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Environmental Accounting System for the Youth Olympic Games

A Thesis on Environmental Management for
the Youth Olympic Games

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Safety, Health and Environment

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The main focus of the assignment is to contribute to the development of the environmental management system for the YOG at Lillehammer in 2016. The study will focus on the fields of environmental aspects of a sporting event, environmental accounting and measures to reduce the consequences of the aspects.

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Sammendrag

Masteroppgaven er skrevet i samarbeid med Lillehammer Youth Olympic Games Organising Committee (LYOGOC) etter deres ønske om å skape en miljøstrategi for det kommende ungdoms-OL (YOG) på Lillehammer i 2016. Avhandlingen fokuserer på de miljømessige aspektene knyttet til arrangementet og hvordan disse kan kontrolleres og håndteres på en ansvarlig måte. Det er derfor videre valgt å utvikle et design for et miljøstyringssystem, som er koordinert og kombinert med et miljøregnskap.

De olympiske leker regnes som et av verdens mest prestisjefylte idrettsarrangement, med historie helt tilbake til antikkens tid. Den moderne olympiske debut, med sommer disipliner, ble holdt i Athen i 1896. Vinterlekene ble først arrangert 28 år senere i 1924, med Chamonix som første vertsby. Den enorme utviklingen i både størrelse og budsjett rundt de olympiske leker har fått personer i IOC miljøet til å ville bringe tilbake den sanne olympiske ånd sammen med dens kjerneverdier. IOC gjorde derfor en innsats for å komme i kontakt med de gamle verdiene, noe som resulterte i konseptet og etableringen av YOG. Visjonen til YOG bygger på tanken om å inspirere unge mennesker over hele verden til å delta i idrett, og samtidig leve etter de olympiske verdiene. Arrangementet ble opprettet for å utdanne, engasjere og påvirke unge idrettsutøvere for å inspirere dem til å spille en aktiv rolle i sine lokalsamfunn. Videre bygger YOG konseptet på tanken om å benytte seg av allerede etablerte idrettsarenaer for å sette fokus på den tredje pilaren i de olympiske leker, nemlig miljøet. Konseptet er dermed med på å redusere den totale miljøpåvirkningen av arrangementet, samtidig som det er en mulighet til å utdanne, utvikle og forme kommende generasjoner. Dette betyr at de største miljøaspektene oppstår under selve arrangementet. Oppgaven har til hensikt å visualisere et systematisk bilde av miljøaspektene knyttet til YOG, og retter oppmerksomheten mot fem hovedpunkter: innkjøp, opphold for deltakere, drift av arenaene, transport samt avfallshåndtering og gjenvinning.

Analysen av miljøaspekter ble utført etter å ha skapt et systematisk bilde av aktivitetene til organisasjonskomiteen og intervju med nøkkelinformanter på hver arena. Analysen gir deretter grunnleggende informasjon som er nødvendig under utviklingen av miljøstyringssystemet og det tilhørende miljøregnskapet.

Miljøstyringssystemet vil være basert på rammeverkene til ISO 14001, ISO 20121 og EMAS. Systemet benytter ”High Level Structure”, oppsettet fra ISO 14001, med de prosedyrer og tiltak som gjenspeiler det systemiske bildet av YOG og det fem hovedpunktene. Hvert under element har sine egne prosedyrer og tiltak som sørger for å kontrollere og redusere miljøaspektene som er knyttet til arrangementet.

Arenaer og overnattingsanlegg vil bli leid under arrangement-perioden. Det vil derfor være vanskelig å påvirke miljøbelastningen på dette området fordi viljen til å utføre forbedringer ligger i hendene på eierne, og alternative arenaer er begrenset. Avhandlingene understreker derfor viktigheten av ekstra fokus og miljøbevissthet rundt innkjøp, transport, gjenvinning og kommunikasjon for å redusere miljøpåvirkningene rundt arrangementet.

Abstract

The thesis is written in collaboration with Lillehammer Youth Olympic Games Organising committee (LYOGOC) and their desire to create an environmental strategy for the upcoming Youth Olympic Games (YOG) at Lillehammer in 2016. The thesis focuses on the environmental aspects connected to a youth Olympic game and how to control and handle these in a responsible manner. It was therefore chosen to develop a design for an environmental management system, which is coordinated and combined with an environmental accounting system.

The Olympics are regarded as one of the world's most prestigious sporting events, with history linked back to the ancient Greek society. The modern Olympic debut, with summer disciplines, were held in Athens, Greece, in 1896. The winter games were established twenty-eight years later in 1924, with Chamonix as the first host. The exaggerating development of the Olympic games might have given thoughts of wanting to bring back the true spirit, Olympism and Olympic values. IOC made an effort to get in touch with the old values, which resulted in the concept and establishment of YOG. The vision of YOG builds upon the thought of inspiring young people around the world to participate in sport, and adopt and live by the Olympic values. The event was created to educate, engage and influence young athletes in order to inspire them to play an active role in their communities.

The YOG concept is built upon the thought of using former facilities, to set the focus on the third pillar of the Olympic games, the environment. The concept reduces the total environmental impacts of the events and a possibility to educate, develop and form the next generation. This means that the most significant environmental aspects occur during the staging of the event. The thesis intends to visualise a systemic picture of the environmental aspects of the YOG, pointing the attention on procurement, accommodation, venues, transportation, waste management and recycling.

The analysis of environmental aspects was performed after creating a systemic picture of the event and interviews with key informants at each site. The analysis gives thereafter the basic information needed in the development of the environmental management system and the environmental accounting system.

The environmental management system will be based on the ideas of ISO 14001, ISO 20121 and EMAS. The system uses the high level structure of ISO 14001, with the procedures and measurements reflecting the systemic picture of YOG with the five main focus areas. Each sub element has its own procedures and measurements to control the environmental outcome of the games.

The venues and accommodations will be rented in the event period, so it will be harder to affect the total environmental impact, because the willingness to improve environmental performance lies in the hands of the owners, and optional venues are not available. The thesis therefore stresses the importance of extra focus and environmental awareness on procurement, transportation, recycling and communication to increase environmental performance.

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Abbreviations

BS	British Standard
CSR	Corporate Social Responsibility
CEP	Culture and Education Programme
EMS	Environmental Management Systems
EMAS	Environmental Management and Audit Scheme
EPA	United States Environmental Protection Agency
EU	European Union
EUR	Euro
GLØR	Gjøvik, Lillehammer and Øyer Renovation
GRI	Global reporting Initiative
IOC	International Olympic Committee
IYOGOC	Innsbruck Youth Olympic Games Organising Committee
ISO	International Standard Organisation
KPI	Key Performance Indicator
LOGOC	London Olympic Games Organising Committee
LYOGOC	Lillehammer Youth Olympic Organising Committee
NTNU	Norwegian University of Science and Technology
MMC	Main Media Centre
OECD	Organisation for Economic Co-operation and Development
OSL	Oslo Airport
SOPP	The Student Welfare Organisation in the County of Oppland
SYOGOC	Singapore Youth Olympic Games Organising Committee
UN	United Nations
UNEP	United Nations Environmental Programme
LOBB	Lillehammer Cooperative Housing Association
YOG	Youth Olympic Games
YOGOC	Youth Olympic Games Organising Committee
YOY	Youth Olympic Village

1 Introduction

The focus of the thesis is to contribute to the development of the future environmental strategy of the Youth Olympic Games (YOG) at Lillehammer 2016. This chapter will introduce the basic historical background of the games, the establishment of YOG and the development of environmental focus along the way. Further, the chapter will introduce the research questions, how the thesis is structured, its limitations and the scope of the thesis.

1.1 The History of the Olympics

The Olympics are regarded as one of the world's most prestigious sporting events, with history back to the ancient Greek society. The modern Olympic debut, hosting the summer disciplines, were held in Athens, Greece, in 1896. The winter games were established twenty-eight years later in 1924, with Chamonix as the first host (IOC, 2013). The event has, with traditions, been held every fourth year since the first occasion in Athens, with the exception of one event during WWI and four events during WW2. The games have through the last 50 years expanded significantly with the power to influence economics, cultural, political and social aspects of the hosting city (Girginov & Parry, 2005). The games are also regarded as a booster for economic growth and a significant catalyst for urban regeneration according to Jones & Stokes (2003). The enormous growth and global popularity has made the games a highlight of most athletes' careers. Hosting the Olympic games is a massive project that leaves permanent traces on the host city and their residents. With the legacy of new or renovated venues and infrastructure, the games represent a facelift for the host city, and the growth of the games puts further pressure on the next organiser to create something even greater. The great task of staging the Olympics does not only put pressure on the organisers, but also on the host city and its citizens. Hosting the games puts a lot of pressure on the city's accommodation stock, its waste management system, land use, energy supply, water consumption, sewage system and on its transport and security networks. Each of these issues needs to be brought up to such a standard so it is able to accommodate the increased population during the games (Furrer, 2002).

The exaggerating development might have given thoughts of wanting to bring back the true Olympism and Olympic values. Johan Rosenzopf from Austria brought up the idea of the Youth Olympic Games in 1998, but the International Olympic Committee (IOC) did not approve the idea before the 6th of July in 2007. His idea was a response to the growing global concern for childhood obesity and the dropping participation of youth in sport activities, especially amongst youth in developing countries. Besides, in order to improve the student's academic performance, schools are dropping sports and physical education from their curriculums (Olympic, 2011a).

The vision of YOG is to inspire young people around the world to participate in sport and adopt and live by the Olympic values. The event is created to educate, engage and influence young athletes in order to inspire them to play an active role in their communities. The event is created for young people, and shall contain a balanced approach on the themes of sport, culture and education. The games intend to work as a catalyst in these fields throughout the Olympic movement. Young athletes will participate in high-level competitions alongside a Culture and Education Programme

(CEP), which is focused on five themes: Olympism and Olympic values, skills development, well-being and healthy lifestyle, social responsibility and expression through digital media. Despite being a new concept, IOC has more than a century of experience and has adopted the ideas and the current format of the Olympic games. The first host of the summer YOG was Singapore in 2010, which brought together approximately 3,600 athletes and 1,450 officials. The first winter YOG was arranged in 2012 in Innsbruck, Austria, and had 1,000 athletes and 500 officials (Olympic, 2012b).

1.2 The Greening of the Games

Since the first Olympic games in 1896 the games have been arranged 49 times. However the environmental issues connected to the games has not always been a top priority. From the beginning it was normal that each host had its own strategies, and environmental concerns usually came second. However, through the technological development and stronger participation from IOC the environmental concerns of sporting events were communicated more frequently. External participation to improve environmental performance was established in 1992 at the first UN Conference on Environment and Development in Rio de Janeiro, Brazil. The United Nations presented Agenda 21 to encourage the global community to play an active role in the sustainable development of the planet. The Olympic movement decided to act on the invitation and developed their own interpreted version of Agenda 21. IOC has since been UNEP's most influential partner in sport and environment (Agenda 21, 2012). The two organisations have worked together since 1994 to incorporate environmental issues into the world's biggest sporting event. UNEP is now represented on the Sport and Environment Commission, which advises the IOC executive Board on environmental matters related to the Olympics (IOC, 1999).

As a result of the new cooperation with UNEP, Lillehammer 1994 became the first Olympics with the environment as a third dimension of the games (Furrer, 2002). Lillehammer had a population of 23,000 in 1994, but during the two weeks of the event, the Olympics hosted approximately 100,000 spectators each day. The large amount of people gathered puts a lot of pressure on the environment (New York Times, 1994). The cooperation with Lillehammer 1994 resulted in a partnership with IOC and UNEP. The agreement was made with the intention to make sports events environmental friendly. A sustainable development concept was adopted, and the environment was to remain as the third Olympic pillar together with sport and culture (Olympic, 2012c). Until today, London 2012 is regarded as the first sustainable organiser of Olympic Games.

1.3 Research Questions and Goals

The purpose of the thesis is to contribute to the total environmental strategy for the Youth Olympic Games at Lillehammer in 2016. The study will focus on creating an overview of the environmental aspects of the event, and further create a designed set up of an EMS and environmental accounting system with guidance and measures to reduce the consequences of the aspects. More specifically the thesis aims to cover the following issues of the environmental strategy of the event:

1. Provide an overview of the relevant standards and frameworks for major sports events
2. Identify the environmental aspects of this type of events, seen from a systems perspective
3. Suggest methods and systems for environmental accounting of major sporting events
4. Propose Environmental Management System to integrate environmental accounting in the different life cycle phases of the event
5. Identify specific measures to control and reduce the environmental impact of the event, and the costs associated with it
6. Consider measures in a social perspective, seen in the light of CSR

The goal is to create an environmental accounting system with guidance and procedures to measure the environmental aspects, which will be valuable for future YOG events. The similarities of the events makes it easier to establish a standardised set up that will help future YOG events to benchmark each other and use earlier hosts as a reference and a motivation to achieve even better.

1.4 Structure of the Thesis

The thesis is divided into six sections including the introduction chapter. This sub chapter will give a description of what the different sections contains.

Chapter two: Literature Review

Based on the six research questions in chapter 1.3 it is chosen to provide a theoretical insight on Environmental Management Systems (EMS), environmental accounting and the environmental and social aspects in sporting events.

Chapter three: YOG Lillehammer 2016

Chapter 3 introduces LYOGOC, its tasks, and the extent of YOG Lillehammer 2016. The venues, the YOG village and the programme are important issues that need to be described in order to provide an environmental analysis of the event.

