers and the connection to the company network was somewhat slow to work with.

The initial review showed that the environmental aspects of the operations are related to used materials, energy usage, transportations, waste and to the environmental impacts of the production itself (Figure 2). The aspect can be direct or indirect depending on whether the company can control it or not. Environmental impact can be adverse e.g. solid waste of production or beneficial like the fact that the products are used for generating renewable energy.

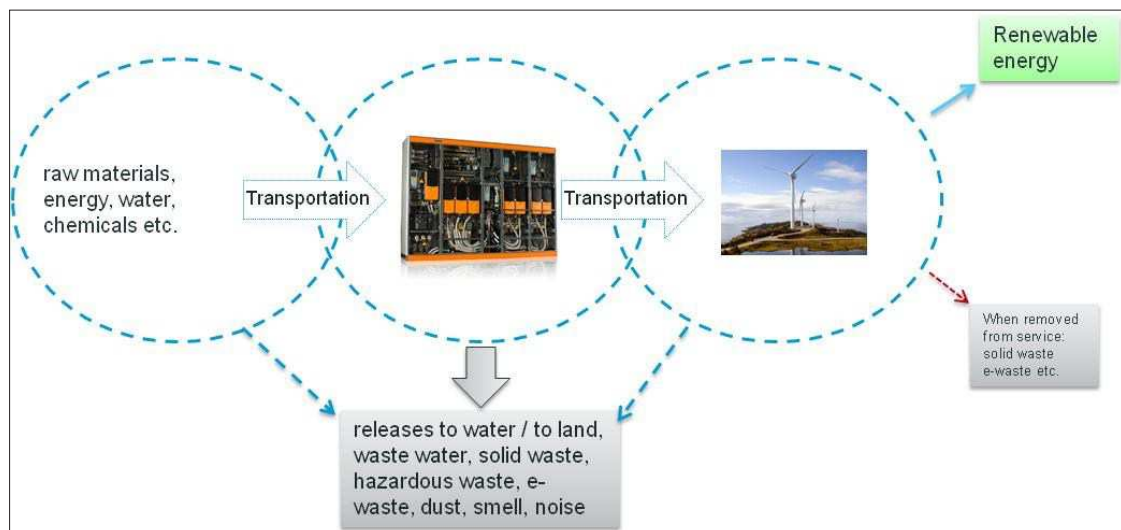


Figure 2. The principal description of the environmental aspects and impacts of The Switch China (Pictures: The Switch)

Procedures and data collecting methods were needed in order to get relevant and up-to-date information over environmental impacts. When the amount of production increases, the environmental impact may grow also. In addition, the following items were raised as possible action items:

- Amounts of different waste, energy consumption etc. environmental impacts should be collected systematically.
- General environmental trainings should be organized in order to increase the environmental awareness of the employees.
- The availability of material safety data sheets (MSDS) of the chemicals (solvents etc.) could be enquired from the supplier.

- Creating procedures needed to identify and prepare for environmental accidents and incidents.
- Questionnaire should be prepared in order to clarify supplier's environmental aspects.
- More emphasis should be put on environmental issues in supplier audit questionnaire.
- Environmental program including objectives and targets needs to be defined.
- Instructions concerning e-waste handling and/or recycling should be implemented in maintenance manual and in training material.

6 Integrating EMS with QMS

Based on observations and findings of operating environment related actions were taken. Actions included preparing documents and templates, preparing training material and performing actual trainings, internal auditing and corrective actions. Because of the tight schedule, many procedures were drafted in advance even before the initial environmental review.

6.1 Environmental policy

The ISO 14001 gives great importance to environmental policy. In the web page of The Switch, sustainability is one of the keywords. The Switch considers corporate responsibility as part of its business strategy. At the beginning of the project, this approach was seen e.g. in one of the values:

Care for environment

- Giving back
- Giving to others
- Green, renewable energy
- Keen sense of higher purpose

Answer the world's call for a cure – a New Energy response – that taps into renewable resources without burdening the environment.

We are constantly mindful of the fragile balance between ecology and productivity. And this challenges us to put more effort into all we do.

We have a keen sense of higher purpose; to work towards something that needs a lot of faith and long-term belief. Giving back to the environment in an authentic way means giving back to others... also within our everyday environment at the workplace... for a truly renewable future based on New Energy. [49.]

The existing business strategy along with the environmental related statements and principles presented on the company's website and other distributed material gave a good platform for EMS development but they were separate and did not fully satisfy the requirements set to the policy by the standard. Therefore, creation of environmental policy was the first task.

Though the system was implemented at this point only to China operations, the policy was created from the whole company's point of view and it was decided that the system is to be implemented to the other locations during 2011. The policy was formulated together with the management team of The Switch (Appendix 4), and after several drafts it was approved by the CEO in January 2011. The management team wanted the policy to reflect the company's values and the business environment. The heart of the policy is that The Switch is dedicated to providing energy solutions that help the environment.

6.2 Identifying significant environmental aspects

As the organization itself can decide the criteria it uses and as the manufacturing operations in Lu'an were in early stages, the instruction called "identification and evaluation of environmental aspects and programs"

(Appendix 5) and the template called “Identification and significance of environmental aspects” (Appendix 6) were created.

The identification was done using themes; water, soil, use of materials and natural resources, energy, radiation, vibration, heat, unpleasant odors and noise. Each theme was reviewed systematically. First, the activities were defined that have environmental aspects towards the selected theme. Each activity was reviewed in normal, abnormal, accident or emergency situations. Then their environmental aspects were identified as well as the actual environmental impact. Finally, the current procedure of that situation was reviewed. Each identified aspect was evaluated against five selected criteria (A to E), and points (1, 3 or 5) were given according to a predefined evaluation table (Table 1).

Table 1. Predefined criteria and their evaluation.

Criteria	Points given		
	1	3	5
A Possibility to generate complaints by interested parties	Low or no complaints expected in any circumstances	Some complaints expected in abnormal circumstances	Many complaints expected in abnormal circumstances
B Controlled and followed up	Continuous follow up and records	Information available but not systematically collected or followed up	No follow-up, situation unknown
C Level of environmental risk	Low and local risk Unlikely to happen,	Medium risk Possible to happen	High risk
D Influence on the company's public image	Insignificant	Local	National or wider
E Legal environmental or related requirements	None specific	General guidance	Direct limits or equivalent

The total points for each aspect were calculated by multiplying the given points. Those five (5) aspects that had the highest points were recognized as significant environmental aspects. They were taken into consideration in creation of the environmental program. At the time of the review, there was no data available over the selected criteria. Therefore, verbal descriptions were

used and the grading was done based on the discussions with employees. Later, when data is collected and available, the criteria can be modified. For some criteria, numerical limits can be added to the template, e.g. low number of complaints could mean less than 1 in 5 years. That way the evaluation becomes more objective.

The risk to use a supplier that may cause severe environmental impacts was rated as a significant environmental aspect. At the time of the review, The Switch had almost 30 active Chinese suppliers and service providers, and the number was increasing. The supplier selection process plays a key role in this aspect. The Switch sourcing organization has audited suppliers mainly from the quality point of view though the suppliers are also briefly questioned about their environmental management, and their RoHS and WEEE compliance. Overall, the supplier auditing is quite challenging in China, as it needs quite many resources and good negotiation skills. Some Chinese suppliers are not willing to open their manufacturing processes under review and some suppliers do not allow persons working for a foreign company to enter their production facilities even if they were Chinese citizens [50].

Handling of broken electronic components and other electric waste emerged as a significant environmental aspect both in Beijing and in Lu'an. The Switch is responsible for those components that break during the assembly phase at The Switch or during commissioning and warranty time in the possession of the customer. Electric waste can cause contamination of the soil or health hazard and the organization had very little knowledge of the WEEE-recycling possibilities in China. In addition, at the time of the evaluation there was no knowledge whether or not the components contain hazardous material.

At every location, some environmental improvement possibilities were found but when looking at the overall situation the supplier selection and auditing systematic was found to be the most significant environmental aspect for all Chinese locations at this point of time.

In its environmental program (Appendix 7), The Switch is going to boost its supplier management in order to have an environmentally responsible supplier base. The target is that one third of active suppliers are EMS audited and approved by the end of 2013.

6.3 Environmental trainings

In order to increase the environmental awareness of the employees, two environmental trainings were held. The first training was more an informative meeting that focused on the project itself. The second training focused on the environmental pollution and its effects in order to increase their understanding e.g. over the harms of improper treatment of waste (Appendix 8). The target was to give the employees better tools to decision-making in environment-related situations in work as in their private life. The training was quite comprehensive as the methods e.g. in waste management differ from those in Finland.

6.4 Control of documents and records

As ISO 9001 and ISO 14001 are very similar, most of the general requirements were already in place and these valid QMS instructions and process descriptions were used as platform when implementing the EMS into practice. For document management and process descriptions, The Switch uses the Integrated Management System Software (IMS), called SwitchON. This browser-based software is available through the company's intranet for those who have access to the company's network. The processes are documented mainly with flow charts, which are supported by verbal descriptions of responsibility, methods, critical factors and records. The process descriptions are supported by additional instructions and links to templates.

There was no need to make major changes to procedures like document and records control, corrective and preventative actions or management reviews.

The list of prepared EMS-related instructions and templates is presented in Appendix 9. It contains the documents the needs of which were identified already in the initial environmental review. The only difference is that at this point no separate audit questionnaire was prepared to supplier audits. The EMS internal audit questionnaire can be used also in supplier audit. The supplier audit does not have to cover all the questions especially if the supplier is ISO 14001 certified.

Quality and environmental records are stored in common network drive in Finland. However, the fact is that network connections between Finland and China are not always working properly. Therefore, it is allowed to store the instructions and such to local network drives and use paper copies as uncontrolled documents.

6.5 Waste management

Recycling in The Switch Lu'an was done in traditional manner in China. A peddler comes, sorts the storage of solid waste and buys the recyclable material. The rest of the solid waste is taken to a bin that is common to all companies of the block. As the manufacturing in Lu'an was in early stages, there was not actual knowledge over the waste amounts. To improve the situation a follow-up table was created (Appendix 11). This way the correct measures can be defined later on.

The best way to minimize environmental impacts of solid waste is to minimize the amount of waste. The Switch Lu'an factory is mainly doing assembly work and packing material of the purchased components cause the main stream of solid waste. Reducing the amount of waste means negotiations with the suppliers. The amount of packing materials should be minimized without risking the quality of the delivered items. Easily recyclable packing materials should also be used.

The use of high quality components minimizes the amount of waste as well. However, it should be considered how the quality of the supplied components is achieved. Only those suppliers should be used that have capable processes. If the quality of the components is gained by sorting, it may not have any positive effect to overall environmental impact. It just transfers the place of the impact and in this case, The Switch ultimately pays for the unqualified products in the prices of the qualified products.

6.6 Legislation follow-up

One target of the project was to create an environmental management system that can be common to all units of the Switch. However, there are issues where the organization parts need to act differently. Especially legislation and infrastructure may cause these needs.

The main environmental laws of the PRC can be found from the official page of Ministry of Environmental Protection of the PRC (MEP). While the Finnish acts and decrees are available via FINLEX database to all public free of charge, and English translations of many of those are available, the English versions of the Chinese legislation are more difficult to find especially the ones on city level. There are consulting and law firms that can provide translations and legal help if needed. However, when using such services the companies need to be aware that no international lawyer or law firm is licensed or qualified to provide PRC legal services, even if based in China.

Just as in Finland, not all legislation needed to maintain EMS compliance is promulgated under environmental legislation status. When there is a legal requirement over identified environmental aspect, that legislation needs to be followed up. These requirements may be related to raw materials, to chemical storage or e.g. to fire protection requirements. For instance, The Measures for Administration of the Pollution Control of Electronic Information Products (EIP) also called as “China RoHS” (Restriction of Hazardous Substances) is given by the Ministry of Industry and Information Technology (MIIT) and fire protection

regulations law is given by Ministry of Public Security. The national and provincial level legislations are complemented by local governments, e.g. by Lu'an Environmental Bureau, and they are available in Chinese via their website.

In normal conditions The Switch China production does not have any environmental impacts that would require special permissions. Therefore, it was decided to identify the applicable legislation by internal resources. The applicable legislation was listed and its influence to operations was evaluated (Appendix 10). The list will be updated and the needed actions reviewed and carried out at least once a year by the local EMS responsible persons.

Even though legislative issues may look the same at first glance, the deeper review reveals differences. "China RoHS" is one of those regulations that need to be followed up by The Switch. "China RoHS" differs from the RoHS of the EU, which covers eight broad categories of finished products in which the lead, cadmium, mercury, hexavalent chromium, PBB and PBDE concentration values must not exceed the permitted maximums. "China RoHS" allows those substances, but the listed Electronic Information Products (EIPs) must be marked (Figure 3). The marking is either green or orange symbol. Product marked with green Chinese pollution control mark (indicates recyclability) is used when none of the six restricted substances are present above permitted levels. The orange symbol indicates an environmentally friendly (safe use) period in years and must be used if any of the restricted substances are present above permitted levels.



Figure 3. Chinese pollution control symbols

The list of appliances and components that “China RoHS” is going to cover is not finalized yet, but otherwise the regulation is in force. If the EIP list is going to cover products of The Switch markets in China, it will increase workload in sourcing and production activities.

6.7 Environmental communication

The Switch had an existing procedure for internal communication and external communication. The external communication covered communication in crisis, orders received, marketing communication and media relations. They did not have a procedure for receiving, documenting and responding to relevant environmental communication from external parties. The original communications procedure was expanded to cover also environmental issues (Appendix 12). The Switch management also decided that when EMS covers the entire company the annual reports would have a short presentation of the environmental aspects and progress.

6.8 Management reviews

As The Switch had already valid QMS, they also had management reviews in place. The management meetings are held once a month by the management team in Vantaa, Finland, and management reviews are held within those meetings. The Chief Financial Officer (CFO) is named as management representative. The Quality Manager collects the data for review and presents it in reviews.

6.9 Internal audit procedure for EMS

The Switch had already established an auditing process for its QMS auditing. Environmental audit was performed according to the same systematics (Figure 4). The only difference was that for environmental audit another audit

questionnaire was created reflecting the ISO 14001 requirements (Appendix 13). This checklist type questionnaire is good at this state when the system is in its early development phase as it covers all requirements of the standard systematically. The findings are divided into major nonconformities, nonconformities and recommended improvements. Both major nonconformities and nonconformities are those that must be improved. In addition, possible improvement recommendations can be presented. All of these are handled with the same procedure as any nonconformity. A responsible person was named for each nonconformity, as well as target schedule for corrective actions.

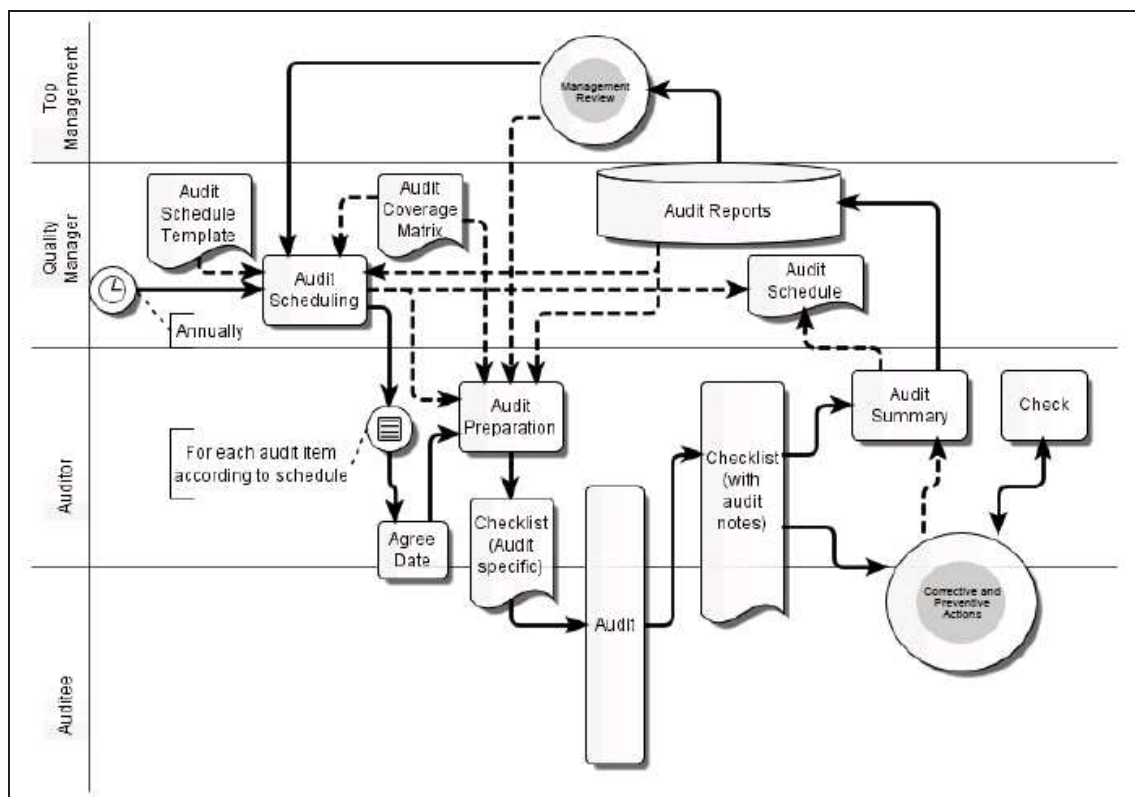


Figure 4. Internal audit process of The Switch

6.10 Document review and initial visit by the 3rd party

Det Norske Veritas (DNV Certification Oy/Ab Finland) has assessed the QMS of The Switch and has issued the ISO 9001 certificate. The same organization was selected to assess the EMS of The Switch China. Because of the project schedule, the document review and initial visit by the DNV was performed already in January 2011 at The Switch headquarters. Many issues were still in

development phase and e.g. internal audits were not performed. Because the actions were already ongoing, the DNV assessed there was enough time to perform and implement the lacking processes and it was agreed that initial audit could be undertaken according to the original schedule.

The following seven minor nonconformities were listed by the DNV:

- The environmental objectives, targets and programs were not completely applied and approved.
- The environmental management system was so fresh that no comprehensive management review had been able to be executed. Internal audits were pending for the same reason.
- It was not known whether the transformers or capacitors in China contain PCB or not.
- The potential environmental impacts of field service activities were not identified and evaluated in connection with the other aspects (littering, leak control etc.).
- A procedure for preventing and handling of fire accidents was prepared for Lu'an but not for other sites.
- Procedures for handling nonconformities and making corrective action did not clearly require to recording and handling actual and potential incidents causing threat to environment (e.g. fire accidents or chemical leaks).
- The records necessary for managing the environmental system needed to be specified.

In addition, one opportunity for improvement was stated; it seemed to be somewhat unsure whether there could exist applicable legislation given under other Ministries than Environmental Ministry (possibly related to fire extinguishing equipment or electrical or other installations in buildings etc.)

6.11 Internal audits

The assessments at The Switch China locations were made in February 2011 by the author together with the Quality Manager of The Switch, both being competent auditors by training and by previous work history.

The assessment of the EMS revealed both nonconformities and opportunities to improve (Appendix 14). The result was expected because of the short implementation time and some resource shortage during the project.

Two major nonconformities (Major NC) were noted; management reviews were not done according to planned intervals and there was no written decision available if and how The Switch was going to communicate environmental aspects externally. These are both direct requirements of the standard and thus considered as major nonconformities.

In addition, four minor nonconformities (NC) were noted. They handled fire trainings, document and record control and the procedure of environmental evaluation of new operations and products. In addition, five recommendations to be considered for improvement (I) were listed

6.12 Corrective and preventative actions, CAPA

The audit findings were as expected and those were taken into CAPA process for further action. CAPA process was one of those QMS related systems that was already in place and could be used for EMS related issues as well. CAPA process is used for issues requiring improvements that originate from audits, management reviews, customer feedback etc. CAPA process covers the following steps; recording the problem, investigation and root cause analysis, planning of actions, immediate corrections, corrective actions, validation actions and comparison of gathered validation data with validation plan. Also responsibilities and target schedules are defined.

Some of the findings were easily corrected but some of the findings needed further development. They were linked with the ongoing development projects.

6.13 The EMS certification plan

The certification (initial) audit was scheduled to take place in late March, but it was postponed until June 2011 because of some negotiations between the auditing company and Chinese authorities. In June the audit was postponed a second time until August 2011 because of the scheduling difficulties of the participants. The DNV also informed that because of Chinese regulations only Chinese auditors have the authority to perform the certification audit.

In July, the management of The Switch announced that the certification audit is frozen until further notice. The reason for that was the upcoming transaction with the AMSC. Some harmonizing of the management systems is apparently going to take place. Nevertheless, The Switch faces time-to-time second party audits by its customers, which together with internal EMS audits give valuable information to the management for further development.

7 Discussion

The project started in September 2010 and the original plan was to certificate The Switch China operations in March 2011. The schedule did not leave much time for any unexpected delays. The plan was to use self-study weeks for necessary travelling and such, but as in any company having global functions, common meetings with responsible persons need to be scheduled in good time and even then, changes may occur. In addition, the different vacations and national holidays in China brought some surprises.