Chapter four: Research Methodology

This Chapter will narrow down the methodology used to answer the research questions. The chapter will discuss the fields of research design, research methods and how the data is presented and evaluated.

Chapter five and six: Analysis and Results

The Chapters will analyse the findings from the methodologies used, and afterwards presents a short summary of the main findings. The delivery of the EMS and accounting system is given fully in appendix one and two.

Chapter seven and eight: Discussion, Conclusion and Recommendations

The last chapters discuss the most important findings and further present the conclusion with recommendations and further studies on the field.

1.5 Limitations of the Research

The YOG-concept builds upon the thought of using facilities already available in the area of the host city. The pre-phase before the event is therefore reduced to only containing procurement, operation and smaller facilitation. There are however three new constructions which will be used under the event, but they are already planned or constructed on the responsibility of other actors. If they were to be added within the boundaries of the system, the total environmental impact would have increased significantly. Since they are not under the jurisdiction of LYOGOC, they are therefore not within the system boundaries. These types of issues are also been discussed concerning flights and the arrival and departure of the athletes. Even though the “total” presented environmental impact is extensive, there are always issues that could have influenced it even more. It is just a question on how far down the supply chain you assess and how the boundaries are set. Given the early stage of the planning there are some environmental issues connected to procurement and transportation that are not easily assessed, because the alternatives or choices are not made yet. It is therefore chosen to focus on recommendations on how to perform more environmental friendly, rather than assuming possible outcomes. A brief description of the mentioned new venues and their construction management is given below.

The main construction project, the YOG village in Lillehammer, is primarily a student accommodation facility and is carried out by The Student Welfare Organisation in the County of Oppland (SOPP) and Lillehammer Cooperative Housing Association (USBL). Since the planning of the construction already has started it is too late for recommendations on the project. The construction and building period is therefore not within the scope of this assignment (LYOGOC, 2012).

The new curling venue was planned by the Municipality of Lillehammer, and was finished on the 19th of June 2012. The venue is an extension of Kristin Hall, where the ice hockey tournament will take place. The venue has four full-scale lanes and has a capacity of 500 spectators. The venue is daily operated by Lillehammer Curling Club (LYOGOC, 2012).

The Municipality of Lillehammer has made a formal decision with regards to the financing and construction of a new ice hockey training venue, located next to Kristin Hall and the new curling venue in the Olympic Park area in Lillehammer. The construction of the venue started in September 2012 and the construction of the venue will, according to the plan, be finalised in June 2013. During the YOG 2016, the venue will be used as a training venue for ice hockey and hockey skills (LYOGOC, 2012).

2 Literature Review

The literature review intends to give an insight to the concepts and theories in the focus areas of the thesis to create an understanding of the fundamental aspects in developing an environmental friendly event. The concepts of EMS and environmental accounting support the basics of handling environmental issues. By connecting these tools and methods to environmental aspects of sporting events, it will leads us in to the specific case of preparing a sustainable YOG at Lillehammer 2016.

2.1 Environmental Management Systems

The usage of EMS has existed for a while, but usage of systems of this character within the context of a sporting event is not that common. The reason for this is probably due to the fact that sporting events are unique happenings with a non-continuous character. This makes their suitability for a procedure focusing on continuous improvement less obvious. However, many organisers have realised that their activities can cause significant environmental impacts, and are looking for ways to address them in a structured manner.

EMS refers to the management of an organisations environmental program in a comprehensive, systematic, planned and documented manner (Stuart, 2000). EMS is not to be interpreted as government regulation, where requirements are imposed on organisations from the outside. The concept of EMS consists of a regulatory structure that arises from within an organisation, and requires the organisations to assess their environmental aspects and impacts, establish goals and continually monitor and review these. Establishment of well functioning feedback loops throughout the whole organisation, both “top-down” and “bottom-up”, are essential for EMS to properly achieve its competitive advantage. These systems of management processes enable organisations to continually improve and reduce their impact to the natural environment (Melnyk et al., 2003). The Plan-Do-Check-Act (PDCA) model describes the basics of an EMS, and is shown in figure 1.

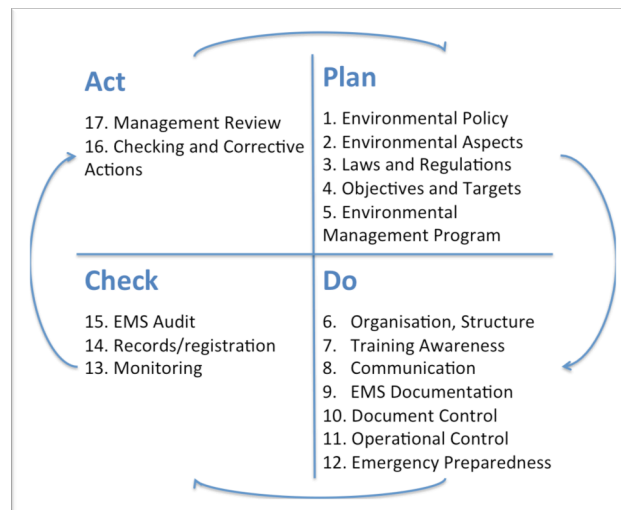


Figure 1: Steps in the Environmental Management System (ISO 14001, 2004).

There are several steps to adopt EMS. The first step is to create an environmental vision, a policy that is made public and states the organisations general philosophy for environmental improvement, this in order to incorporate commitments for continual improvements for pollution prevention, and for complying with the relevant legislation. The second step is to evaluate and set goals. The policy defined in the first step is set into action. Following, the third step, the organisation creates a management structure to realise its environmental goals. This structure promotes and enhances communication both within and outside the organisation. The employees are also trained to better develop their awareness of reducing the environmental impact, and thus enhancing the business performance. During the fourth stage the organisation monitors for discrepancies within the system, this by recording and documenting the routine operations and audit their activities. Identified discrepancies are thus corrected to maintain the continual environmental improvement. Finally, the last step is to review the management, creating a report that identifies the EMS's shortcomings and highlights needs for tighter control and propositions for improvement. The PDCA model is not explicitly an environmental model, but is also adaptable on internal control and risk management systems. The EMS tool, or "way of thinking", can be considered as an innovative drive in reaching for a sustainable world. (Darnall & Edwards Jr, 2006).

The most recognised application of EMS is the ISO 14001 (ISO 14001, 2004), which is an effective tool to guide managers in their efforts to capitalise on the cost reduction potential of waste reduction (Darnall & Edwards Jr, 2006). Event organisers tends to have a broader perspective on their thoughts of EMS, and after the development of BS 8901 and ISO 20121 it is more common to see the EMS as a part of a sustainable event management system. The phrase takes geography, culture and social demography within its boundaries. However, BSI states that ISO 20121 integrated with ISO 14001 or 9001 would give even better results. The next chapter will introduce the most common frameworks when establishing an EMS.

2.2 Frameworks Applicable for Sustainable Events

The large amount of green labels and standards has made it a comprehensive task to chose the right one. Some of the labels and certificates can be quite expensive, but will give a good reputation while others are cheaper with lower reputation. It is therefore important to evaluate the necessity and profits before selecting a standard. The certificates or labels imply a certain form of proactive environmental performance, but they do necessarily mean the same. Some labels, like ISO 14001 and EMAS, indicate an environmental proactive management system on the organisation while others are directly linked to a specific product. Another issue related to the labels is how an organisation claims it. To act in accordance to a label or certificate as a 1st party verification means that the organisation it selves claims it. At 2nd party verification is occur when a related party has verified the product or the organisation, while a 3rd party verification implies that the it is verified by a independent verification body. Chapter 2.1 intends to provide an overview of the most common frameworks applicable for a sustainable event. The overarching frameworks and ISO 20121 specifically made for sustainable events are labels that refers to an organisations ability to operate an environmental management system. The GRI label indicates the organisations ability to report and communicate environmental performance, while the last section gives examples of certification to specific venues or merchandise.

Overarching Frameworks for the Environmental Management System

ISO 14001 Environmental Management Systems

ISO 14001 indicates best practice for a proactive management of the environmental impacts of the business. ISO 14001 is an internationally recognised standard for environmental management with a general approach. It is suitable for organisations in all industries. It is developed by the International Organization for Standardization (ISO), and is based on the two concepts of continual improvement and regulatory compliance (ISO, 2004).

The European Eco-Management and Audit Scheme (EMAS) and sporting events

The Eco-Management and Audit Scheme, is the EU programme that helps organisations across Europe to identify their main environmental impacts, to make systematic plans, to undertake actions to improve environmental performance, and to communicate this effectively with stakeholders. The standard has several similarities to the mentioned ISO 14001 (EMAS, 2012).

Specific Framework for Event Sustainability Management Systems

ISO 20121:2012, Event Sustainability Management Systems

The standard was inspired by and developed through the organising process of the Olympic Games in London 2012. The framework is established to ensure systematic and comprehensive identification and management of sustainability issues to event organisers. It is a new approach that intends to offer a strategic way to handle sustainability and to embed continual improvement (ISO 20121, 2012). The standard is based on BS 8901 and intend to give specific requirements for an event sustainability management system (BSI, 2013). The systems approach is generalised and addressed for any type of event related activity, in addition to provide guidance on conforming to those requirements. The purpose of the standard is to support the establishment, implementation, maintenance and improvement process of an event sustainability management system. It ensures that the knowledge gained through the implementation of sustainability initiatives, and the analysis of issues and impacts is transferred and imbedded within the organisation and that the continual improvement is the key. The standard is in place for the event industry to support improved sustainability performance. The standard is not prescriptive against specific performance indicators, and performance benchmarks should be set against the organisations own achievements (ISO 20121, 2012).

The standard can be first, second or third party verified, but since the standard is quite new it depends on which country the event is sited.

Communication of Environmental Performance

Global Reporting Initiative (GRI)

GRI is a voluntary non-profit organisation that works to promote economic, environmental and social sustainability. The GRI framework provides companies and organisations with a comprehensive sustainability-reporting system, with the intention of reporting on economic, environmental, governance and social performance. The organisation is connected with the United Nations through the status of collaborative institution with UNEP, and has strategic partners such as ISO, UN Global Compact

and OECD. GRI has developed the principals and measures indicators for reporting, and is an effective tool that makes it easier to benchmark companies between countries (GRI, 2013).

Certification of Venues and Merchandise

Certification of venues and merchandise might be the most confusing part because of the high amount of labelling and certifications. However, the most common labels in Scandinavia can be regarded as the Eco-Lighthouse, The Nordic Swan and the EU Flower. Certification of venues and merchandise are not especially relevant to the like of an EMS and reporting system, and is therefor only mentioned to get a thorough picture of certification and frameworks.

2.3 Sustainability

According to the United States Environmental Protection Agency (2013) sustainability is based on one principle:

“Everything that we need for our survival and well-being depends, either directly or indirectly, on our natural environment.”

However, the quote is rather vague and the terms sustainability and sustainable development has been defined in many ways. The most frequently quoted definition recently is from “Our Common Future”, also known as the Brundtland Report (Rogers et al., 2008).

“Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.” The Brundtland Commission report, 1987.

The definition of sustainable development requires a perspective of looking at the world through a systemic approach, either as a system over space or time. When looking at a system over space, it is easier to understand that air pollution from Sweden or England might also affect the air quality in Norway, and that pesticides sprayed in Norway might eventually harm fish stocks on the coast of Denmark. From a time perspective it is reasonable to think that the decisions made today, whether it is economical or environmental, will have an impact when the next generation grows up (Chang, 2011).

System thinking and the concept of sustainable development enable us to understand the connections and relations of the global environment. The environmental problems that might occur in the future are thought to be complex. Cultural differences, the willingness to invest in science projects and the will to co-operate globally and sacrifice are just some of the obstacles that needs to be settled to be able to adapt to a more sustainable way of living (Chang, 2011). In order to meet the increasing population, drastic changes are required either in our way of living or the development of new and more sustainable technology. Meeting the basic needs and at the same time conserve the life support systems of our planet will also require an acceleration of slow progress, which has recently reached a vital point in the re-negotiations of the Kyoto Treaty (Kates, 2010).

2.4 Environmental Accounting

The purpose of environmental accounting is to detect the environmental aspects within an organisation and the significance they pose. The variety of methods and concepts on how to perform such an accounting can be split into two main categories, shown in figure 2.

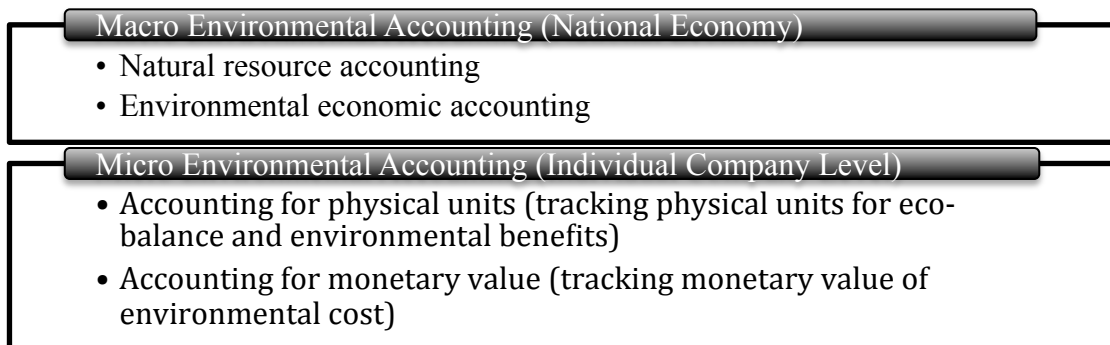


Figure 2: Options of Environmental Accounting (Government of Japan, 2013a).