As The Switch had implemented quality management system according to the ISO 9001, many of the required procedures were already in place. The EMS-related additional elements are presented in this study. However, it should be

noted that required procedures are case dependent. For organizations having severe environmental risks in their operations, more detailed procedures and production controls are naturally required. These requirements may be presented by authorities or they can be determined by organization itself. In some fields of industry, customers are having environment management related requirements as well, and those requirements are increasing in China too.

In public environmental aspects of wind power are normally related to the construction of high towers and rotating blades. The manufacturers of the generators and converters are not so much in focus though the massive use of rare earths in modern generators has raised some concerns. The concern does not so much criticize the use of rare earths but the mining and processing of them. The same applies to electronics. Therefore exercising responsible supplier management and selecting components, which strain the environment as little as possible, can have a significant influence both on environment but also on market interest.

The Chinese environmental legislation is accused of being quite vague but so is the Finnish environmental legislation in many parts if looking only at the main laws. Because in China the legislation is enacted also on provincial and on city level, they are expected to be more detailed. However, this is not the case in many parts of China, at least not yet. Even if the laws and acts were in place, the infrastructure may not be at the level that supports the good intentions. The Chinese environmental management infrastructure or lack of it presented challenge to the project. Finland has many environmental management companies that give advice and help other companies in organizing environmental management as required by legislation, e.g. for sorting, collecting and recycling of waste. As described in this study, the methods are quite different even in developed areas of China.

The main target for this study was to evaluate if the same procedures could be used both in China and in Finland. Because ISO 14001 is quite a location-specific standard, copy-paste type of approach cannot automatically be used. Modifications may be required because of separate laws and their execution,

cultural factors and different expectations of interested parties. In this case, the templates were created for common use as well as some general procedures. Some site-specific procedures were also needed, because of the differences in infrastructure. The environmental legislation itself did not cause major differences. However, Chinese environment-related laws and regulations are developing slowly but constantly. New regulations both in China and in Finland may always have an influence on existing procedures.

In order to understand the operating environment, more theoretical research was done than in the situation where more presence could have been possible. Local participation in the system development was a necessity though it could have been even more spontaneous. As no certification audit was conducted, it remained uncertain whether all required actions were taken. Based on the findings during the initial visit by the DNV and in internal audits, a few nonconformities would probably have been issued. However, as the assessment would have been by Chinese auditors it remained unclear whether the ISO 14001 standard is interpreted according to the same principles.

Implementing the EMS into operation indicates the organization's awareness over environmental issues, even The Switch decided to postpone the certification into the future. The project suffered from several unexpected changes in the operating environment as in scheduling the certification audit that could not have been seen beforehand. Nevertheless, the base for the EMS has been created and development of it can continue. In many organizations also occupational health and safety standard OHSAS 18001 can be integrated as a part of the management system, having same kind of requirements as ISO 9001 and ISO 14001. The carbon footprint calculations e.g. for permanent magnet generators could also support the sustainable development of the company. The actual outcome and the benefits of management systems are highly dependent on the company's internal cooperation and commitment at all levels of organization.

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Suunnitelma ympäristöjärjestelmän laatimiseksi opinnäytetyönä

Yleistä Tämä alustava suunnitelma perustuu käytyihin keskusteluihin ja opinnäytetyölle asetettuihin vaatimuksiin. Opinnäytetyön kohteena on The Switchin Lu'anin tehtaan ympäristöjärjestelmän laadinta ja käyttöönotto ISO 14001 standardia vastaavaksi. Sertifiointi ajankohdan tavoitteeksi on asetettu 1Q2011.

Virallisesti opinnäytetyön tekeminen voi alkaa elokuun puolivälin jälkeen, jolloin PK-AMK:n opinnäytetöiden hyväksymisestä vastaavien kesälomat päättyvät.

Alustavasti työhön on käytettävissä kokopäiväisesti etäopiskeluviikot syyslukukaudella 2010 viikot 37, 41, 45, 49 ja kevätlukukaudella 2011 viikot 5, 9, 13, 17 ja 21. Tapaamiset ja vierailut olisi luontevinta sijoittaa näille viikoille. Lähiopetuksen lukujärjestyksen muutoksen voivat vaikuttaa aikatauluun.

Projektin vaiheet

Aloitus Aloituspalaveri viikolla 33 tai 34, sen jälkeen kun aihe on hyväksytty opinnäytetyöksi. Tarkoituksena on luoda läpileikkaus tulevaan projektiin sekä tarkentaa projektin aikataulu ja sisältö. Lisäksi sovitaan mahdollisuuksien mukaan projektiryhmästä ja/tai vastuuhenkilöistä, työnjaosta ja tarkennetaan aikataulu.

Valmisteleva katselmus Valmisteleva katselmus tehdään viikolla 37. Katselmuksen lopputuloksena on raportti, josta selviää tehtaan valmius ympäristöjärjestelmän vaatimuksiin nähden. Katselmus sisältää myös selvityksen lakisäteisistä vaatimuksista ja raportointi velvollisuuksista. Lakisäateisten vaatimusten selvittämiseksi tarvitaan ehdottomasti Kiinan ja paikallisten ympäristömääräysten asiantuntija. Katselmus voidaan tehdä kyselykaavakkeen avulla ja/tai paikan päällä havainnoiden.

Päämäärät ja tavoitteet Ympäristönäkökohdat selvitetään tehtaan prosessien tai toimintojen mukaisesti 41/2010 mennessä. Selvityksessä huomioidaan myös alihankinta ja poikkeavat tilanteet.

Viikolla 41/2010 asetetaan ympäristöpolitiikan (tarvittaessa päivitys), alustavan katselmuksen ja merkittävien näkökohtien perusteella tehtaan toiminnoille päämäärät ja tavoitteet. Näissä on hyvä huomioida myös globaalit tavoitteet.

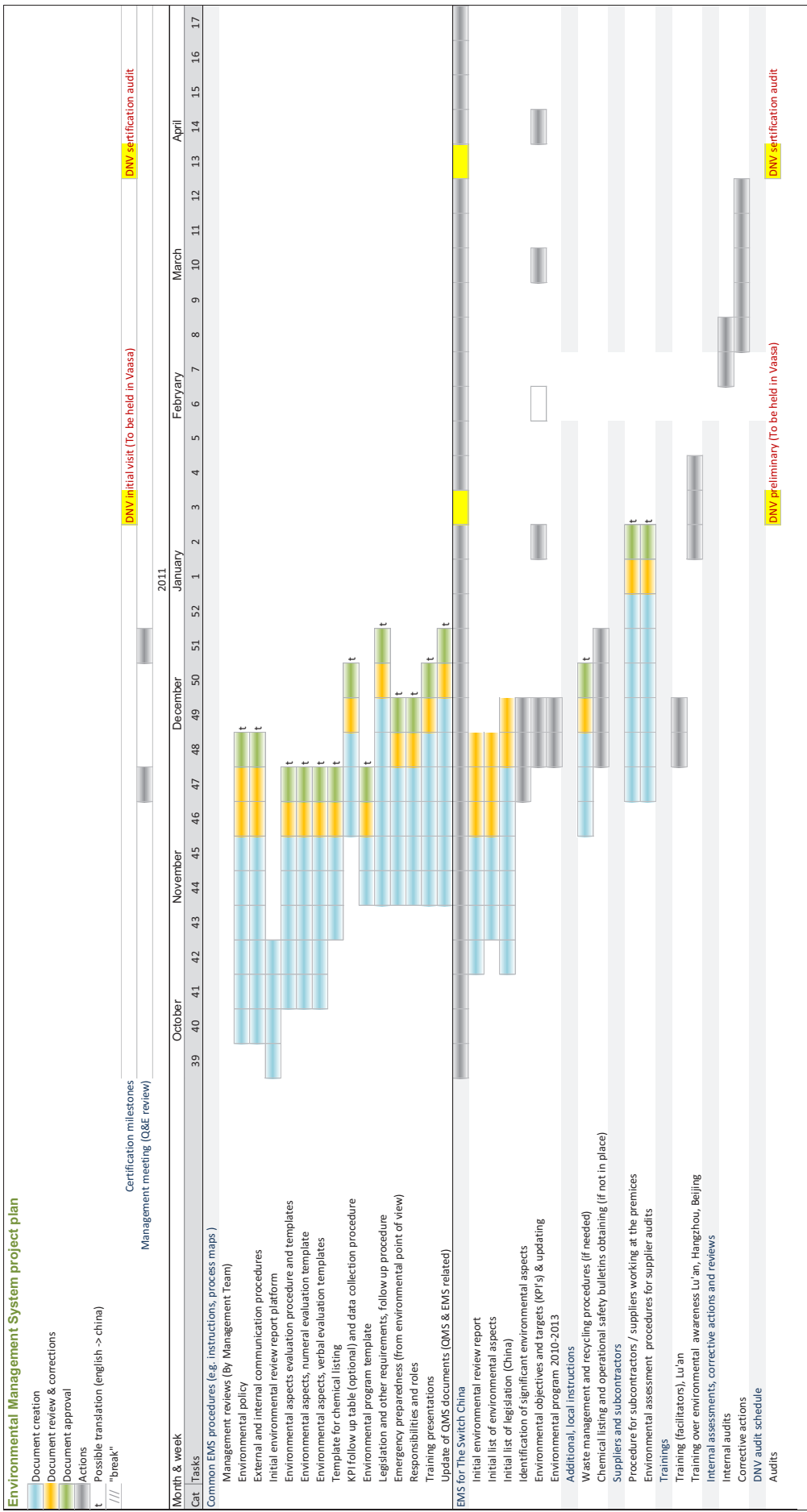
Hallintaohjelmat ja osaaminen

Hallintaohjelmat tavoitteiden saavuttamiseksi laaditaan ja otetaan käyttöön viikosta 45 alkaen. Samoin rakennetaan tarvittavat raportointimenettelyt ja koulutetaan henkilökunta tarvittavin osin.

Sisäinen auditointi Projektin edetessä suunnitelman mukaisesti sisäinen auditointi voidaan tehdä viikolla 5/2011. Tulokset käsitellään johdon katselmuksessa. Mahdolliset korjaavat toimenpiteet tehdään seuraavien viikkojen aikana ennen ulkoista sertifiointi auditointia.

Dokumentointi	Samanaikaisesti edellä mainittujen projektin vaiheiden kanssa laaditaan ja otetaan käyttöön tarvittavat ohjeet ja lomakkeet. Ohjeiden ja lomakkeiden kieli on englanti.
Opinnäytetyö	Kirjallinen osuus opinnäytetyöstä laaditaan kevään 2011 aikana.
Kustannukset	Kustannukset koostuvat työstä maksettavasta korvauksesta, tietoliikenne yhteyksistä ja mahdollisten matkojen kustannuksista. Korvauksen määrästä sovitaan erikseen.

Project Schedule



Initial identification of environmental aspects

China operations

Location: Lu'an

Consumption of raw materials and components		
Raw material / component type	Amount used / (2010) year	Comments regarding environmental impact (recycling, plating methods etc.)
Metal parts	100 sets	recycling
Busbar	100 sets	recycling
cable	100 sets	
screw	50,000 pcs	recycling
transducer	600 pcs	
fuse	600 pcs	
Fuse base	200 pcs	
grommet	800 pcs	
Circuit breaker	200 pcs	

Annual energy consumption			
Type of Energy	Consumption	Cost	Comments regarding environmental impact
Electricity	Average 1500 kWh/month	CNY 1600.00	Energy-saving equipment (lights,...)
Oil	N/A		

Waste and Recycling – Hazardous and Segregated Waste				
Type of Waste	Amount	Internal Handling	External Handling	Cost or receipts in euros (receipts mark with +)
busbar	400 pcs		yes	Wait to be handled
Metal part	5 pcs		yes	Wait to be handled
screw	2000 pcs		yes	+40.00

Emissions and Discharges (production)			
Process/ Activity	Pollutant	Amount	Current Monitoring Procedures
N/A			

Products				
Product	Annual Quantity	Packaging	Transportation method	Recyclability (possibilities)
GBB 1014	100 pcs	Wooden pallet	Air freight,	N/A
GBB 1017	100 pcs	Wooden pallet	Air freight,	N/A
RCS	200 pcs	Wooden pallet	Air freight,	N/A

Accidents			
When?	Where?	Reasons?	Damage to the Environment?
N/A			

Risk of Accidents		
Process/ Activity	Potential Risk	Preventive Measure
Damage during movement	Injury to handler	Use lifting tools

Other		
N/A		

Environmental policy



ENVIRONMENTAL POLICY

The Switch is **dedicated** to the battle against climate change and to preserve the world's energy resources.

To put this dedication into action our policy is **to provide**

- the best approach to new **energy solutions**
- techniques **that** transform un-tapped energy into electricity
- products that **help** to reduce carbon emissions
- production that minimizes load on the **environment**
 - We use all our resources efficiently
 - We use high-quality raw materials
 - We provide end of life treatment recommendations for our products
- supply chain that is willing to act in a responsible way

We comply with legislation and we are constantly challenging ourselves. We are committed to continual environmental improvement and sustainable development by:

- environmental programs and objectives
- management principles and performance indicators



环境政策

斯维奇目标在于对付环境变化，并维护世界能源资源。

为实现这一目标，我们政策如下

- 新能源解决方案的最佳方法
- 技术--将可再生能源转换成电能
- 产品--帮助减少二氧化碳排放
- 生产--尽量减少对环境的影响
 - 我们有效使用现有资源
 - 我们使用高品质的原材料
 - 我们提供产品寿命终期处理建议
- 供应链—愿以负责的方式行事

我们遵守法规，并不断挑战自我。我们致力于不断改善环境和可持续发展，并制定：

- 环境计划和目标
- 管理原则和绩效指标

斯维奇竭诚提供能源解决方案，以改善我们的环境



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Customer reference	Internal reference
Project ID:	Project no:
Prepared: see version table	Approved: see version table
Date: table	Date: table

Identification and evaluation of environmental aspects

Version	Date	Prepared	Description	Approved	Date
1.0	2010-12-15	PikSa	approval	see	SwitchON
0.2	2010-12-14	PikSa	Modifications, changes criteria		
0.1	2010-10-18	PikSa	Initial draft		

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5	Environmental objectives, targets and programs	3

1 Purpose of this document

This document describes how to identify environmental aspects of The Switch activities, products or services and impact of those on surroundings.

2 Responsibilities

Each unit is responsible for identifying its environmental aspects and for creating environmental programs in order to improve environmental performance.

3 Identification of environmental aspects

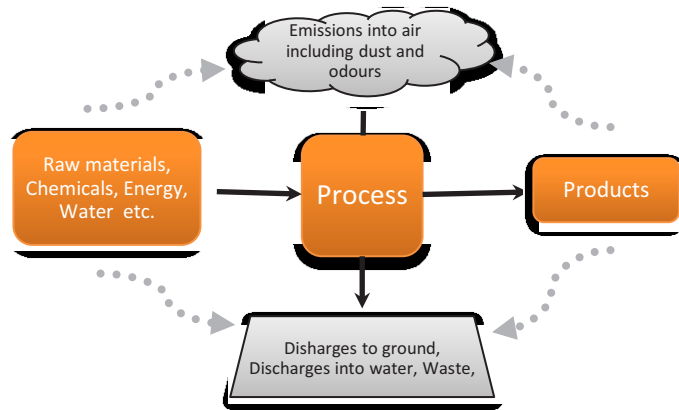
Environmental standard ISO 14001 defines environmental aspect as an element of an organization's activities, products or services that can interact with the environment. Both direct and indirect aspects need to be considered.



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Direct environmental aspect: Company can be expected to have an influence and control.
 Indirect environmental aspect: Actual or potential activities over which the organization can be expected to have an influence, but no control.

Use the form “identification of environmental aspects” and list all activities that might have environmental aspects. Do the identification using themes like e.g. water, soil, use of materials and natural resources, energy, radiation, vibration, heat, unpleasant odors and noise.

1. Identify environmental aspects associated with the selected activity, product or service.
2. Consider normal, abnormal, accident and emergency situations.
3. Identify actual and potential, positive or negative environmental impacts associated with each identified aspect.
4. Evaluate the significance of the impact, from different points of view. Note that the significance of each identified environmental impacts can differ between organizations and facilities.

Examples of environmental aspects and impacts:

Evaluation theme	Environmental aspect	Impact
Air	Emission of cars, truck	Rise of ground level ozone, health hazard
Air	Industrial emissions: evaporation	Exposure to hazardous gases
Air	Industrial emissions (CFCs, halogens, chlorinated compounds)	Ozone layer depletion
Noise	Construction, traffic	Annoyance, health , behavioral changes in nature
Soil	Release to land	Soil / groundwater contamination
Soil	Hazardous waste generation	Contamination of the soil, health hazard
Soil	Solid waste	Soil pollution, landfill
Use of materials and natural resources	Paper consumption	Depletion of natural resources
Water	Release to the sewer system	Malfunction at the sewage treatment plant
Water	Release to the waterways (e.g. through rainwater outlets)	Water contamination



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4 Significance

To each identified environmental aspect, points are given according the following template.

		Points given		
Criteria		1	3	5
A	Possibility to generate complaints by interested parties	Low or no complaints expected in any circumstances	Some complaints expected in abnormal circumstances	Many complaints expected in abnormal circumstances
B	Controlled and followed up	Continuous follow up and records	Information available but not systematically collected or followed up	No follow up, situation unknown
C	Level of environmental risk	Low and local risk Unlikely to happen,	Medium risk Possible to happen	High risk
D	Influence on the company's public image	Insignificant	Local	National or wider
E	Legal environmental or related requirements	None specific	General guidance	Direct limits or equivalent

The significance is calculated by multiplying the given points (A x B x C x D x E), resulting maximum points 3125.

Those 5 aspects that have the highest points are recognized as significant environmental aspects. Those need to be taken into consideration when creating environmental program.

5 Environmental objectives, targets and programs

When setting up environmental objectives, significant environmental aspects are noticed. Aspects with similar impacts can be handled as one. In addition of those also BAT (best available technology), environmental permits, legislation and company policies are noticed.

Environmental target is a measurable (if applicable) target of the environmental objective.

An environmental program is established for achieving objectives and targets. The program contains planned actions, time frames and responsibilities for each objective. The time frame of the program should not be longer than three years (program period). Use document template called "environmental programs".

The program is followed up in environmental audits and management meetings.

The identification and significance of environmental aspects

Place of review:		The Switch, Lu'an and Beijing		Significance															
Date of review:		24.11.2010 - 30.11.2010		Criteria:		Legal environmental or related requirements		Influence on the company's public image		Level of environmental risk		Control and follow up measures		Complaints by interested parties		Total points			
Reviewers:		San Pikkariainen, Raimo Lewing, in Lu'an: Anna Chen, Solly Song, Eason Chu, Timo Eronen (HangZhou), Mike Gao, in Beijing: Paul Black, Carlo Cecchi, Scott Liang, Stone Shi, Maggie Xu		Environmental aspect		Environmental Impact		Current procedures in brief		A		B		C		D		E	
#	Evaluation theme	Activity	Situation (normal, abnormal, accident, emergency)	Environmental aspect	Environmental Impact	Current procedures in brief	A	B	C	D	E								
B10	soil	After sales, broken circuitboards and other electronic components e.g. Capacitors	abnormal or accident	Hazardous waste generation	Contamination of the soil, health hazard	Hazardous materials? Customers are asking what to do with broken capacitors. Currently, in case of warranty those are returned to The Switch. No disposal / recycling instructions in maintenance documents Significant aspect - see also L12	3	3	5	5	3							675	
H06	various	Supplier chain	normal	Pollution by supplier	Various impacts to water, air and soil	The risk to use suppliers that have major environmental impact. Environmental awareness of the supplier is checked in some extend during supplier evaluation and audits. Significant aspect	5	3	3	5	3							675	
L12	soil	Broken or unsatisfactory components	abnormal	Hazardous waste generation	Contamination of the soil, health hazard	Components found to be unsatisfactory during the assembly are returned to the supplier. Component broken down during the assembly, that waste is handled by The Switch. Significant aspect	1	3	3	3	5							135	
L04	air	Transport of incoming material	normal	Emission of cars, airplanes etc.	Rise of ground level ozone, health hazard	Many suppliers -> quite many deliveries per produced set. Total number is not known, as mass production is just starting up. Final destination vurrently landfill. Need to look at the local environmental regulations and guides.	3	3	3	1	3							81	
B06	hazardous waste	batteries, cells and office e-waste,	normal	Hazardous waste generation	Contamination of the soil, health hazard		1	5	3	1	3							45	
B09	various	Fire fighting	emergency	Emissions to air, releases to waterways and soil pollution by the water, used in fire fighting	Water contamination, Soil (groundwater) contamination, Rise of ground level ozone, health hazard	No fire practices	3	5	1	1	3							45	
H04	hazardous waste	batteries, cells and office e-waste,	normal	Hazardous waste generation	Contamination of the soil, health hazard	Small amounts. No collection of those. Need to look at the local environmental regulations and guides.	1	5	3	1	3							45	
H08	various	Fire fighting	emergency	Emissions to air, releases to waterways and soil pollution by the water, used in fire fighting	Water contamination, Soil / groundwater contamination, Rise of ground level ozone, health hazard	The emergency instruction have been given by the owner of the building (in Chinese). No fire practices.	3	5	1	1	3							45	
L03	air	Production	normal	Evaporation of used solvents and other chemicals	Exposure to hazardous gases	Low amount, slightly irritating chemicals. No MSDS available.	3	5	1	1	3							45	
L07	energy	Electric heaters/coolers	normal	Use of non-renewable energy	Depletion of natural resources, air pollution, greenhouse effect	The thermal insulation of the building is rather weak, so in cold weather warming is needed as in summer time cooling is used. The total amount of used energy (electricity) is paid according used kWh.	3	5	1	1	3							45	
L15	use of materials and natural resources	Delivery of the products	normal	Solid waste	Soil pollution, landfill	Amounts and types used per package is not known.	3	5	1	1	3							45	