The increasing pressure for environmental awareness and expectations for decreasing the environmental footprint has led to a need of a greater understanding of an organisation's environmental impact. To support environmental investments within a company it is vital to present numbers or facts that are easy to relate with, often mentioned as key performance indicators (KPI). It gives an indication of the environmental situation the firm is in, and might give an idea of where the biggest potential of reduction is, and where there are needs for improvement. Seen from a social perspective, publishing environmental accounting gives bigger transparency and gives customers the knowledge to choose from an environmental perspective as (Government of Japan, 2013b).

The internal environmental costs and benefits are those that the organisation records in its own accounts. To improve environmental performance, the organisation needs to manage and control costs related to waste management, energy consumption and resource use. It also needs to understand the benefits, such as cost savings, environmental grants, taxes avoided or revenues generated.

The external environmental costs and benefits are the impacts from the organisation's activities on wider society and the environment, in present time and in the future. Their activities and operations give rise to external environmental impacts such as for example contamination of ground water, traffic congestion and poor urban air quality. The rest of society picks up the cost of these external impacts. The price does not reflect the environmental cost, so organisations do not pay the full costs of their production and consumption decisions. External costs are currently free to the organisation as the rest of society pays for them. This represents "value extracted" by the organisation.

Internal and external environmental accounting can, if performed properly, inform decision-makers about strategic and tactical planning, increase the awareness of potential environmental benefits and opportunities in addition to reduce the company's exposure to future environmental risks and liabilities (IUCN, 2013).

2.5 Corporate Social Responsibility

Corporate Social Responsibility share in common the belief that companies have a responsibility to the public good, but they emphasize different elements of this (Blowfield & Murray, 2011). The European Commission defines Corporate Social Responsibility (CSR) as:

“A concept whereby companies integrate social and environmental concerns in their business operations and in their interaction with their stakeholders on a voluntary basis.” (European Commission, 2011)

ISO 26000, on the other hand, is slightly more precise:

“Social responsibility is the responsibility of an organisation for the impacts of its decisions and activities on society and the environment through transparent and ethical behaviour that is consistent with sustainable development and the welfare of society; takes into account the expectations of stakeholders; is in compliance with applicable law and consistent with international norms of behaviour; and is integrated throughout the organisation.” (ISO, 2010)

How should a company address these challenges? A strategic approach to CSR has become increasingly more important for the competitiveness of a company. A functional CSR model in a company requires engagement with both internal and external stakeholders. The World Business Council for Sustainable Development (WBCSD) has described CSR as the “businesses contributions to sustainable economic development”. It builds upon a base of compliance with legislation and regulations, and typically includes “beyond the law” commitments and activities pertaining (Hohnen, 2007). A list of the framework from WBCSD is given beneath:

1. Corporate Governance and Ethics
2. Health and Safety
3. Environmental Stewardship
4. Human Rights (including core labour rights)
5. Sustainable Development
6. Conditions of Work (including safety and health, hours of work, wages)
7. Industrial Relations
8. Community Involvement, Development and Investment
9. Involvement of and Respect for Diverse Cultures and Disadvantaged Peoples
10. Corporate Philanthropy and Employee Volunteering
11. Customer Satisfaction and Adherence to Principles of Fair Competition
12. Anti-Bribery and Anti-Corruption Measures
13. Accountability, Transparency and Performance Reporting
14. Supplier Relations, for Both Domestic and International Supply Chains

Figure 3 shows a structured overview on the different fields and aspects of CSR within a company, and can in many ways be seen as an overall summary of the framework from WBCSD.



Figure 3: Areas of CSR (TycoonSystems, 2013).

Issues and challenges mentioned in framework from WBCSD are often connected to a specific stakeholder. Some stakeholders are more obvious (such as customers and the authorities), while others might be more difficult to identify (such as NGOs and financial markets). In order to understand how the daily operations of the company affect different stakeholders it is necessary to understand their needs and objectives, as well as their opinions about the company. When developing and implementing a corporate responsibility, it is essential to understand your context and surroundings.

There has been discussion on whether or not SR is beneficial for an organisation. A study from the International Institute for Sustainable Development (Hohnen, 2007), claims that CSR improves several areas of the business, if used in the right context, and benefits in terms of risk management, cost savings, access to capital, customer relation, HR management and innovative capacity. These qualities give a quicker reaction time in anticipating fast changes of societal expectations and operational conditions. It can therefore drive the development of new markets and create opportunities for growth (Watts & Holme, 2000). As mentioned, corporate responsibility is often criticised for its unknown effectiveness. The approach has until recently lacked a reporting framework that is commonly used, which might have boosted the debate. This reflects the extent to which ideas of corporate responsibility have influenced business thinking, public debate, and the public policy in some parts of the world. These criticisms are part of a debate within the field about how to carry out corporate responsibility in ways that are efficient, effective and best able to satisfy the need of business to while recognising the concerns of other stakeholders (Blowfield & Murray, 2011).

There are already tools available for assessing CSR in a firm. Because of many definitions and aspects of CSR, it may have created some confusion on the subject. ISO created the guideline ISO 26000, in November 2010, on how to set up and assess

the CSR issues after demands from businesses and organisations (ISO, 2010). Other suggested frameworks are given in table 1.

Table 1: Possible Tools for Assessing CSR (Hohnen, 2007).

The Organisation for Economic Co-operation and Development (OECD) Guidelines for Multinational Enterprises
The International Labour Organization (ILO) Tripartite Declaration of Principles concerning Multinational Enterprises and Social Policy and Core Labour Standards
The UN Global Compact Principles
The Global Reporting Initiative (GRI) Sustainability Reporting Guidelines
The International Organization for Standardization (ISO) standards
The Accountability AA1000 Series
The Social Accountability International SA8000 standard.

There are, at the moment, three available analytical sources of information related to the impacts of corporate social responsibility. First, corporate responsibility reports including social, environmental and sustainability reports. Secondly, rating of companies (such as FTSE4Good, the Ethibel Sustainability Index), and at last, case studies of companies undertaken by companies, CSR organisations or others. A significant area of impact is how corporate responsibility's success has impacted its own behaviour. The adaptation of common standards that facilitate comparison between companies is another important aspect of this (Blowfield & Murray, 2011).

2.6 Environmental Aspects of Sporting Events

Sporting events have an unusual way of affecting the environment. The short-lived happenings can occur in several forms, from football championships to the Olympics, and from motorsports to athletics. Despite the differences, they usually all have one common feature: the events often have a considerable impact on the environment. The events usually involve extensive infrastructure development, such as stadiums or ski facilities, which may cause a damaging impact on the soil, water, forest, wildlife and sensitive areas. Large crowds attend these events, resulting in increased resource consumption, waste generation and transport issues. Although a sporting event may be short in duration, the environmental impacts during its preparation may have a far longer lasting effect (Collins et al., 2009). This chapter will provide information on the typical impacts that occur in presence of a sporting event.

The practice of sports includes activities at different levels, and the total environmental impact depends on several areas. This implies, to a varying degree, the amount of spectators, structure of the organisation, facilities and equipment, logistics and sponsors, media and athletes. Figure 4 gives an overview of the common drivers that accelerates the environmental aspects of an event.



Figure 4: Occurring Activities and Need Caused by a Sporting Event (IOC, 1997).

Depending on the extent of the event and the environmental precautions made, sport can cause several impacts on the ecosystems, from smaller implications to severe damage. The extent and degree of the impact depends primarily on the type of sport and the size of the event. Impacts of a sporting event can be categorised in four different categories: short term, long term, direct and indirect. A description of each category is given in table 3 below.

Table 2: Categorisation of Environmental Impacts of a Sport Event (IOC, 1997).

Type of impact	Description
Short term	Occurs during the event, (noise, local air pollution)
Long term	Impacts that exists during the event and remains afterwards, (soil deterioration, long term pollution or soil packing)
Direct	Caused by facilities and people directly involved in the event
Indirect	Due to new infrastructure built for the event, but not directly related to the sport activity, (new roads, bridges, hotels etc.)

The need for environmental awareness should increase with the dimension of the event. The likes of biodiversity conservation, protection of ecosystems, land use and landscape, pollution, resource and waste management, health and safety, nuisances and safeguarding of cultural heritage are all important issues when planning an event (Collins et al., 2009). The environmental awareness should be included through the whole life cycle of the event from planning and construction to usage and legacy (IOC, 1997).

Most of the literature on environment and sports are connected to the Olympic games and other elite competitions. The YOG however, has less information. It is therefore necessary to base the literature review on the Olympic games and the common environmental aspects of sports and further assess the information in relation to a YOG event.

2.6.1 Environmental Lifeline of a Youth Olympic Game

An event like the Youth Olympic Games with a policy of re-using stadiums and constructions will have their largest impacts within the period of the event. This chapter will assess the environmental life cycle of an Olympic game, and highlight the main environmental challenges that can occur.

The environmental aspects occur through several stages of the event. However, the foundation of the total environmental impact of the event is set in the conceptual- and the planning stage. The difference between an ordinary life cycle for a product and an event is that an event occurs over a short period of time, while the life cycle of a product is a continuous operation that gives several opportunities for improvement (Chang, 2011). The legacy, and remaining venues of the event however, continues afterwards. From an environmental perspective, it is therefore necessary to look at the event from a wider perspective, rather than just the event period. Figure 5 gives an overview of environmental obstacles, and questions that should be raised in the different phases of the event (Theodoraki, 2007).

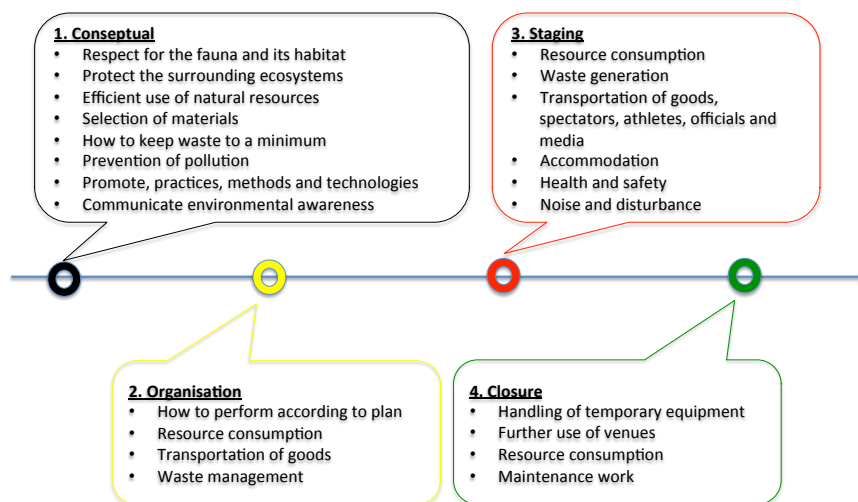


Figure 5: Lifeline of Environmental Aspects within an Olympic Event.

The conceptual phase includes the candidature period and the framing of the event. The organisational phase means the planning and run-up of the event. Staging the event includes the time period from the opening ceremony to the closing ceremony. The closure phase includes post event activities, with reassignment of sites and managing of temporary equipment.

The most common environmental commitments are related to energy conservation, water conservation, waste avoidance, pollution avoidance and protection of the natural environment. This is among others are mentioned in the official reports from Sidney 2000, Torino 2006 and London 2012 (LA84, 2013), (Sidney, 2000). The reports lack information on vital environmental information on land use and materials used when building new stadiums. However, London 2012 who arranged the last games has shown how this can be done in a proper manner (London, 2012).

The chapter will further introduce some of the most important environmental challenges during a youth Olympic game, procurement, energy consumption, water and sanitary consumption, waste generation and Transportation.

Procurement

Procurement of merchandise and artefacts is essential to set the right surroundings and atmosphere of the games. Each of every object bought has some form of environmental impact and it is therefore necessary to not only evaluate the price, but also its environmental footprint. Apart from the environmental side, it will also generate negative publicity if a procured item is created with a threatened or unnecessary large amount of resources.

Green purchasing' is considering both environmental and social factors when making a purchasing decision. The aim is to minimise the environmental and social impact that the items you have purchased have. Green Public Procurement (GPP) is defined in the European Commission's Communication Public procurement for a better environment as "*a process whereby public authorities seek to procure goods, services and works with a reduced environmental impact throughout their life cycle*" (European Commission, 2011b).

Traditionally, purchasing considerations went no further than the initial purchase price. Environmentally preferable goods and services are those that have a lesser or reduced impact on the environment over the life cycle of the goods or service, when compared with competing goods or services serving the same purpose. Whole life costs include this initial outlay, but also consider the operational and disposal costs of the product. Nearly every item we buy has a greener alternative, whether it is for dresses to volunteers or signs to the arenas. Issues that should be raised in the products impact on greenhouse gas emissions and air contaminants, energy and water efficiency, reduced waste and support reuse and recycling, hazardous waste and toxic related to the products. The green market is expanding rapidly due to the increased demand for sustainable goods (Government of Canada, 2013).

How certain can the organisation be that they have made a green procurement? The procurement life cycle usually consists of several steps and by setting priorities and requirements to the suppliers it is more plausible that you end up with a greener result. An appropriate path is mentioned in the section below and is based on the purchasing process of Lysons & Farrington (2012).