Place of review:		The Switch, Lu'an and Beijing		Significance Criteria:							Total points
Date of review:		24.11.2010 - 30.11.2010		Legal environmental or related requirements influence on the company's public image							
Reviewers:		Sari Pikkariainen, Raimo Lewing, Anna Chen, Solly Song, Eason Chu, Timo Eronen (HangZhou), Mike Gao, Paul Black, Carlo Cecchi, Scott Liang, Stone Shi, Maggie Xu		Level of environmental risk							
		in Lu'an:		Control and follow up measures							
		in Beijing:		Complaints by interested parties							
#	Evaluation theme	Activity	Situation (normal, abnormal, accident, emergency)	Environmental aspect	Environmental Impact	A	B	C	D	E	
B08	soil	Disposal of ink cartridges of the printer ends up as solid waste	normal	Hazardous waste generation	Contamination of the soil, health hazard	1	3	3	1	3	27
L08	energy	Lightning	normal	Use of non-renewable energy	Depletion of natural resources, air pollution, greenhouse effect	1	3	3	1	3	27
L10	hazardous waste	Batteries, cells and office e-waste,	normal	Hazardous waste generation	Contamination of the soil, health hazard	1	3	3	1	3	27
L13	soil	Disposal of ink cartridges of the printer ends up as solid waste	normal	Hazardous waste generation	Contamination of the soil, health hazard	1	3	3	1	3	27
L14	soil	Material handling & warehouse	normal	Solid waste (plastics)	Soil pollution, landfill	1	3	3	1	3	27
L17	various	Fire fighting	emergency	Emissions to air, releases to waterways and soil pollution by the water used in fire fighting	Water contamination, Soil / groundwater contamination, Rise of ground level ozone, health hazard	3	1	1	3	3	27
L2	air	Malfunction and breakage of electronic components in testing	abnormal or accident	hazardous gases	Exposure to hazardous gases	1	3	1	3	3	27
B03	energy	electric heaters/coolers	normal	Use of non-renewable energy	Depletion of natural resources, air pollution, greenhouse effect	1	5	3	1	1	15
B04	energy	lightning	normal	Use of non-renewable energy	Depletion of natural resources, air pollution, greenhouse effect	1	5	1	1	3	15
B05	energy	Office equipment	normal	Use of non-renewable energy	Depletion of natural resources, air pollution, greenhouse effect	1	5	1	1	3	15
B07	natural resources	Printed documents	normal	Paper consumption	Depletion of natural resources and raw material, paper waste	1	5	1	1	3	15
B12	water	House cleaning operations, use of detergents	normal	Release to the sewer system	Waste water contaminated with chemicals	1	5	1	1	3	15
H03	energy	lightning, cooling and office equipment	normal	Use of non-renewable energy	Depletion of natural resources, air pollution, greenhouse effect	1	5	3	1	1	15
L05	air	Travel to work, employees and visitors	normal	Emission of cars, truck	Rise of ground level ozone, health hazard	1	5	1	1	3	15
L18	waste	"Household" and other refuse	normal	Unrecyclable solid waste	Ends up to landfill. Total amount is not known as the fee is paid according floor area of the facility (m ²). Legal requirements at national level about waste exists. Local requirements are unclear.	1	5	1	1	3	15

Place of review: The Switch, Lu'an and Beijing Date of review: 24.11.2010 - 30.11.2010 Reviewers: Sari Pikkariainen, Raimo Lewing, Anna Chen, Solly Song, Eason Chu, Timo Eronen (Hang/Zhou), Mike Gao, Paul Black, Carlo Cecchi, Scott Liang, Stone Shi, Maggie Xu in Lu'an: in Beijing:				Significance Criteria: Legal environmental or related requirements Influence on the company's public image Level of environmental risk Control and follow up measures Complaints by interested parties					A	B	C	D	E	Total points
#	Evaluation theme	Activity	Situation (normal, abnormal, accident, emergency)	Environmental aspect	Environmental Impact									
B02	air	Visits to suppliers	normal	Emission of cars, airplanes etc.	Rise of ground level ozone, health hazard	1	3	3	1	1	9			
B11	waste	use of disposable plates and cups	normal	Solid waste	Soil pollution, landfill	1	3	1	1	3	9			
H01	air	after sales and other customer related operations	normal	Emission of cars, airplanes etc.	Rise of ground level ozone, health hazard	1	3	3	1	1	9			
H05	Natural resources	Printed documents	normal	Paper consumption	Depletion of natural resources and raw material, paper waste	1	1	3	1	3	9			
H07	soil	Disposal of ink cartridges of the printer ends up as solid waste	normal	Hazardous waste generation	Contamination of the soil, health hazard	1	3	1	1	3	9			
L01	air	Customer related travelling	normal	Emission of cars, airplanes etc.	Rise of ground level ozone, health hazard	1	3	1	1	3	9			
L06	energy	Delivery of the products	normal	Use of non-renewable energy (fuel),	Depletion of natural resources	3	3	1	1	1	9			
L11	Natural resources	Printed documents	normal	Paper consumption	Depletion of natural resources and raw material, paper waste	1	3	1	1	3	9			
L16	use of materials and natural resources	Material handling & warehouse	normal	Cardboard	Depletion of natural resources and raw material, paper waste	1	3	1	1	3	9			
B01	air	Travel to work, employees and visitors	normal	Emission of cars, truck	Rise of ground level ozone, health hazard	1	5	1	1	1	5			
H02	air	Travel to work, employees and visitors	normal	Emission of cars, truck	Rise of ground level ozone, health hazard	1	5	1	1	1	5			
L20	water	House cleaning operations involving use detergents	normal	Release to the sewer system	Waste water contaminated with chemicals	1	5	1	1	1	5			
H09	waste	"household" and other refuse	normal	Unrecyclable solid waste	Waste up to landfill	1	3	1	1	1	3			
H10	waste	use of disposable plates and cups	normal	Solid waste	Soil pollution, landfill	1	3	1	1	1	3			
H11	water	House cleaning operations involving use detergents	normal	Release to the sewer system	Waste water contaminated with chemicals	1	3	1	1	1	3			
L09	energy	Office equipment	normal	Use of non-renewable energy	Depletion of natural resources, air pollution, greenhouse effect	1	1	1	1	3	3			
L19	waste	Use of disposable plates and cups	normal	Solid waste	Soil pollution, landfill	1	3	1	1	1	3			



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Environmental programs

Version	Date	Prepared	Description	Approved	Date
1.0	2011-03-04	PikSa	Program finalization for approval	see	SwitchON
0.2	2010-12-15	PikSa	Program for China operations		
0.1	2010-11-15	PikSa	Template draft		

Purpose of this document

For the defined operations with valid environmental management system (EMS) an environmental program is required to be established. For other operations it is voluntary.

This document contains all existing environmental programs of the Switch.

Program creation

An environmental program is established for achieving objectives and targets. The program contains planned actions, time frames and responsibilities for each objective. The time frame of the program should not be longer than three years (program period).

Each program shall contain 1 to 4 environmental objectives with measurable targets if practicable.

When creating an environmental program the following shall be taken into account:

- Previous objectives (continuous improvement)
- Environmental policy and commitments to prevention of pollution
- Significant environmental aspect of the defined operations
- Environmental permits, legal or other subscribed requirements
- BAT (best available technology)
- Views of interested parties (e.g. customers, local residence, employees)

Each program is reviewed at internal EMS audit of the particular operation and in management reviews. If needed, management review requires setting corrective actions plan so that the set target could be achieved.

Program update

All programs are entered to this same template. Program for each separate operation (defined in the title) is valid for 3 years, and then new program is created. Each program can be updated also earlier e.g. in case new significant environmental aspects are noticed (production change) or set targets have been achieved earlier than expected.



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Environmental program of China operations 2011-2013 (Lu'an, Beijing, HangZhou)

Environmental objective 1.1	Environmentally responsible supplier base			
Environmental target	One third of active suppliers, located in China, are EMS audited and approved by the end of 2013			
Indicator	Number of EMS audited and approved suppliers / active suppliers * 100 %			
Overall responsibility	Raimo Lewing, Simon Hewitt,			
Actions	Action	Influence of the action	Schedule (mm/yy)	Responsibility
	Prepare: Review the current situation of supplier audits in China. Define environmental auditing methods and select suppliers to be audited and make audit plan.	Information over the current situation is known and new procedures are ready to be taken in use.	03/2011	HewSi, PikSa, LewRa,
	Audit and EMS approve 2 active suppliers.	8 % of active suppliers EMS audited and approved	12/2011	HewSi
	Audit and EMS approve another 2-3 active suppliers.	20 % of active suppliers EMS audited and approved	12/2012	HewSi
	Audit and EMS approve another 2-3 active suppliers.	32 % of active suppliers EMS audited and approved	12/2013	HewSi
Resources	Sourcing and quality personnel			
Follow up	Internal and external audits, Management reviews, internal sourcing meetings			

Environmental training, pollution and waste

Environmental training 环境培训

understanding the harms of pollution and improper treatment of the waste
了解污染及对废弃物处理不当的危害
Sari Pikkariainen, translated by Anna Chen 9/20/2011

ENVIRONMENTAL POLICY

The Switch is **dedicated** to the battle against climate change and to preserve the world's energy resources.