Identify needs is an internal phase for a company, where it establishes an understanding of its need in compliance with the defined technical direction and requirements. When the company has defined its needs, it is necessary to **Identify possible suppliers** who can deliver the required product. The next involves **supplier communication**, where references for products or services are consulted, and any requirements for follow-up services including installation, maintenance, and warranty are investigated. Some institutions choose to use a notification service, a **tender notification**, to raise the competition for the chosen opportunity. This solution is required when conducting public procurement in Norway. After tendering, the next step is to proceed to further **negotiations** with the chosen company or companies. Price, availability, customisation possibilities are established, schedules are negotiated and contracts are acquired. **Supplier liaison**, the phase involves evaluation of performance of the products and any accompanying service support during the production. A supplier scorecard is a popular tool for this purpose. The last step is **logistic management**. Supplier preparation, expediting, shipment, delivery, and

payment for the product are completed, based on contract terms (Lysons & Farrington, 2012).

Why should sports organising committees buy green? With a tight budget it is often tempting to choose the cheapest option available. When purchasing under guidelines for green procurement there are a variety of economical, environmental and social reasons why any business should undertake green purchasing. It can be argued that the presence of procurement schemes or guidelines will decrease the possibility of damaging the reputation. Potential savings are higher when managing temporary equipment after the games and cheaper, or even profitable, to recycle (EU Commission, 2008).

Energy Consumption

A high stake of the globe's total energy consumption comes from fossil resources. The production of energy is the biggest contributor to global warming and localised air pollution. In sporting events, energy is required to produce goods that are consumed, to run the event and related facilities, and to transport people and products to the event. Even if sports organisations can generally not exert and influence the global energy policy of a region, they are able to act at their own level. The arenas used in a YOG event requires a high amount of energy, especially the ice halls which requires -6 °C on the ice and 7-16 °C in air temperature, depending on training or competition conditions. Efficient use of energy consumption can therefore be a way to minimise the environmental impacts and to save money (IOC, 1997).

Water and Sanitary Consumption

Fresh water resources are limited and do only exist in a closed system. Several areas across the world are subjected to intense pressure on its fresh water resources. 3 per cent of the earth's water is fresh water, and two thirds of this is frozen in glaciers and polar ice caps. The supply of water depends on rainfall, fulfils rivers, lakes and accessible aquifers, and is highly variable depending on location. A higher consumption than usual might bring extra pressure on local sewage systems and increased energy consumption to clean the water.

When practising sport, water is needed to satisfy drinking, washing and maintenance needs. Sometimes, water is part of the sports facility itself. Sporting events tends to raise the total water consumption on the specific area of the event, but the amounts consumed are rarely significant unless it occur in dryer areas (IOC, 1997).

Waste Generation

Large-scale sports activities can generate a considerable amount of waste. Most of the waste occurs through packaging of merchandise and snacks, which only cause minor disturbance. More hazardous waste can occur accidentally from leakage from cooling systems in arenas and waxing cabins from the skiing arena. Waste is unavoidable, but sound waste management ensures that waste quantities are kept to a strict minimum (IOC, 1997), (London, 2012).

Transportation

Transportation includes movement of goods and people by airplanes, trains, busses and other vehicles. The majority of greenhouse gas emissions from transportation are CO₂ emissions, which is a result of combustion of petroleum-based products. Small

amounts of methane (CH₄) and nitrous oxide (N₂O) are also emitted during fuel combustion.

Sporting events depends on the transportation of goods and people to the given area. A Strategy for reducing the emissions could be to set up an efficient driving plan for transporting athletes and officials to the arenas in order to decrease the total distance for the busses. The alternative might be combined with the likes of environmental friendly busses with alternative fuel (IOC, 1997).

3 Lillehammer Youth Olympic Games 2016

Norway and Lillehammer was, in December 2011, given the honour of hosting the winter youth Olympic games in 2016. The YOG event will be the second winter youth Olympics in the history. Like Innsbruck, the games will have approximately 1,000 athletes and 500 officials, and the event will last for ten days (Innsbruck, 2012). The athletes will compete against the elite of their generation, with the intention of creating a global meeting point that stimulates athletics, education and culture (LYOGOC, 2012).

The Games at Lillehammer reunites the Municipalities of Lillehammer, Hamar, Gjøvik and Øyer by taking on the task of hosting the event. The winter games at Lillehammer will hold tournaments in all the seven sports disciplines on the original Olympic program: luge, bob, skeleton, curling, ice hockey, cross country, biathlon, alpine skiing, skating and snowboarding. IOC wishes to use the YOG event as a platform to explore new disciplines in addition to the traditional. As an example, it will be held competitions with both genders in curling and with special composed teams from different countries on short track skating. The YOG concept states that existing construction shall be used, and it is not expected to build new construction in relation to the event. This does also count for the games in Lillehammer, where the constructions from 1994 will be used. The only exception is a curling rink, which is an extension of Kristin Hall that Lillehammer Municipality already has completed. In addition to the extension of Kristin Hall, a new training arena for ice hockey is under construction (LYOGOC, 2012).

3.1 Lillehammer Youth Olympic Games Organising Committee

The organisation responsible for the games, Lillehammer Youth Olympic Games Organising committee (LYOGOC), is a corporation owned by three different associations given in table 4 beneath (LYOGOC, 2012).

Table 3: Ownership of Lillehammer YOG 2016.

Owner:	Share:
Ministry of Culture	51 %
Lillehammer municipality	24,5 %
Norwegian Sports Association (NIF)	24,5 %

Lillehammer 2016 has a total budget of 328 million NOK. 228 million NOK of the total is a contribution from the Ministry of Culture to cover the expected losses of the event budget. The public ownership of the event creates media attraction and public interest, and it is therefor as important as ever to act in a responsible manner.

3.2 Facilities

The venues for YOG Lillehammer 2016 are based on the venues from the winter Olympic games at Lillehammer in 1994. The competition schedule, figure 6, gives an overview of “what, when and where” during the staging phase of the event. The stadiums are not owned by the organising committee, but are rented during the event period (LYOGOC, 2012).

Table 4: Competition Schedule of YOG 2016.

COMPETITION SCHEDULE													
SPORT/DICIPLINE	VENUE	26. FEB	27. FEB	28. FEB	29. FEB	01. MAR	02. MAR	03. MAR	04. MAR	05. MAR	06. MAR	TOTAL GOLD MEDALS	
		FRI	SAT	SUN	MON	TUE	WED	THU	FRI	SAT	SUN		
	DAY	1	2	3	4	5	6	7	8	9	10		
Opening/Closing Cerem.	Lillehammer Olympic Park									X (2)			2
Biathlon	Birkebeineren Ski Stadion					2		1	1	1			5
Bobsleigh	Lillehammer Olympic Bobsleigh and Luge Track, Hunderfossen									2			2
Skeleton	Lillehammer Olympic Bobsleigh and Luge Track, Hunderfossen								2				2
Curling	Kristin Hall, Curling rink			1							1		2
Ice Hockey	Kristin Hall, Ice Hockey rink					2			2				4
Luge	Lillehammer Olympic Bobsleigh and Luge Track, Hunderfossen	1	1	2									4
Figure skating	Hamar Olympic Amphitheatre							2	3				5
Short Track	Gjøvik Olympic Cavern Hall			4		1							5
Speed Skating	Hamar Olympic Hall "the Viking ship"	4	2		2								8
Alpine skiing	Lillehammer Olympic Alpine Centre, Hafjell	2	2	2		2	1						9
Freestyle, Ski halfpipe	Kanhaugen Freestyle Arena							2					2
Freestyle, Ski cross	Lillehammer Olympic Alpine Centre, Hafjell								2				2
Snowboard, Halfpipe	Kanhaugen Freestyle Arena				2								2
Snowboard, Slopestyle	Lillehammer Olympic Alpine Centre, Hafjell			2									2
Cross-country	Birkebeineren Ski Stadion			2	2	optional			optional				4
Nordic Combined	Birkebeineren Ski Stadion/ Lysgårdsbakkene Ski Jumping Arena					1							1
Ski Jumping	Lysgårdsbakkene Ski Jumping Arena						2		1				3
Combined CC/Biathlon	Birkebeineren Ski Stadion										1		1
TOTAL GOLD MEDALS		7	5	13	6	8	3	5	11	3	2		63

In addition to the old facilities from 1994, IOC has contributed with 108 million NOK to the Norwegian Sports Association. The contribution will eventually result in 360 new student accommodations on Stampsletta, near by Håkon- and Kristin Hall. The construction of the buildings will begin in August 2013. The participants at the YOG event will use the student accommodations as residence during the 10 days of the games. The Youth Olympic village is represented by five large buildings and will have the capacity of hosting 1,200 people under the YOG event. The building will, as

mentioned, be converted after the games into a student dormitory at Lillehammer University College and the Norwegian College of Elite Sports with a capacity of 300 units. SOPP and the housing cooperative LOBB are responsible for the building project. Figure 7 gives an impression on how the construction is planned (LYOGOC, 2012).



Figure 6: CAD of the Planned Youth Olympic Village (LYOGOC, 2013).

In addition to the planned dormitory project, 360 beds at the existing Birkebeineren Hotel & Apartments, located next to the planned Village, will be part of the Youth Olympic Village in Lillehammer. Since the various ice skating athletes will have attendance in Hamar and Gjøvik, it will be relevant to provide a hotel for the occasion.

The Municipality of Lillehammer finished a new curling venue on the 19th of June 2012. The venue are one of the two new arenas that will take part in the event, and is an extension of Kristin Hall, where the ice hockey tournament will take place. The venue has four full-scale lanes and has a capacity of 500 spectators, and is daily operated by Lillehammer Curling Club. The second venue, which was not part of the Olympic games in 1994, is a new ice hockey training venue, located next to Kristin Hall and the new curling venue in the Olympic Park area in Lillehammer. The construction of the venue started in September 2012 and the construction of the venue will, according to the plan, be finalised in June 2013. During the YOG 2016 the venue will be used as a training venue for ice hockey and hockey skills (LYOGOC, 2012).

3.3 Culture and Education Programme

During the YOG at Lillehammer the organising committee are obliged to arrange a Culture and Education Programme (CEP) during the event period. The programme is regarded as an integral part of the YOG, with a mission to educate and engage young athletes, inspiring them to play an active role in their communities. The CEP aims for the athletes to embrace, embody and express the Olympic values of excellence, friendship and respect (SYOGOC, 2010).

The CEP for YOG Lillehammer is not given yet, but the main content should be based on Olympic values and how you should interact with them. There will in example be presentations of the Olympism, the Olympic movement, global and sport issues, or tasks that forces the participants to interact and facilitate the learning of new ideas and exploration of new cultures. The IOC prefers that the following educational themes are included in the programme (SYOGOC, 2010).

- **Olympism:** This theme traces the origins, philosophy, structure and evolution of the modern Olympics.
- **Skill Development:** This theme considers various facets of a professional athlete's career such as personal development and managing transitional phases in life.
- **Well-being and Healthy Lifestyle:** This theme promotes healthy eating and also deals with stress management and the issue of doping in sport.
- **Social Responsibility:** This theme considers the environment, sustainable development and community relations in the context of being a responsible global citizen.
- **Expression:** Activities under this theme include learning and interaction opportunities via digital media and evening festivals at the YOV.

4 Research Methodology and Research Design

This Chapter maps out the essential methods utilised throughout the research process of the master dissertation. The chapter includes a general definition of the approaches used, and how the collection of data where made. The thesis has been developed in collaboration with the LYOGOC with the approach of creating an environmental strategy. YOG is a new concept from IOC based on re-using of old venues with the same selection of sports disciplines. This means that the environmental issues of the thesis are transferable to future YOG events, which supports the science perspective of the thesis. The thesis is generally based on a qualitative approach with a study of relevant literature, interviewing of key informants and analyses.

4.1 Qualitative Method

A qualitative method can be defined as a method for obtaining and processing information that emphasises on interpreting observations, statements and sources. In a simplified way, qualitative methods emphasises words and descriptions to understand the content of a literature review (Flick, 2009). A qualitative method can be characterised in three types of strategies: design, data collection and fieldwork, and analysis (Patton, 2001).

4.2 Research Design

To grasp an understanding of the six research questions it was firstly necessary to create knowledge about the context of the organisation (LYOGOC) and the extent of it. The information was gathered by workshops with LYOGOC, the candidature application and background information on each venue. The second stage of the process was to establish a literature review to create a systematic picture on the themes of the thesis.

Literature review

A literature review can be describes as a systematic, explicit and reproducible method for identifying, evaluating, and synthesising the existing body of completed and recorded work produced by researchers, scholars or practitioners. The literature review of the study focuses on the themes from the research questions, but most importantly the attributes of an environmental management system and the relevant standards connected to it. Life cycle thinking has also been an important issue in terms of creating a complete understanding of the event. The last chapter in the literature review connects the issues of sustainability and environmental aspects in the specific case of a sporting event (Sounders et al., 2009), (Blumberg et al., 2008).

Secondary data gathered from the field of study seen in the light of sports and environment has been used consistently throughout the thesis. The benefit of using secondary data is that there is developed a lot of tools and theories which can be quickly gathered (Sander, 2004). Not all data is available, mainly because YOG is a relatively new concept with only one youth Olympic winter event conducted. To promote a possible solution, it is chosen to design a template on how an environmental management system and an environmental accounting system can be established in connection to a YOG event. Information that was hard to find through secondary data was gathered through different types of interviews with key informants on the fields of sports and environment and environmental accounting (Blumberg et al., 2008).

Semi-Structured and in-Depth Research

Interviews can be differentiated according to the level of structure and standardisation adopted. Semi-structured and in-depth research interviews can be used to explore topics and explain findings. One typology that is commonly used relates to these levels of formality and structure as presented in table 6.

Table 5: Differentiation of Interviews (Sounders et al., 2009).

Type	Description	Purpose
Structured Interview	Questionnaires based on predetermined and standardised questions. Used to collect quantifiable data, referred to as “quantitative research interviews”.	Used to gather information, which will be used in a quantitative analysis (ex: part of a survey).
Semi-structured Interview	Non-Standardised, qualitative research interviews. The Researcher will have a list of themes and possibly some key questions to be covered; the questions may vary from interview to interview. The order of questions may also vary depending on the flow of the conversation. The interview will either be audio-recorded or with note taking.	Used to gather data, which are normally analysed qualitatively (ex: as a part of a case study).
Unstructured or in-depth interviews	Informal, Non-Standardised, qualitative research interviews. Used to explore in depth a general area of interest. No predetermined list of questions, but a clear idea of the aspects you want to explore. Also called an informant interview since it is the interviewee’s perceptions that guide the interview and he/she can talk freely.	Used to gather data, which are normally analysed qualitatively (ex: as a part of a case study).

The styles of interviewing have different qualities. A structured interview can be useful in order to identify a general pattern of a descriptive study. The semi-structured interview may be used to understand the relationships between variables that are revealed as a part of an explanatory study. An in-depth interview can be helpful to understand a certain context, as a part of an exploratory study (Sounders et al., 2009).

Throughout the working process the author have been in touch with several key informants performing qualitative interviews. An in-depth interview with David Stubbs, Head of Sustainability for the Olympic Games in London 2012, was performed with the intention of getting an insight of the sustainability work and most importantly the creation of ISO 20121.

In order to perform an analysis of the environmental aspects at each venue it was performed semi-structured interviews with the operational managers.

Regarding the structure of an environmental accounting system it was chosen to attend a focus group with Multiconsult and their branch called “Environment and Special Consulting”.

Data quality issues related to reliability, form of bias, generalizability and validity might be overcome by considering why it is chosen to interview. Recognising that all research methods have limitations and through careful preparation to conduct interviews in order to avoid bias that can threaten the reliability and validity of your data (Sounders et al., 2009).

- Reliability: is concerned with whether alternative researchers would reveal similar information. Need to be standardised.
- Forms of bias: (three forms of bias)
 - Interviewer bias: where the interviewer uses a certain tone, make comments or impose own beliefs that can affect the interviewees answer (leading questions).
 - Interviewee/response bias: caused by perception about the interviewer
 - Participation bias: the nature of the individuals or organisational participants who agree to be interviewed. Maybe those you want to interview do not have time or want to.
- Generalizability: the extent to which the findings of a research study are applicable to other settings.
- Validity: the extent to which the researcher has gained access to a participant's knowledge and experience, and is able to infer meanings that the participant intends from the language used by that person.

Systems Engineering

Systems engineering is applied to understand how the different activities of the LYOGOC can be related to each other and further, the environmental outcome of the YOG. The system also intends to highlight the different aspects of the games to create a better understanding of the whole.

International Council of Systems Engineering expresses the systems engineering as an “understanding of the whole” (INCOSE, 2003).

“In systems science, a system is a set of elements interacting with one another purposefully to achieve some common goals making the whole functionality greater than the sum of individual parts” (Chang, 2011).

The boundaries of a system enable the practitioner to separate the relevant field of activities from the surroundings. Within the defined boundaries of the system, the elements of the system have a given set of attributes that composes the system. The relationships between the elements serve to define the aggregation of several subsystems, or the organisation of the whole system.

System arises either as opened or closed systems. Closed systems are usually staged as models, with unnatural attributes, most common in experiments. Open systems are more realistic and have the possibility of being influenced by external components.

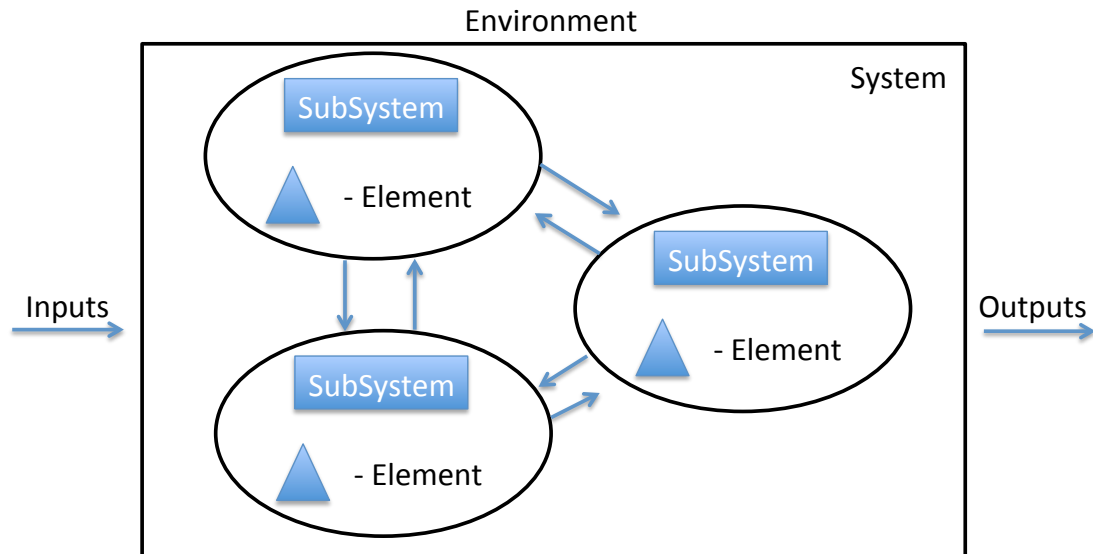


Figure 7: The Fundamental Configuration of a System (Chang, 2011).

All environmental systems are literally open systems that can be characterised by continuous throughputs of information, materials, and energy. Yet one of the merits of building systems analysis models is that they simplify the complexity of the environmental systems in the real world.

The YOG system is a soft system approach, which is designed from the viewpoint of “critical limits”, and should be regarded as a contribution of problem solving on environmental issues, rather than as a goal-directed methodology. It involves a review of the unstructured problem, and further clarifies and expresses it. After expressing the problem, the relevant system and subsystems will be defined. Chang (2011) defines the process of establishing a soft system as like eight steps beneath:

1. Reviewing the unstructured problem situation
2. Clarifying and expressing the problem situation
3. Defining the relevant systems and subsystems, whether these are formal or informal
4. Building conceptual models with the expressed situation
5. Comparing these models, scenarios and analogies
6. Obtaining simulation outputs and arranging alternatives
7. Effecting such changes as are currently both feasible and desirable
8. Taking action to improve the problem situation

A similar process is developed by INCOSE, (2003): State the problem – Investigate Alternatives – Model the Systems – Integrate – Launch the System – Assess Performance – Re-evaluate.

Analyses Used in the Thesis

As a part of designing an environmental management system I have made two analyses to support the outcome.

A Case Study of Innsbruck 2012, which has the closest similarities to the upcoming event at Lillehammer, was made to get a feeling of the dimensions of YOG. Case study research is suitable for explanatory, descriptive and exploratory research. A case study can be defined as an empirical inquiry that investigates a contemporary phenomenon within its real life context. The Innsbruck 2012 is the only winter YOG so far, and it is therefore only possible to perform a single case study (Blumberg et al., 2008).

The Life Cycle Assessment intends to uncover the environmental consequences of the YOG from cradle to grave, and was performed after the Systemic approach was finished (Wrisberg & Helias, 2002). The life cycle assessment analyses the impacts of energy and material use and release to the environment and identifies and evaluates the opportunities that lead to environmental improvements (Chang, 2011).

Risk Analysis is used to relate environmental and human health risk to accidents. It analyses possible scenarios that might affect human beings and ecosystems.

5 Analysis

The analysis chapter provides an environmental life cycle analysis of YOG Lillehammer 2016, a brief case study of Innsbruck 2012, and a systemic approach of the YOG to create a baseline for the design of the environmental management system and the environmental accounting system. The systemic presentation evaluates the context of the organisation and sets the boundaries of the system. The approach will further be used to identify the environmental aspects connected to it.

5.1 Environmental Life Cycle Analysis of the YOG

The life cycle or lifeline of the Youth Olympic Games differs from the Olympic games due to the re-using of old venues, and the crowds will presumably be smaller. It is therefore necessary to adjust the framework from figure 5 in chapter 2.6.1 to a more suitable life cycle of a YOG event. This chapter will assess the activities of LYOGOC and the YOG event at Lillehammer 2016. The assessment will be used to clarify and identify the environmental obstacles of the event. The assessment is separated into 4 phases like in figure 5.

1. Conceptual

The conceptual stage is the first phase for the Olympic host. The phase consists basically of the development of a concept and an idea or framework on how the YOG event shall be hosted. The LYOGOC board brought out the assignment in a period before December 2011, when Lillehammer was given the honour of hosting the winter youth Olympic games. From an environmental perspective, the phase is not significant since it mainly consists of the creation of candidature, guarantees and photographic files, maps of the event area, as well as the task of assembling an organising committee (LYOGOC, 2012). A certain amount of travelling was probably done, but this is not documented. It is however not usual to keep these activities within the boundaries of an eventual environmental accounting even though it might should be.

2. Organisation: Planning and Run-up

The planning and run-up stage describes the activities done from getting the host assignment until the start of the event. The LYOGOC will during this period develop the program of the event, and the surrounding elements of it. The activities with environmental impact include procurement of merchandise, food, transportation of goods and temporary equipment. However, there are some activities that can reduce the impacts, by in example promoting practices, methods and technologies that reduce the negative impacts on the environment.

During the assessment and planning phase it is important to ask the right questions and create innovative solutions to cope with the environmental challenges that occur during the event. In example, how can we protect the surrounding ecosystems? How can we use natural resources efficiently? How can we reduce the amount of waste that is generated? And how can we minimise the pollution from transportation?

3. Staging of the Event

The staging of the event is more or less the point of no return. The highest stake of the total environmental impact in a YOG event would occur in this phase, so it is important to stay according to the plan and to follow the procedures that are set. The most significant environmental aspects that occur in this phase are the resource

consumption at accommodation and venues, waste generation from the whole system, and transportation of athletes, officials and spectators within the system.

4. Closure

The final stage of the YOG lifeline is the closing stage. Disassembling and managing of temporary equipment, recycling, in addition to transportation are regarded as the main environmental aspects of this phase.

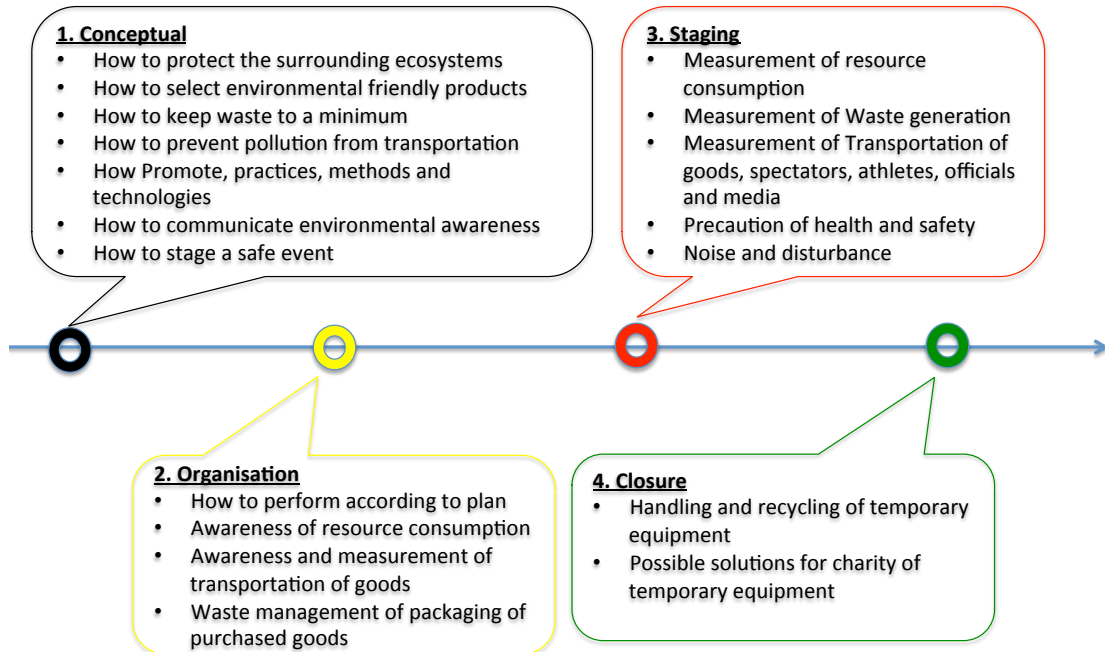


Figure 8: Lifeline on Environmental Aspects Within for YOG Lillehammer 2016.