To put this dedication into action our policy is **to provide**

- the best approach to new **energy solutions**
- techniques **that** transform un-tapped energy into electricity
- products that **help** to reduce carbon emissions
- production that minimizes load on the **environment**
 - We use all our resources efficiently
 - We use high-quality raw materials
 - We provide end of life treatment recommendations for our products
- supply chain that is willing to act in a responsible way

We comply with legislation and we are constantly challenging ourselves. We are committed to continual environmental improvement and sustainable development by:

- environmental programs and objectives
- management principles and performance indicators

环境政策

斯维奇目标在于对付环境变化, 并维护世界能源资源。
为实现这一目标, 我们政策如下

- 新能源解决方案的最佳方法
- 技术--将可再生能源转换成电能
- 产品--帮助减少二氧化碳排放
- 生产--尽量减少对环境的影响
 - 我们有效使用现有设备
 - 我们选用高品质的原材料
 - 我们为提供产品寿命周期处理建议
- 供应链--愿以负责的方式行事

我们遵守法规, 并不断挑战自我。我们致力于不断改善环境和可持续发展, 并制定:

- 环境计划和目标
- 管理原则和绩效指标

斯维奇竭诚提供能源解决方案, 以改善我们的环境

The environmental effects of wastes 废弃物对环境的影响

- Wastes can pollute the environment and constitute health hazards
废弃物会污染环境, 并对健康构成危害
- Improper waste recovery and processing of wastes may generate various types of emissions
不当的废物回收和处理可能产生不同类型的排放
- Waste also means inefficient use of raw materials
废弃物也意味着原材料的使用效率不高

Pollution types 污染种类

- Air pollution 大气污染
 - Release of chemicals and particulates into the atmosphere.
化学物质及微粒释放到大气中
- Soil contamination 土壤污染
 - Chemical spillage or underground leakage. 化学品泄漏或地下渗漏
- Water pollution 水体污染
 - Release of waste products and contaminants into water systems. 废弃物产品及废物流放入水循环系统
- Noise pollution 噪音污染
 - Roadway, aircraft and industrial noise. 街道, 飞机和工业噪音
- Other 其他
 - Thermal pollution 热污染
 - Visual pollution 视觉污染
 - Radioactive contamination 放射性污染
 - Littering 乱抛垃圾

Air pollution 大气污染

- The Earth's atmosphere 地球的大气层
 - Ozone (O₃) is a poisonous gas.
臭氧(O₃)是一种有毒的气体
 - The ozone layer shields the earth from the harmful radiation of the sun.
臭氧层能屏蔽来自太阳的有害辐射
 - Some chemicals damage the ozone shield.
有些化学物质能破坏臭氧层

Air pollution 大气污染

- Other gases and particles 其他气体和微粒
 - In some circumstances gases emitted from industry and vehicles may react and create ozone, that is poisonous gas on ground level (=bad ozone).
在某些情况下, 工业废气与汽车排放尾气会发生反应并在地球表层产生臭氧, 这种臭氧是有毒的(坏臭氧)
 - carbon monoxide (CO), Nitro oxides (NOx), VOC compounds...
一氧化碳(CO), 硝酸盐(NOx), 挥发性有机化合物...
 - Particulate (PM), coal dust, lead, arsenic...
颗粒, 煤粉, 铅, 砷...
 - May cause health hazards like bronchitis, pneumonia and lung cancer.
可能引起如支气管炎, 肺炎和肺癌等健康危害

Air pollution 大气污染

- Greenhouse gases 温室气体
 - Without greenhouse gases earth would be too cold place to have life on, but
如果没有温室气体, 地球温度会太冷而不会产生生命, 但
 - too much of greenhouse gases affect global warming. 过多的温室气体导致全球变暖
- To limit climate change the extent of greenhouse gas emissions should be cut down.
为限制气候变化, 应降低温室气体的排放程度
- Remember The Switch Environmental policy: 牢记斯维奇环境政策

The Switch is **dedicated** to the battle against climate change and to preserve the world's energy resources.
斯维奇目标在于对付环境变化, 并维护世界能源资源。

How can you prevent air pollution? 怎样防止大气污染?

- Drive less (even a little less) and drive smart
少开车(再少一点)
 - About half of the air pollution comes from cars and trucks.
大约有一半的大气污染来自于小汽车和卡车
- Fly less 飞的更少
 - Take offs and landings count, not the distance.
降低起降数量, 而非飞行距离
- Choose Air-Friendly Products 选择大气环保产品
 - Select products that are water-based or have low amounts of volatile organic compounds (VOCs). 选择以水为能耗或只产生少量挥发性有机化合物的产品
- Save Energy 节约能源
 - Whenever you burn fossil fuel, you pollute the air.
只要你一使用化石燃料, 你就污染了环境



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Soil contamination 土壤污染

- Soil pollution results from the absorption of toxic substances into the ground.
土壤污染源于从地面吸收的有毒物质
- Plants absorb these pollutants and pass them along to the animals and humans who consume them.
植物从土壤吸收这些污染物, 并传播给食用它们的动物和人类
- Pesticide overuse and oil and fuel dumping are examples of direct contamination.
直接污染的例子: 过度使用农药, 石油和燃料倾倒
- Polluted soil affects our health either through direct contact with the toxic soil or by contaminated groundwater.
若地下储油罐发生降解, 有毒物质渗入土壤, 则造成间接污染
- Indirect contamination happens if underground storage tanks degrade and the toxic contents leak into the ground.
若地下储油罐发生降解, 有毒物质渗入土壤, 则造成间接污染
- Metals like chromium or lead (in drinking water) can be carcinogenic (cause cancer) or cause other chronic health conditions.
金属如铬、铅(饮用水中)可致癌, 或引起其他慢性健康状况



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Water pollution 水体污染

- Release of toxic waste products directly into lakes, rivers, oceans, or groundwater without adequate treatment to remove or filter harmful substances.
有毒废弃物未经充分去除或过滤处理便直接释放到湖泊、河流、海洋和地下水
- It affects the organisms living in those waters but also the entire ecosystem.
它影响的不仅是生活在这些水域的生物, 而是整个生态系统
- Organic water pollutants include non-degradable detergents, fats and grease from food-processing, pesticides or fuels.
有机水污染物包括非降解洗涤剂, 食品加工产生的脂肪和油脂, 农药及燃料
- Chemical waste, heavy metals or pieces of debris also count as severe water pollutants.
化学废物, 碎片及其中的重金属也是严重的水污染物



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How can you prevent soil and water contamination 怎样防止土壤和水体污染


- Purchase products (e.g. for cleaning) that are non-toxic whenever possible.
尽可能购买无毒产品(如清洁产品)
- Dispose toxic chemicals and their containers through designated hazardous-waste collection centers instead of pouring them down the drain or outside.
通过指定的危险废物收集中心处理有毒化学品及其容器, 而非倾到排水系统或外界
- Small amounts of contaminants from all over the land add up to cause water pollution. That's why even the little things matter!
所有地面的一小量污染累加到一起便造成水污染。这就是为什么小事也关系重大
- Its not only chemicals that pollute water. 除了化学物质, 以下也造成水污染:
 - Untreated sewage is a significant risk to human health and wildlife.
未处理的污水是对人类及野生动物的一个重大风险
 - Waste from livestock pollutes water. 来自畜畜污染过的水
 - Too much soil in runoff can pollute. 径流中的土壤会污染水
 - Littering pollutes both soil and water. 乱扔垃圾同时污染水和土壤



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Littering 乱扔垃圾


- Littering means discarding waste products such as plastic wrappers, cigarette butts, paper, boxes and food containers anywhere but in a waste container.
乱扔垃圾意为: 随处乱扔废弃物, 如塑料包装, 烟头, 纸张, 包装盒和食物容器, 而不是放到垃圾收集处
- Trash is a breeding ground for insects and rodents that might spread disease.
垃圾是昆虫和啮齿类动物滋生的温床, 这些动物可能传播疾病
- Uncollected litter might clog streams or rivers, fouling the water supply and endangering wildlife.
未回收的垃圾可能阻塞溪流或河流, 污染水源, 危害野生动物



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Waste management methods 废弃物管理办法

- Reduce the amount of waste generated in the first place
 - reduce also the hazardousness of the waste by reducing the presence of dangerous substances in products
通过减少产品中含有的危险物质来减少废弃物的危害性
=> disposing of the waste will become simpler 可以更简单处理废弃物
- Recycle (or reuse) 回收(或再利用)
 - Recyclable materials are separated from the waste stream and collected for use as a substitute for raw materials in a manufacturing process.
将可回收物从废弃物中分离出来并集中, 作为生产过程中原材料的替代品使用
 - As many of the materials as possible should be recovered, preferably by recycling. Energy can be recovered by burning rubbish in a controlled furnace.
尽可能多的收回材料, 最好是通过废物回收的方式。在控制的燃料炉内燃烧垃圾可回收能源
- Landfill should be used only as a last resort
垃圾填埋应作为最后的方法



EMS training 9/20/2011 14

E-waste 电子垃圾

- Main sources of e-wastes (in China): 电子垃圾的主要来源(中国)
 - Waste electronic products from households 家庭电子废旧产品
 - Waste electronic products from governments, institutions and enterprises 政府、机构和企业的电子废旧产品
 - Defective electronic products from manufacturer 生产商有缺陷的电子产品
 - Imported electronic waste 进口电子产品废弃物
- Recycle electronics in a proper way 以适当的方式回收电子产品
 - Saves energy and raw material 节约能源和原材料
 - BUT NOTE! Informal dismantling and material recovery facilities may cause significant environmental and human health impacts.
但请注意! 非正式拆解和材料回收设施可能对环境影响和人类健康造成重大影响
- When ever technically possible, we choose to use "green electronics"
只要技术可行, 请选择“绿色电子产品”



EMS training 9/20/2011 15

Hazardous waste 危险废物

- Waste that poses substantial or potential threats to public health or the environment.
废弃物对公众健康或环境带来极大或潜在威胁
- Hazardous property of the waste can be 危险废物性质可为:
 - Corrosive (C), Toxic (T), Ignitable (I,E) or Infective (In)
腐蚀(C), 有毒(T), 易燃(I, E)或感染(I)
- Hazardous E-waste 有害电子废物
 - Lead Acid battery, Ni-Cd battery, Mercury switch, CRT tube, PCB capacitor, Printed circuit board
铅酸电池, 镍镉电池, 汞开关, 阴极射线管, 印刷电路板电容器, 印刷电路板




EMS training 9/20/2011 16

Exposing to hazardous substances 接触有害物质	What can you do! 你该如何应对!
<ul style="list-style-type: none"> ○ People may be exposed through 人们可能通过以下方式接触: <ul style="list-style-type: none"> ○ direct skin contact 皮肤直接接触 <ul style="list-style-type: none"> ○ E.g. in occupational activities when using strong solvents in painting or in cleaning tasks. Protect yourself accordingly! Look at precautions from the container or from MSDS 例如: 职业活动中: 绘画或清洁工作时使用强溶剂, 要相应的保护自己! 阅读容器上的预防措施或化学品使用说明书 ○ inhalation of polluted air 吸入受污染的空气 <ul style="list-style-type: none"> ○ outdoor as well as indoor 室内以及室外 ○ ingestion of contaminated food 摄入受污染的食物 <ul style="list-style-type: none"> ○ e.g. eating fish contaminated with mercury 如: 食用受汞污染鱼类 ○ contaminated drinking water 被污染的饮用水 <div style="text-align: center; margin-top: 10px;">  </div> <div style="text-align: right; margin-top: 10px;">  </div> <p style="font-size: small; text-align: center;">EMO training 9000011 17</p>	<ul style="list-style-type: none"> ○ Do not Pollute - Do not Waste means...不要污染—意为: <ul style="list-style-type: none"> ○ Choose recycled products and choose products with recyclable packaging. 选择再生产品, 选择使用可回收包装的产品 ○ Recycle paper, plastics and metals. 回收纸张, 塑料和金属 ○ Use energy saving light bulbs. 使用节能灯泡 ○ Do not litter. 勿乱丢垃圾 ○ Purchase energy saving appliances. 购买节能电器 ○ Use a timer that automatically turns off the air conditioner or heater when you don't need them. 使用定时器, 在不需要时自动关闭空调或取暖设备 ○ Other methods? 其他方法? <div style="text-align: right; margin-top: 10px;">  </div> <p style="font-size: small; text-align: center;">EMO training 9000011 18</p>

minimize load on the environment 让环境负担最小化







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List of EMS related documents and records

Version	Date	Prepared	Description	Approved	Date
				See	SwitchON
0.2	2011-07-29	PikSa	Updated for Lu'an		
0.1	2011-04-27	PikSa	Initial draft		

Purpose

This document lists the needed documentation in order to to maintain the Environmental Management System (EMS) and records that need to be maintained in order to demonstrate the conformity to the requirements of the ISO 14001, The Switch environmental management system and the results achieved.

EMS related documents

The following instructions/templates/training documents are created in order to implement and maintain the Environmental Management System (EMS).

Type	Name	Location
Instruction	The Switch environmental policy.pptx	SwitchON /Documents/Business and Social Processes
Instruction	Environmental aspects, objectives, targets and programs.doc	SwitchON /Documents/Business and Social Processes
Template	Template for identification and significance of environmental aspects.xls	SwitchON /Documents/Business and Social Processes Note! As record: Q:\RECORDS\EMS ->Subfolder China, Common, Finland or USA Because of bad data connections Chinese records can also be stored to local servers.



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Type	Name	Location
Template	Template for identification of environmental legislation.xls	SwitchON /Documents/Business and Social Processes Note! As record: Q:\RECORDS\EMS ->Subfolder China, Common, Finland or USA Because of bad data connections Chinese records can also be stored to local servers.
Instruction & template	Environmental programs.doc	SwitchON /Documents/Business and Social Processes
Training document	EMS training rev 1.0.ppt	Q:\Instructions\EMS
Training document	Environmental training, pollution and waste_ rev 1.0.ppt	Q:\Instructions\EMS
Instruction & template	Audit_Questions_Internal_ISO14001-2004 template.xls	SwitchON /Documents/Business and Social Processes Note! As record: Q:\Audits\Internal...
Instruction	Emergency preparedness.doc	SwitchON /Documents/Business and Social Processes

The following instructions are used both as part of Quality Management System and EMS.

Type	Name or description	Location
Other - The scope of EMS	Scope	SwitchON / Operation manual / 3.1 scope
Instruction	Operations manual	SwitchON / Operations manual
Other - Document control	Description of the management system.doc	SwitchON / Documents / process documents
Other – Supplier evaluation procedures	Supplier selection Audit template	V:\Supply_Management\Suppliers



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Environmental records

Environmental record is a document (paper, magnetic, electronic or optical computer disc, photograph etc.) which

- states the environmental results achieved or
- provides evidence of activities performed

On the following table records that need to be retained are listed. Some of the documents may be relevant only to some facility of the Switch (marked by name or abbreviation of the location).

EMS process phase	Issue/document/record showing the compliance towards ISO 14001	Archive place
Starting point	Initial environmental review version 1_0_China.doc	Q:\RECORDS\EMS ->Subfolder China, Common, Finland or USA Because of bad data connections Chinese records can also be stored to local servers.
Environmental Policy	Environmental policy.pptx	SwitchON/Documents/process documents/business and social processes
Planning	Identification and significance of environmental aspects China.xls	Q:\RECORDS\EMS ->Subfolder China, Common, Finland or USA Because of bad data connections Chinese records can also be stored to local servers.
Planning	List of China environmental legislation applicable for The Switch operations.xls	Q:\RECORDS\EMS ->Subfolder China, Common, Finland or USA Because of bad data connections Chinese records can also be stored to local servers.
Planning	Lu'an: The registration of the environmental influence of construction project (hard copy)	Lu'an office
	Environmental programs.doc	Q:\RECORDS\EMS ->Subfolder China, Common, Finland or USA Because of bad data connections Chinese records can also be stored to local servers.



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EMS process phase	Issue/document/record showing the compliance towards ISO 14001	Archive place
Implementation	Internal and external communication	SwitchON / Operations manual / 2.3. Internal and external communication The decision NOT to communicate externally about significant environmental aspects at the moment is stated in management meeting minute The Switch - MT meeting 1-11 extract.
Implementation	Supplier audit reports	V:\Supply_Management\Suppliers
	Calibration documents	Lu'an office
Implementation	General or task specific training materials (especially training material related to the tasks, machinery or materials that may have environmental impacts)	More detailed / work specific orientation/training methods (instructions, material) are to be developed by HR during 2011
Implementation	Chemical or other material control	Local records: - e.g. chemical listing and handling instructions + Material safety data sheets if needed
Checking & Corrective action	Management review minutes	Q:\Records\ManagementReviews
	Communications with interested parties	www.theswitch.com
Checking & Corrective action	Records of waste and recycled material	Q:\RECORDS\EMS ->Subfolder China, Common, Finland or USA Because of bad data connections Chinese records can also be stored to local servers. Local records (follow up tables, receipts) e.g. Recycled material in Lu'an follow up table.xls
	Internal & external audit reports (-> CAPAs)	Q:\Audits\... Q:\CAPA\...
	Supplier audits	V:\Supply_Management\Suppliers



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EMS process phase	Issue/document/record showing the compliance towards ISO 14001	Archive place
	Environmental complaints or concerns and related CAPA report and enclosures as mentioned in the report (received document, response, investigation documents)	Q:\CAPA\...
	Near accident and accident reports, include (near) environmental accidents	Local reports and archive + Possible CAPA at Q:\CAPA\...
	Records of fire alarm system testing. Fire/emergency practice training records	Local archive
	Process surveillance records, measuring reports etc Records of such processes in production that are monitored constantly because of environmental aspects	Local archive
	Training records	Q:\TrainingDB; training.xlsx
Management review	Management meeting minutes	Q:\Records\ManagementReviews
	Meeting minutes of local environmental team or work safety committee (which ever handles local environmental issues)	Local archive



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List of China environmental legislation applicable for The Switch operations

Version	Date	Prepared	Description	Approved	Date
				see	SwitchON
0.1	2010-12-17	PikSa	Initial draft		

1 Purpose of this document

This document contains the applicable environmental legislation of PRC and other subscribed requirement for The Switch operations in China.

The list is reviewed ones a year and the influence of possible amendments or new requirements is evaluated and needed actions (CAPA) are taken. However if the term "follow up" is written in the column "Contents in brief", that regulation etc. needs to followed up more closely, though at the time of review it has no effect to the operations.



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2 Applicable legislation

Environmental laws of PRC	Adopted or promulgated and latest amendment	Contents in brief	Influence on The Switch
Environmental Protection Law of the People's Republic of China	1989-12-26 1999-03-15	General requirements on environmental protection	Local Standards need to be reviewed and if needed to be included into this document (article 10). Emergency preparedness procedure must be kept up-to-date (article 31).
Constitution of the People's Republic of China (excerpts of environment-related articles)	1982-12-04 1999-03-15	General information	
Law of the People's Republic of China on Prevention and Control of Pollution From Environmental Noise	1996-10-29 --	General information	
Law of the People's Republic of China on the Prevention and Control of Environmental Pollution by Solid Waste	1995-10-30 --	Requirement to prevent the pollution caused by solid waste.	To be noticed in production, in disposal and in packing (articles 15, 16 and 17). Recyclable packing materials need to be used when possible.
		Dangerous waste of different classifications shall be collected and stored separately according to their properties.	Dangerous waste need to be identified and handled according local requirements.
Law of the People's Republic of China on the Prevention and Control of Atmospheric Pollution	1995-08-29 --	General information	To be noticed in supplier audits
Law of the People's Republic of China on Prevention and Control of Water Pollution	1984-05-11	General information	To be noticed in supplier audits



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Environmental laws of PRC	Adopted or promulgated and latest amendment	Contents in brief	Influence on The Switch
Law of the People's Republic of China on the Promotion of Clean Production	2002-06-29	Article 27 If any product or package is listed in the <u>compulsory recycling directory</u> , enterprises engaged in their production or sale shall recycle the discarded product or used packaging. The relevant department for economics and trade under the State Council will formulate the compulsory recycling directory of products and packages and its detailed methods for recycling.	The contents of the compulsory recycling directory of products and packages and its detailed methods for recycling needs to be found.
Law of the People's Republic of China on Conserving Energy	1997-11-01	General information	
Construction Law of the People's Republic of China	1997-11-01	General information	
Electric Power Law of the People's Republic of China	1995-12-28	General information	
Foreign Trade Law of the People's Republic of China	1994-05-12	General information	
Law of the People's Republic of China on Water and Soil Conservation	1991-06-29	General information	

Environment or related Regulations and Standards	Adopted or promulgated and latest amendment	Contents in brief	Influence on The Switch
Administrative Measures on Prevention and Control of E-waste Pollution (SEPA Order No. 40)	2008-02-01	General information	Influence needs to be evaluated
National Catalogue of Hazardous Waste (No.1 Order of Ministry of Environmental Protection)	2008-08-01	Definition of hazardous waste	E-waste and many hazardous wastes produced by households in daily life may not be managed as hazardous wastes. Local requirements need to be found out?