5.2 Innsbruck Youth Olympic Games 2012

It is chosen to perform a brief case study on the facts and figures of the youth Olympic games in Innsbruck 2012. The event was the first youth Olympic winter game, and so far the only one. It is therefore relevant to establish a basic of such an event and the extent of it. The case study can also be useful as a reference in connection to estimating the significant aspects in an eventual environmental accounting scheme. The comparison of Lillehammer with 26,850 inhabitants compared to Innsbruck with 118,000 can be a little harsh, but the size of the event is of a similar size. It can therefore be speculated that the event in Lillehammer might bring a smaller amount of spectators. The case study is based on numbers and facts from the official report after the games in Innsbruck.

The social and environmental work done in the YOG Innsbruck 2012 goes under the term sustainability. The general principles of their work is summand as an effort towards team commitment, accessible venues and services, minimal travel, cooperation with local companies, local recruitment, eco-efficient operations, waste minimisation and long-term legacy.

Finance and Budget

Innsbruck 2012 had a total budget of € 23,7 millions EUR, approximately 180 million NOK. During the spending, the IYOGOC had 2,250 tenders received and a total of 1,025 suppliers (Innsbruck, 2012). Each supplier has some form of environmental

impact and if the procurement process focuses on selecting environmental alternatives it will reduce the total impact significantly.

Spectators

Innsbruck had a total of 110,000 spectators throughout the event period. According to IOC President Jacques Rogge it was regarded as a surprise (Around the rings, 2013).

An overview of the location to the tickets sold is shown in table 6.

Table 6: Ticket sales of Innsbruck 2012 (Innsbruck, 2012).

Type	Amount
Outdoor tickets	45,055
Indoor tickets	35,434
Ceremonies	30,000
Total	110,000

Innsbruck has a population of 121,329, while Lillehammer has 26,639 inhabitants according to Store Norske Leksikon (2013). Kept in mind the big population differences, it is presumable to think that the amount of spectators in Lillehammer will be smaller, and the willingness to travel to experience the games will obviously not be the same as an elite event. The amount of spectators will influence the total value of energy and water consumption, and maybe most importantly the waste generation.

Athletes, Officials and Accommodation

The event had a total of 1,020 athletes and 750 volunteers and staff in the youth Olympic games (Innsbruck, 2012). A throughout description of participants is show in the table 7.

Table 7: Participants of YOG Innsbruck 2012.

Type	Amount
Athletes	1,020
National Staff from each team	750
IYOGOC (January 2012)	109
Innsbruck 2012 Volunteers (security etc.)	1,357
Total	3,236

Through the ten days of the event, the amount of participants resulted in 40,469 over night stays at 39 different hotels using over 2,000 rooms (Innsbruck, 2012). In connection to the games it was built a YOG village with passive house standard. The village contains of three residential zones with 13 buildings that offered 444 passive energy flats with an energy consumption of 8 kWh per m² and an average energy consumption of 2.768 kWh per person (Innsbruck, 2012). The amount of athletes and officials will be roughly the same in Lillehammer 2016. So, the total energy- and water consumption, and waste generation can be comparable, depending on the attributes of buildings and the ability to promote environmental awareness to the users.

Food and Beverage

During the games it was served 109,185 meals, 336 lunch boxes and 414,324 units of beverages consumed (except tea and coffee) to athletes and officials (Innsbruck, 2012).

No further specific information is given in the official report about food and beverage. The numbers are not usable, and do not indicate how much food that was consumed, what type of food it was and the environmental impact of it.

Waste

Waste is generated in large amounts in such an event and the total amount of waste from the event reached to 61,940 kg of waste in total. The given categories for sorting in the report states that it was 3,120 kg paper, 53,220 kg residual waste, 800 kg biodegradable waste and 4,800 kg other waste (Innsbruck, 2012).

In connection with having snow free streets throughout the event period and increasing the accessibility on opening- and medal ceremonies it has been used gritting salt to remove ice. The gritting salt might also been used in some of the alpine events to reduce melting of snow in the racing tracks. However, the total usage of gritting salt after the event was 900 kg (Innsbruck, 2012).

After the event, temporary items such as banners and commercial effects were recycled. 1,140 new bags were made of branding material. 13,000 m² of fleece and 6,500 m² of PVC were used to create bags, mobile-phone cases, pencil cases, purses and key rings (Innsbruck, 2012). The recycling rate of PVC is not mentioned, so it is hard to say if this is a good result or not. Could the PVC be recycled into something more useful than key rings? Figure 9 beneath illustrates the amount of waste:

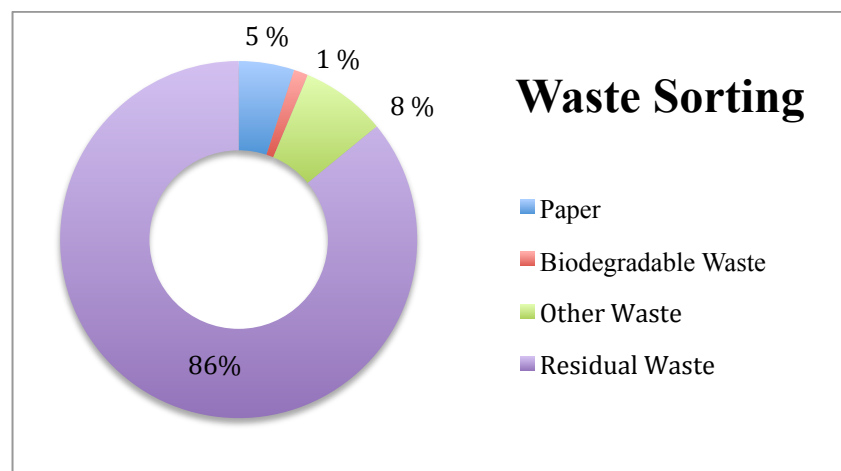


Figure 9: Waste Categorisation at Innsbruck 2012.

Logistic and Transportation

The Innsbruck 2012 event used common shuttle busses to transport people. Everyone with a ticket to the event and accreditation was able to use the shuttle busses for free. The shuttle busses made 3,428 journeys within the ten days of the event and carried at total of 176,834 passengers during the games. However, the report does not state the pollution efficiency of the "environmental friendly shuttles", so it is hard to judge the environmental impact of the transportation activities. The only information given on

logistics of material throughout the event is that the total weight of material transported was 800 tons. The emission made from the activities is not stated.

Venues

The YOG in Innsbruck used six competition venues and three training venues, in addition to two culture and education venues and two ceremony venues. 15,609 seats was maximum capacity at all competition venues and the ceremony venues offered 19,000 seats. The event resulted in two new ski-jumping arenas, one shoot range for biathlon, one super pipe, one slalom slope, one giant slalom and super-G slope, one slope style park and one ski cross slope. The new environmental impacts of the new venues are not stated in the report.

Procurement

Temporary equipment at venues is necessary to set the frame of the Olympic games. 955 signs was installed (later recycled), 20,000 meter of fencing, 30,000 meter of high voltage cables, 25 forklifts, ten snowmobiles, six quad bikes and 4,040 litre of oil was used on the 20th of January, the busiest day in the YOY.

5.3 A Systemic Approach of the Lillehammer Youth Olympic Games 2016

This chapter will emphasize the extent of the event and its activities. As a part of understanding the context of the organisation, it is made an attempt to define the YOG system and its boundaries. The context of the organisation stands as an important part of developing an EMS and environmental accounting systems in order to set the right boundaries, objectives and goals.

The Youth Olympic Games at Lillehammer will take place on five different sites, and LYOGOC's activities will basically occur within these. There will however be some exceptions with in example transportation of procured merchandise and the arriving athletes and officials from each country. Looking towards other Olympic events, there have been preferred to keep transportation of athletes and officials to the host country out of the system, in example London 2012 and YOG Innsbruck 2012. On the other hand, the cross-country world championship in Oslo 2011 kept it inside the system. The choice of keeping flight transportation, will definitely affect the total environmental impact of such an event, but the scheduled flights used by the athletes and officials would probably have been conducted even if the event were not arranged. Based on the experience from interviews with David Stubbs and Multiconsult it is assumed that the most realistic approach is to set the boundaries at the arrival at Gardermoen and the departure at the same place.

Another issue when setting the boundaries are the new constructions of the YOY and The curling- and ice hockey rink. The constructions are under the jurisdictions of the Municipality of Lillehammer and will also be kept outside the system. However the usage of them will be included.

It can therefore be appropriate to regard the venue map as the frame of the system. The system, shown in figure 10, will further be used as a reference on which activities to include, or not, in the development of the environmental management system and the environmental accounting system.

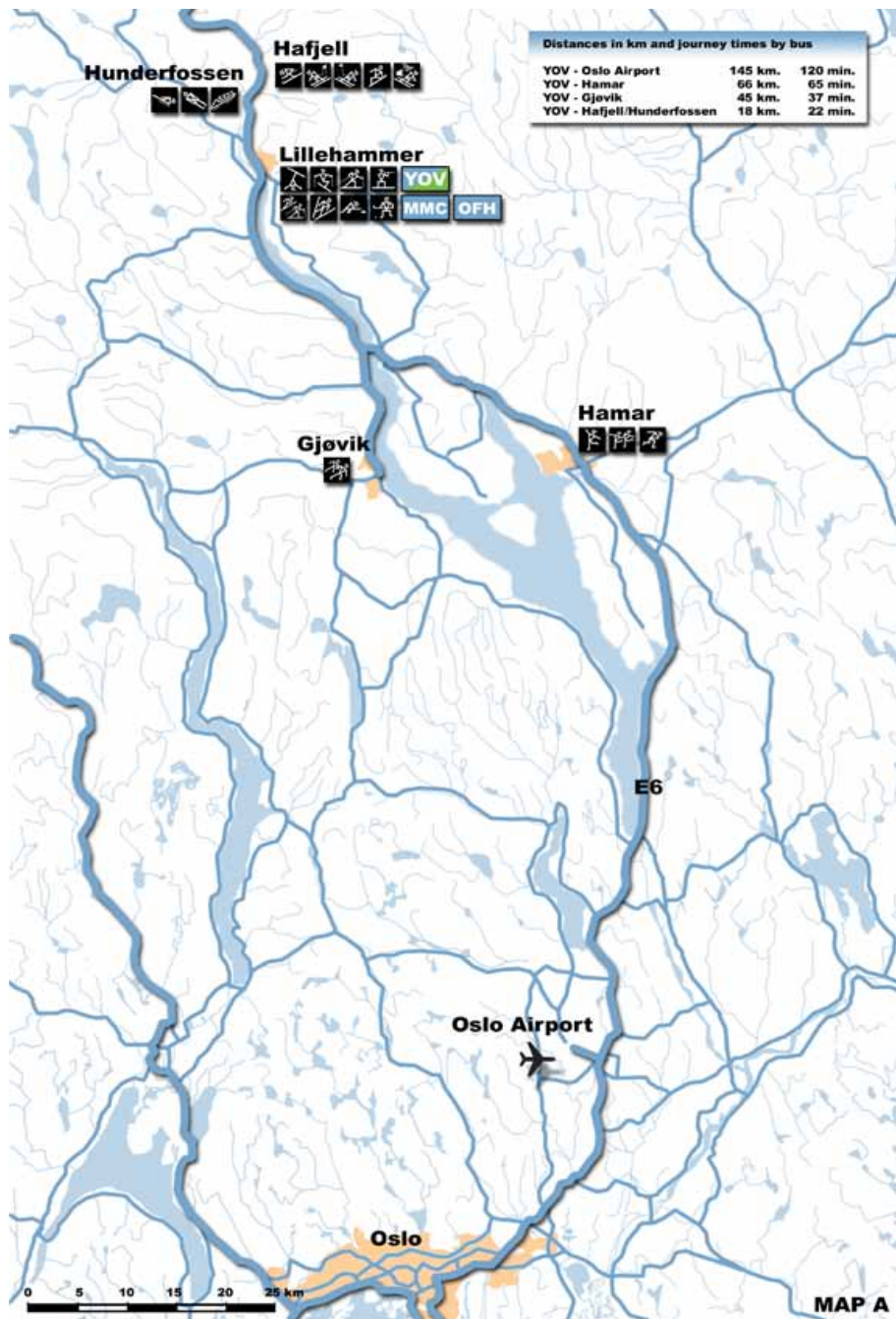


Figure 10: Boundaries of the Environmental System of YOG Lillehammer 2016.

The LYOGOC disposes ten competing venues, three accommodation sites, one arena for the CEP in addition to an unknown (at the moment) amount of vehicles. From an environmental perspective the system can be categorised as followed:

The Total System:

The system of the organisation can be described as the overarching frame of the total amount of activities done by the organisation. The venue map is a possible way of framing them. Another option, and probably more used is an organisational chart.

Sub System:

The sub-system in this context is given as the areas of usage, in example procurement, accommodation, venues, and transportation.

Element:

The element describes each specific site at each sub system, in example Hafjell Olympic alpine centre.

Sub-Element:

The sub-elements describes the environmental aspects form each element.

A chart of the system is given in figure 11.