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Environment or related Regulations and Standards	Adopted or promulgated and latest amendment	Contents in brief	Influence on The Switch
<u>Emission Standard of Pollutants for Electroplating (GB 21900--2008)</u>	2008-08-01	The current standard specifies such contents as the discharge limit for electroplating water pollutant and air pollutant emission limit of electroplating enterprises and enterprises with electroplating facilities.	To be noticed in supplier audits
Cleaner Production Standard-Printed Circuit Board Manufacturing (HJ 450-2008)	2009-02-01	This standard provides the general requirements for printed circuit board manufacturing industry to have cleaner production on the basis of meeting the national and local environmental standards and in line with the existing technological, equipment and managerial levels of this industry.	To be noticed in supplier audits

Local Regulations and Standards	Adopted or promulgated and latest amendment	Contents in brief	Influence on The Switch

Recycled material in Lu'an, recycling info and follow up table (template)

Recycling info				
The Switch Lu'an				
Material	Recyclable types	How to recycle	Non-recyclable types	How to dispose
Paper	newspapers	sold to local waste picker	paper that is not clean, shredded office paper	with solid municipal waste
	envelopes			
	office paper			
	plastic coated paper			
Cardboard	brown cardboard and paper			
Wood	Delivery box			
	Delivery palette			
Plastics	Packing material			
Glass				
Aluminum				
Steel				
Copper				
Special waste				
batteries				
fluorescent or energy saving light bulbs				
oil				
office / production tool electronics				
Industrial process waste, scrap materials, off-specification products,				

Recycled material in Lu'an factory

Date	Material	Amount	Unit (pcs, kg, l, m3 etc.)

Environmental communications over environmental issues

(Additions to Operations Manual)

It is the duty of the whole personnel to listen and to receive the questions over the environmental matters of the company and make sure that at least those with possible environmental concerns are registered according CAPA process. However all question from external interested parties are beneficial to record as background information for continuous improvement of EMS.

All questions are answered as soon as possible and the environmental policy and instructions of internal and external communication presented previously in this sheet are followed too.

General environmental question can be answered immediately by the respondent

- A common and simple question
- The answer does not contain any classified information

The person to give the answer to the significant environmental question is decided during CAPA process

- The question cannot be answered immediately
- The question contains arguments over unfavorable behavior of the company against environment.
- The question has been asked in the past also.

The following questions/concerns are considered being serious or extensive and are answered by CEO

- It is argued that the company is behaving against its environmental policy
- The question over environmental matter is presented by the press
- The significant situation is repeated within a month
- The question concerns environmental aspects, environmental targets or environmental programs (except when only presenting or referring to already published information = "general case")

EMS audit questionnaire
(Questions asked in internal audit)

Environmental management system

The numbering refers to ISO 14001:2004

4.1 General requirements

Is the EMS documented and maintained according ISO 14001?

Is the scope of EMS clear (defined and documented)?

4.2 Environmental policy

Does the environmental policy include a commitments concerning

- legal requirements and applicable other requirements
- continual improvement and prevention of pollution

How is the policy communicated internally and externally (availability)?

Is the scope of the policy clear (link to company products, operations and to environmental aspects of those)?

4.3 Planning

4.3.1 Environmental aspects

Is there a procedure to define the environmental aspects of the current products, operations and services? (Both direct and indirect impacts, from raw materials to final disposal of the products).

Criteria for significance?

Have there been changes in operations and have the new possible risks for the environment and abnormal situations been evaluated?

4.3.2 Legal and other requirements

What legal requirements are applicable to the company?

How the company has access to those?

How these requirements apply to environmental aspects?

What other than legal requirements company has subscribed to?

How is it secured that the information over legal requirement is known by the personnel (if needed)?

4.3.3 Objectives and goals

Does the company have environmental program and does it contain

- Objectives?
- Targets?
- Time frame for those?
- Responsibilities?

Is the program known/available for those in charge?

Are the objectives measurable whenever practicable?

How were the following taken in account when objectives and targets were defined?

- environmental policy
- significant environmental aspects
- aspect from the interested parties
- the financial and operational requirements of the organization
- commitment to prevention of pollution
- legislation and other requirements
- technological possibilities
- financial and operational requirements

4.4.1 Implementation and operation

How are the roles, responsibilities and authorities communicated to the personnel?

How is the top management commitment to the continuous development of EMS and how does it ensure the availability of resources

- special skills
- infrastructure
- technology
- financial resources

Have environmental related responsibilities and authority been defined in writing?

- marketing, sales, customer service
- design and development
- production planning
- investment projects
- sourcing
- incoming inspections and warehouse
- maintenance
- packing
- transportations
- service
- internal audits

Management representative

- Who?
- Tasks and reporting methods?

Are there legislative responsibilities? Where those responsibilities have been stated and named?

4.4 Planning

4.4.2 Competence, training and awareness

How are the training needs identified?

How are the environmental issues noticed in training of new employees?

How and where is training, orientation and competence needs recorded?

How is it secured that the personnel, doing tasks that affect significant environmental aspects, are trained / practiced enough?

Special requirements in the company? (Environmental inspections, process control, checks for authorities).

How is it secured that all personnel is aware of the environmental policy?

Do they understand why it is important to follow those principles as well as other procedures of EMS?

How is it secured that the personnel are aware of the negative and positive environmental impacts of their work, both in normal as in abnormal situations?

How is it secured that employees are aware of the potential consequences of departure from specified procedures?

4.4.3 Communication

How the internal communication is secured between functions and organization levels

How environmental aspects are externally communicated? Where is it stated?

What are the procedures to document and to respond to relevant communication from external interested parties? Information in case of abnormal situation?

How is the external communication secured in case of abnormal situation?

- customers
- share holders
- authority
- neighbors
- press
- media
- others

Is there a register of environmental concerns, questions, visits etc.?

4.4.4 Documentation

What is the structure of EMS system?

Is the location of documented procedures known, are those always available?

How are environmental management system and the main parts of it documented?

4.4.5 Control of documents

What is the procedure in reviewing, updating and re-approving the documents?

How is it secured that documents remain legible and readily identifiable?

How is it ensured that relevant versions of applicable documents (internal and external) are available at points of use?

How is the unintended use of obsolete documents prevented or have those been identified somehow in case those are retained for any purpose.

4.4.6 Operations control

How is it ensured that the control, measurement and testing is coordinated enough at different parts of the organization?

Does the control of operations cover all activities of the company?

- marketing, sales, customer service
- design and development
- production
- investment projects
- sourcing
- incoming inspections and warehouse
- maintenance
- packing
- transportations
- service

Are there written documents determined by the organization to be necessary to ensure the effective planning, operation and control of processes that relate to its significant environmental aspects.

How are the environmental aspects of used services and products controlled?

- raw-material
- transportation
- cleaning
- maintenance
- waste management

How these demands are informed to suppliers?

How are abnormal situations and emergencies noticed in operations control?

How and where are the operational requirements stated?

How is the environmental program and EMS taken in notice when planning, developing and/or creating new/changed operations, products or services?

4.4.7 Emergency preparedness and response

Are abnormal situations, accidents and emergencies included in the documentation of the EMS?

What are the methods to identify possible accidents and emergencies and to react in those?

Do emergency plans include methods to prevent and to minimize the environmental impacts?

How are the emergency plans reviewed and updated?

Have emergency plans been tested?

Do employees know needed actions in case of emergency (preparedness, duties)?

4.5 Checking

4.5.1 Monitoring and measurement

How are those operations monitored that might have significant environmental aspects?

Have the monitoring and measurement of the operations done on regular basis?

Have the acceptance criteria been set and what are the actions in case of those have not been reached?

Is the equipment, used for monitoring and for measurement of environmental impacts, maintained and calibrated or verified? Records?

4.5.2 Evaluation of compliance

What is the procedure to evaluate the compliance with legal requirements?
Records of periodic evaluations?

4.5.3 Nonconformity, corrective action and preventive action

Is there a procedure for identifying and correcting non conformities?

Does it cover also potential nonconformities?

Does the procedure contain the following?

- actions to mitigate environmental impacts caused by nonconformity
- defining root cause
- actions to avoid their occurrence
- action plan
- review of taken actions
- making changes to EMS procedures

4.5.4 Control of records

Is there a procedure that defines how environmental records are identified and traced to the activity, product or service?

How do the records demonstrate conformity to the requirements?

Do the records include

- training records
- audit records
- review results
- performance indicators
- emission / discharge measurements

Do the records show that the requirements of ISO 14001 are fulfilled?

4.5.5 Internal audit

What kind of internal audit procedure exists? (Is there a written audit program?)

Do the audit records show, that

- the EMS is executed as planned,
- it fulfills the requirements of ISO 14001
- EMS is properly implemented and managed?

On what ground the audit program is prepared.

- Is the environmental importance of the operation(s) concerned (how)?
- The results of previous audits?

Does the audit procedure contain the following?

- the scope of audit
- the frequency (planned intervals)
- audit methods
- reporting method
- responsibilities

What are the requirements for the auditors?

- expertise
- objectivity
- training
- experience

How are the results of audits reported to the management?

4.6 Management review

How often the management reviews are held (planned intervals)?

How does the management evaluate that the EMS is suitable, adequate and effective?

What do the records of management review contain?

How is it secured that the management gets all needed information for its review?

Are the following considered in management reviews?

- Is the environmental policy followed or is there a need for change
- At what extent environmental program and its objectives and targets have been met
- Concerns of interested parties?
- Effectiveness and results of internal audit
- Consistent with the commitment to continual improvement

Does the review point out decisions and actions?



EMS INTERNAL AUDIT REPORT

2(20)

Summary of observations:

See evaluation questions table for details.

Must be improved (NC, MAJOR NC):

MAJOR NC1: Management reviews are not done according planned intervals. [4.6]

MAJOR NC2: There is no written decision available if The Switch is going to externally communicate environmental aspects and how. [4.4.3]

NC 1: There have been no fire trainings for the employees in Beijing; some problems in knowledge of how to react in case of fire. There is also a fire risk at wind turbine, which may cause environmental impact, so service engineers should be trained how to use fire extinguishers. The fire extinguishers in Beijing are not in order (2 out of 5 is out of zone according pressure pointer) [4.4.2]. Needs actions also in Lu'an [4.4.6 and 4.4.7]

NC2: The information about external communication is not the same in intranet as in SwitchON. External communication about environmental issues is not defined (draft version is not accepted). [4.4.3]

NC3: It is not decided how to make sure that new operations and products are evaluated from the environmental point of view in planning phase. [4.4.6]

NC4: List of validated auditors is not up to date for environmental audits. [4.5.5]

See evaluation questions table for details.

Recommended to be considered for improvement (I):

- CI 1. Environmental policy is not available externally through web-site, but can be handed over on request [4.2].
- CI 2. The legislation knowledge does not cover all provinces where The Switch has operation in China or where the products are delivered. This item is ongoing but could be partially implemented into CE process development [4.3.2]
- CI 3. More task related environment training is requested [4.4.2]
- CI 4. Follow up of the amounts of recycled materials should be done in order to see the trend, possible significant environmental aspect in the future as the manufacturing amounts are growing [4.4.6]
- CI 5. Training records are not done according process description. Also the templates vary between locations [4.5.4]

See evaluation questions table for details.