Environmental System YOG Lillehammer 2016			
System	Sub-system	Element	Sub-Element
LYOGOC	Procurement	Office	Environmental Aspects of all procurements
	Accommodation	Youth Olympic Village Birkebeineren Hotels and Apartment Hamar Hotel	Environmental aspects at each Site
	Venues	Lillehammer Olympic Park Birkebeineren ski stadium Lillehammer Olympic bobsleigh and luge track Kristin Hall Hamar Olympic amphitheatre Gjøvik Olympic Cavern Hall Hamar Olympic Hall "the viking ship" Lillehammer Olympic Alpine Centre, Hafjell Kanthaugen Freestyle Arena Lydgårdsbakkene ski jumping arena Håkon Hall	Environmental aspects at each site
	Transportation	Road network between each site	Environmental aspects of transportation
	Recycling and Waste Management	Each site and handling at GLØR	Environmental aspects of waste generation

Figure 11: Visualisation of the Environmental System of YOG Lillehammer 2016.

5.4 Identification of Environmental Aspects at YOG Lillehammer 2016

The analysis has the purpose of creating an overview of the different environmental aspects connected to the Youth Olympic games at Lillehammer 2016. As described in the methodology the analysis is based on a two days period at Lillehammer, visiting the venues and interviewing a representative from each site. A summary from the interviews can be found in appendix 4. As a support to the interviews it is also performed a literature study of the Manual on Sport and the Environment from IOC. The analysis is split in five chapters introducing the environmental aspects from procurement, accommodation, venues, transportation/logistics, and recycling and waste management.

5.4.1 Procurement

The procurement of goods is maybe the environmental aspect that the LYOGOC can control the most. Because the procurement work at LYOGOC is in the starting phase and not fully set, it is difficult to evaluate or determine the outcome of environmental performance on the field. Nevertheless, it is an important part of the total

environmental impact of the event and therefore necessary to set some guidelines on how you should evaluate alternatives before the procurement is done. Rather than identifying environmental aspects of unknown procurement it is chosen to describe procedures and “rules” of green procurement that should be included and implemented in the procurement process of YOG Lillehammer.

During the procurement process it is therefore advised to seek reduction of environmental impact of the goods, services and work through the whole procurement life cycle, which is described in chapter 2.6.1.

The EMS will be based on this, and the system will set some grounding rules to ensure that selected suppliers also are evaluated after environmental considerations.

Goods

Examples of green procurement range from the purchase of “green” office supplies to objects of recycled materials and purchasing organic food. The ultimate green procurement is the avoidance of purchase altogether, but this is of course not an alternative. Companies that implement sustainability initiatives develop and publish a “Sustainable Development Procurement Guidelines and Procedures” to their supply-chain.

There are varying shades of “Going Green” and some of the considerations for the supply chain may be:

- Recycled content
- Bio-based content
- Assessing toxic content
- Energy or water consumption
- Products take-back and actual recycling

Food and Catering

According to a study carried out for the European Commission, the food and drinks sector is responsible for between 20 and 30 per cent of the most significant environmental impacts in Europe (European Commission, 2006). The most significant environmental impacts in this sector relate to the use of harmful chemicals in the production and manufacturing of food and food transportation. Many public authorities are looking to increase the share of organic food served in schools and office canteens, as well as reducing the share of high-impact meat products. The unsustainable use of marine resources and packaging waste are also important considerations. Beneath there are some suggestions of guidelines to implement in the EMS:

- Specify a minimum percentage of food, which must be organically produced. Provide additional points during the award stage for percentages above the minimum requirement.
- Specify minimum percentages and/or award points for the use of fruit and vegetables that are in season, and sustainably harvested marine products.
- Include contract clauses on minimising food waste and waste from food packaging.

- Apply selection criteria for caterers based on applying appropriate environmental management measures, such as training for staff.

Electricity

Electricity generation from fossil fuels is one of the principal sources of greenhouse gas emissions globally. Many European public authorities are now purchasing electricity from renewable energy sources. This could also be an option for the LYOGOC if the conditions are right.

5.4.2 Accommodation

Whether the event is a championship or a local competition, sports events attract a large number of people. Athletes, coaches, organisers, journalists, staff members, sponsors and spectators gathered on the same place and require accommodation throughout the event period. In this case the event period lasts for ten days, from the 26th of February to the 6th of March (LYOGOC, 2012). It is important to note that the evaluation of environmental aspects only evaluates the operational phase of the event since the construction of the YOY is under the responsibility of Lillehammer Municipality and Birkebeineren Hotels & Apartments are already built.

The operational environmental aspects of running the YOY and hotels connected to the game will be the energy consumption, waste generation and water consumption, with a significance that indicates that it should be included in an eventual environmental accounting. More unusual environmental aspects could however occur in the presence of an eventual fire or other accidents.

Table 8: Environmental Aspects of the Accommodation Sites.

Environmental Aspects	Why?
Energy consumption	Due to heating of air, lights and usage of other electrical equipment.
Waste generation	From the users
Water consumption	Due to showering, hygiene and maintenance
Noise/disturbance	Extra activity in the area

5.4.3 Venues

This chapter evaluates the environmental aspects at each of the nine Olympic venues in addition to the main media centre. The venues was built for the Olympic Games in Lillehammer 1994, and is used daily through the winter seasons. The venues have a multi purpose use during the summer seasons, hosting exhibitions, concerts and more.

Hamar Olympic Hall "the Viking Ship"

The venue will be used for speed skating under the event and is rented by Hamar Olympiske Anlegg. The hall has the capacity of 8,500 spectators and the competitions will be performed on the 26th, 27th and 29th of February (SNL, 2013), (LYOGOC, 2012). The distance between the arena and the unknown hotel in Hamar will be between 1,5 km and 3,5 km.

Table 9: Environmental Aspects at Hamar Olympic Hall, "The Viking Ship" (Sundmoen, 2013).

Environmental Aspects	Why?
Energy consumption	Due to heating of air, cooling of ice and lighting of the indoor arena. Usage of other electrical equipment.
Waste generation	From spectators
Water consumption	Ice production, showering and maintenance
Usage of ammoniac and brine	Small amounts are used in the ice cooling system
Noise/disturbance	Extra activity in the area

The usage of ammoniac and brine is highly regulated, and high priority safety measures are done in order to prevent leakage. It is not regarded as a significant environmental aspect, and will only be in the environmental accounting system if an accident occurs. A possible accident at Hamar Olympic Hall can cause damage on the bird sanctuary next to the stadium. The biggest impact of the arena is the energy consumption with heating of 350,000 m³ of air and an ice surface of 10,000 m² (SNL, 2013). The consumption depends on the outdoor temperature, preferred indoor temperature and ice quality. The arena usually operates with three different conditions: practicing, improved and championship conditions.

Table 10: Energy Consumption at "the Viking Ship" (Sundmoen, 2013).

	Practicing	Improved	Championship
Indoor temperature	8°C	12°C	16°C
Ice temperature	-5°C	-6°C	-7,5°C
Lighting	400 Lux	600 Lux	900 Lux
Energy consumption pr. day	20.000 kW	35.000 kW	50.000 kW

The data presented is based on an ice surface of 10.000 m². The total energy consumption can vary up to 30-40 per cent depending on an outdoor temperature of 0 degrees compared to minus 10 degrees.

Gjøvik Olympic Cavern Hall

The venue will be used for short track under the event and is rented by Gjøvik Olympiske Anlegg. The competitions will be performed on the 28th of February and the 1th of March. Like the name implies the arena is placed inside a mountain, and is capable of hosting 5,400 people during a short track competition (SNL, 2013). The distance between the arena and the hotel village in Hamar is approximately 50 km.

Table 11: Environmental Aspects at Gjøvik Olympic Cavern Hall (Motrøen, 2013).

Environmental Aspects	Why?
Energy consumption	Due to heating of air, cooling of ice and lighting of the indoor arena. Usage of other electrical equipment.
Waste generation	From spectators
Water consumption	Ice production, showering and maintenance
Usage of ammoniac and brine	Small amounts are used in the ice cooling system
Noise/disturbance	Extra activity in the area

The cooling system at Gjøvik Cavern Hall also contains ammoniac and brine, and is therefore evaluated in the same way as Hamar Olympic Hall. The stadium is located in a cavern and is quite isolated, so the most prioritised issues are related to the safety in case of an eventual fire. Like Hamar Olympic Hall, the biggest environmental impact comes from the energy consumption with heating of 135,000 m³ and an ice surface of 5,400 m² which depends on outdoor temperature, preferred indoor temperature and ice quality (SNL, 2013). However, the air volume and ice surface is considerably smaller and will likely use less energy.

Lysgårdsbakkene Ski Jumping Arena and Kanthaugen Freestyle Arena

The venues will be used for the ski jumping and half pipe competition under the event and is rented by Lillehammer Olympiaparken AS. The ski jumping competition takes place on the 2nd and 4th of March. Kanthaugen lies next to the ski jumping arena and will be used for the half pipe events of the game, and competitions will be held on the 29th of February and 3rd of March. Lysgårdsbakkene are able to gather up to 50,000 spectators in the ski jumping arena, while Kanthaugen requires temporary stands, which is not settled yet (Olympiaparken, 2013). The site is 1 km from the YOY at Stampesletta.

Table 12: Environmental Aspects at Lysgårdsbakkene Ski jumping Arena and Kanthaugen Freestyle Arena (Pedersen, 2013).

Environmental Aspects	Why?
Energy consumption	Due to lighting of the outdoors arena. Usage of other electrical equipment.
Waste generation	From spectators
Water consumption	The consumption of water will be high when producing snow to the half pipe
Ski waxing	Disposal of fluorine and fluorocarbons
Noise/disturbance	Extra activity in the area

The steady winter climate in Lillehammer usually provides enough snow, and the need for snow making in the ski jumping arena in February is rare. However, the most significant environmental aspects at the arena are linked to the production of snow to the half pipe in Kanthaugen freestyle arena. The events will most likely happen in daylight so the need for lighting will be minimal compared to a world cup event. The environmental issues related to ski waxing are minimal, but the disposal has more impact on the officials that are waxing the skis. Fluorine and fluorocarbons are

released when heating the wax and could affect the health on people in its presence. Waxing activities are however regulated to waxing cabins with high ventilation and the personnel are equipped with masks with gas and particle filter.

Birkebeineren Ski Stadium

The venue will be used for the cross-country, biathlon and combined CC competitions under the event with the cross-country competitions placed on the 28nd and 29th of February. The Biathlon competitions will take place on the 1th, 3rd, 4th and 5th of March, while the combined CC will take place on the 6th of March. The venue is rented by Lillehammer Olympiske Anlegg and the stadium has the possibilities of gathering 30,000 spectators at cross-country, and 10,000 at biathlon events (Olympiaparken, 2013). The ski stadium is sited in Sjøsetervegen 29, behind Lysgårdsbakkene, and is approximately 4,5 km from the village on Stampesletta.

Table 13: Environmental Aspects at Birkebeineren ski Stadium (Nes, 2013).

Environmental Aspects	Why?
Usage track machines	Emissions from track machines
Waste generation	Waste from spectators and athletes. The bullets from biathlon athletes at the shooting range.
Water consumption	Production of snow (not likely)
Energy consumption	Due to lighting of the outdoors arena. The Competitions will however, most likely, be performed in daylight. Usage of other electrical equipment.
Shooting rage activity	Disposal of ammunition
Ski waxing	Disposal of fluorine and fluorocarbons
Noise/disturbance	Extra activity in the area

Disposal of ammunition are gathered in gutters at the shooting spot. The bullets are made of lead and are gathered in boxes behind the target. Both are brought to a site where it is possible to re-melt it and create new bullets. Ski waxing activities are evaluated in the same way as the Lysgårdsbakkene Ski Jumping Arena and Kanthaugen freestyle arena. The track machines are used daily and consume diesel fuel. The energy and water consumption are likely to be smaller than the ice rinks.

Lillehammer Olympic Bobsleigh- and Luge Track, Hunderfossen

The venue will be used for bobsleigh and skeleton under the event, and is rented by Lillehammer Olympiske Anlegg AS. The competitions will be performed on the 26th, 27th and 29th of February and the 4th and 5th of March. The arena has a capacity of 6,000 attendances and the route from YOV Stampesletta to Hunderfossen is 15 km.

Table 14: Environmental Aspects at Lillehammer Olympic Bobsleigh and Luge Track, Hunderfossen (Tangen, 2013).

Environmental Aspects	Why?
Energy consumption	Due to cooling of ice and lighting of the outdoors track. Usage of other electrical equipment.
Waste generation	From spectators
Water consumption	Ice production and maintenance
Usage of ammoniac	Small amounts are used in the ice cooling system
Noise/disturbance	Extra activity in the area

The bobsleigh- and luge track are positioned in the shade, and are constructed with the intent of minimising the energy consumption. Since consumption is highly depending on the temperature and weather conditions it will vary a lot. The most significant environmental aspects are evaluated on the same line as the ice rinks. The track is 1,370 m long and the total ice surface is 6,670 m² (Olympiaparken, 2013). To create the ice surface, the concrete is cooled to -12 degrees and water is sprayed on until a 5 cm layer of ice is formed.

Kristin Hall, Hockey and Curling Rink

The venue will be used for hockey and curling under the event, and is rented by the Municipality of Lillehammer. The competitions will be performed on the 28th of February and 1st, 4th and 6th of March. The hockey arena has a capacity of 3,000 spectators while the curling arena has an unknown capacity (Lillehammer Kommune, 2013). The site is located 0,5 km away from the village at Stampesletta.

Table 15: Environmental Aspects at Kristin Hall, Hockey and Curling Rink (Linderud & Olsen, 2013).

Environmental Aspects	Why?
Energy consumption	Due to heating of air, cooling of ice and lighting of the indoor arena. Usage of other electrical equipment.
Waste generation	From spectators
Water consumption	Ice production, showering and maintenance
Usage of ammoniac and brine	Small amounts are used in the ice cooling system
Noise/disturbance	Extra activity in the area

The significant environmental aspects are the same as other ice rinks, requiring high energy consumption. The differences of environmental impact between the arenas depend on dimensions of the halls, the amount of spectators and the waste generation.

Hamar Olympic Amphitheatre

The venue will be used for figure skating under the event, and is rented by Hamar Olympiske Anlegg. The competitions will be performed on the 3rd, 4th of March. The amphitheatre has a capacity of 6,100 spectators and is situated in Hamar city centre, 1-4 km away from the Hamar hotel (Hamar Olympiske Anlegg, 2013).

Table 16: Environmental Aspects at Hamar Olympic Amphitheatre (Sundmoen, 2013).

Environmental Aspects	Why?
Energy consumption	Due to heating of air, cooling of ice and lighting of the indoor arena. Usage of other electrical equipment.
Waste generation	From spectators
Water consumption	Ice production, showering and maintenance
Usage of ammoniac and brine	Small amounts are used in the ice cooling system
Noise/disturbance	Extra activity in the area

The significant environmental aspects are the same as other ice rinks, with high energy consumption. The differences of environmental impact between the arenas will depend on the spectators and the waste generation.

Lillehammer Olympic Alpine Centre, Hafjell

The venue will be used for alpine competitions under the event, and is rented by Hafjell Alpintsender AS, which has several investors (Oppland, 2012). The competitions will be performed on the 26th, 27th and 28th of February and 1st 2nd and 4th of March. The Alpine centre is 15 km north from the village at Stampesletta.

Table 17: Environmental Aspects at Lillehammer Olympic Alpine Centre, Hafjell.

Environmental Aspects	Why?
Energy consumption	Lighting and usage of electrical equipment
Waste consumption	From spectators
Water consumption	From making of snow (not likely)
Ski waxing	Disposal of fluorine and fluorocarbons
Usage of track machines	Emissions from track machines
Usage of diesel engine	Emissions from running ski-lifts
Noise/disturbance	Extra activity in the area

Ski waxing activities are evaluated in the same way as the Lysgårdsbakkene Ski Jumping Arena and Kanthaugen freestyle arena. The track machines and ski lift are used daily and consume diesel fuel. The making of a slopestyle course will require a considerable amount of water to the snow making machines.

Håkon Hall

Håkon Hall will be used during the entire event, with the purpose of hosting the CEP programme and as a dining hall for athletes and officials.

Table 18: Environmental Aspects at Håkon Hall (Linderud & Olsen, 2013).

Environmental Aspects	Why?
Energy consumption	Due to heating of air, lights and usage of other electrical equipment.
Waste generation	From the users
Water Consumption	Due to showering, hygiene and maintenance
Noise/disturbance	Extra activity in the area

The most significant environmental aspects of the venue are the waste generation from stand activities and dining, in addition to the energy consumption of the venue.

Lillehammer Olympic Park

Lillehammer Olympic Park is a temporary construction that will hold the opening and closing ceremony, medal ceremonies and activities linked to the CEP programme.

Table 19: Environmental Aspects at Lillehammer Olympic Park

Environmental Aspects	Why?
Energy consumption possibly driven by diesel generator	Lights and usage of other electrical equipment.
Waste generation	From the spectators
Noise/disturbance	Sound from concerts and spectators

The venues biggest challenge will most likely be the handling of waste in the area. The usage of diesel generators to provide lighting of the stage and other effects will also have an impact on the local air quality, due to air emissions.

The Main Media Centre (MMC)

The Main Media Centre (MMC) is planned to be located in a three-storey education building near the Lillehammer Youth Olympic Village. The layout may present some challenges due to the lack of large open interior spaces. Upgrade works would be completed prior to the Youth Olympic Games. The Centre will be used to hold press conferences. The main issues from an environmental perspective are the amount of energy needed, waste generation in addition to smaller noise and disturbances in the immediate surroundings.

5.4.4 Transportation

Transportation and logistic is an essential part of arranging the event. Vehicle activities occur through the likes of transportation of goods, athletes, officials, the organisation, as well as the track machines in Hafjell, Lysgårdsbakkene, Kanthaugen and Birkebeineren ski stadium. The ice rinks use ice resurfacer vehicles to smoothen the ice as well. Vehicle activity contributes to many environmental hazards, mainly through pollution of green house gasses (GHG). Other issues are the occurrence of increased particles in the local air as well as noise and disturbance.

Transportation of goods is highly related to the procurement process. Short travelled food and merchandise will decrease the transportation distance, and should be a criterion when evaluating several options of procurement.

The selection of transportation methods of athletes and officials during the event will affect the most since it is likely to be the post with the longest distance in total. In addition to selection of environmental friendly transportation, it is relevant to set out effective routes to minimise the distance of the vehicles. Other efforts to promote environmental transportation could be to organise training and competitions in ways that gather as many participants as possible at each buss.

The following lists describe possible routes for athletes and official from Stampesletta and Hamar hotel in the event period, and arrival/departure at Gardermoen Airport. The routes will further be brought in to the accounting system that requires information on type of vehicle and how many times travelled. With the information it is possible to calculate total distance and amount of CO₂-emmissions from the activities.

Gardermoen – Hamar
Gardermoen – Lillehammer

Stampesletta – Lyngårdsbakkene and Kanthaugen
Stampesletta – Birkebeineren ski stadium
Stampesletta – Håkon Hall/Kristin Hall
Stampesletta – Hafjell Olympic Alpine Centre
Stampesletta – Lillehammer Olympic Bobsleigh- and Luge Track Hunderfossen
Stampesletta – Lillehammer Olympic Park
Stampesletta – Main Media Centre

Hamar hotel – Hamar Olympic hall “The Viking Ship”
Hamar hotel – Hamar Olympic Amphitheatre
Hamar hotel – Gjøvik Cavern Hall
Hamar hotel – Lillehammer Olympic Park
Hamar hotel – Håkon Hall
Hamar hotel – Main Media Centre

Regarding the transportation of spectators it is likely to think that the LYOGOC would provide a solution similar to Innsbruck 2012, where issued tickets to events entitle free access to shuttle busses. This will encourage them to use collective transportation instead of private cars. Given routes are not set, but can be set in the same way as the transportation of athletes and officials.

The machines connected to each site are run in the daily operation of the venues, and it is not possible to make any changes of these. It is also necessary to provide good conditions for the athletes, so encouragement of less preparation will probably cause more harm than the small environmental benefits.

5.4.5 Recycling and Waste Management

The degree of environmental impact generated from waste is highly dependent on what type of waste that is generated. At a sporting event it is likely to end up with mainly paper, plastic and food.

The production and use of paper is causing negative effects on the environment and are generally known as paper pollution. Pulp mills contribute to air, water and land pollution through bleaching substances.

One of the positive characteristics of plastic is the fact that it is durable. Unfortunately this is not a positive characteristic when it comes to the environment. The fact that plastic is durable means that it degrades slowly. In addition, burning plastic can sometimes result in toxic fumes. Aside from trying to recycle plastic, creating it can be costly to the environment because of the significant amounts of fossil fuels used.

Food waste can for example be collected separately and recycled as soil improver or fertiliser. This is an option for all the venues but especially for the dining area at the Håkon Hall.

5.4.6 Emergency Analysis

The emergency situation analysis is an extension of the identification on environmental aspects. The possibilities of unwanted incidents can cause environmental damage and are often more significant than the usual aspects. Table 20 presents occurring environmental aspects if an unwanted incident happens, its frequency, consequence, magnitude and risk.

Table 20: Risk Analysis.

Environmental Aspect	Emergency Situation	Frequency	Consequence	Magnitude	Risk
Atmospheric emissions	Accident and/or breakdowns during supply operations of the ice-making facility and cooling circuit of the bobsleigh run	1	Gradual release in the atmosphere of about 40 tons of ammonia with potential consequences for the vegetation and fauna within 500 m from the facility	3	3
Soil and underground spillage	Accidental spillage on unpaved areas of hazardous substances (lubricant oil, diesel oil, chemical products) during handling, supplying and storage operations	3	Soil and shallow groundwater contamination due to spillages of diesel oil.	1	3
Waste water atmospheric emissions with the vegetation	On site fire	1	Atmospheric emissions of potential toxic and harmful gases depending on the burning materials/products. Discharge of contaminated fire-fighting wastewater in to the drainage system or into surface water bodies depending on site location. Potential fire propagation to neighbouring wood if present.	3	3

The analysis of emergency situations took into account the likelihood of an emergency happening and the potential impact that such an emergency would have on the territory. The fact that the environmental review took place during the early stage of planning makes it hard to evaluate a correct and precise emergency analysis.

5.5 The Development of an EMS

This analysis will assess the EMS standards from EMAS and ISO 14001 in addition to ISO 20121. The intention with the analysis is to draw out the requirements from the standards and create a suitable EMS for YOG Lillehammer 2016.

An Organisation, which intends to join the EMAS regulations, is required to achieve and implement the following elements of an EMS system:

1. Carry out the initial **environmental review** with which the initial position of the organisation is established with respect to the environmental conditions;
2. Establish its **environmental policy** i.e. the objectives and general principles of action with respect to the environment, defining the reference context in order to set specific objectives and targets;
3. Draft the **environmental programme** which contains a description of the measures adopted to achieve the specific objectives and targets, pursuant to the environmental policy;
4. Implement the **environmental management system**, i.e. that part of the overall management system (structure, planning, responsibility, practices, procedures, processes and resources) which makes it possible to develop, introduce, realise and maintain the environmental policy;
5. Carry out **auditing** i.e. carry out a systematic, periodic, documented and objective evaluation of the performance of the organisation, the environmental management system and the processes intended to protect the environment;
6. Draft the **environmental statement**, aimed at the public, which comprises the environmental policy, a brief description of the environmental management system, a description of the organisation, the major environmental aspects, the environmental objectives and targets and in general the environmental performance of the organisation.

ISO 14001 is a standard to comply with, rather than “use”. However, it does come with guidance, and a support manual in ISO 14004. A major part of the management system is to ensure that the team has the skills, knowledge and competence to successfully implement it. An Organisation, which intends to join the ISO 14001 regulations, is required to implement the themes of the standard presented in table 5.16. However, the on going revision of ISO 14001, which will be announced in 2014, might bring some changes. Chapter 4 in ISO 14001 consists of six sub-chapters, each with general requirements. The headlines require specific documentation on the subject from the organisation.

Table 21: Themes of ISO 14001.

4.1	General requirements
4.2	Environmental Policy
4.3	Planning
4.3.1	Environmental Aspects
4.3.2	Legal and other Requirements
4.3.3	Objectives, Targets and Programmes
4.4	Implementation and Operation
4.4.1	Resources, Roles and Responsibility
4.4.2	Competence, Training and Awareness
4.4.3	Communication
4.4.4	Documentation
4.4.5	Control of Documents
4.4.6	Operational Control
4.4.7	Emergency Preparedness and Response
4.5	Checking
4.5.1	Monitoring and Measurement
4.5.2	Evaluation of Compliance
4.5.3	Nonconforming, Corrective Actions and Preventive Actions
4.5.4	Control of Records
4.5.5	Internal Audit
4.6	Management Review

Like ISO 14001, ISO 20121 is a standard to comply with, rather than “use”. The standard is built with the same logical sense and general requirements. An organisation, which intends to join the ISO 20121 regulations, is required to comply the following themes:

Table 22: Themes of ISO 20121.

4	Context of the Organisation
4.1	Understanding the Organisation and its Context
4.2	Identification and Engagement of Interested Parties
4.3	Determine the Scope of the Management System
4.4	Event Sustainability Management System
4.5	Sustainable Development Principles, Statement of Purpose and Values
5	Leadership
5.1	Leadership and Commitment
5.2	Policy
5.3	Organisational Role, Responsibility and Authorities
6	Planning
6.1	Actions to Address Risks and Opportunities
6.2	Event sustainability Objectives and how to Achieve them
7	Support
7.1	Resources
7.2	Competence
7.3	Awareness
7.4	Communication
7.5	Documented Information
8	Operations
8.1	Operational planning and Control
8.2	Dealing with Modified Activities, Products and Services
8.3	Supply Chain Management
9	Performance Evaluation
9.1	Performance against Governing Principles of Sustainable Development
9.2	Monitoring, Measurement, Analysis and Evaluation
9.3	Internal Audit
9.4	Management Review
10	Improvement
10.1	Nonconformity and Corrective Actions
10.2	Continual Improvement

The management systems provides many of the same attributes, but it is argued that ISO 20121 are more suitable for event organisers because it is made specifically for it. There are however some aspects of EMAS and ISO 14001 that benefits from the general approach and systemic presentation, which makes the total understanding of the system more visible. It is therefor chosen to not dismiss any of the standards or to just use only one of them. The management system, given in appendix 1, will therefore be designed with the intention of covering the essential themes of each standard with the possibility of including more from one, depending on which framework the organiser wish to use.

5.6 Creating an Environmental Accounting System

The design of the environmental accounting system has a micro approach, accounting for physical units, with the intention of controlling the environmental aspects of the event and establishing eco-balance and environmental benefits. The accounting system is based on the five main areas of the YOG-system and environmental management system, to measure physical units of the environmental impacts connected to the event. The total environmental accounting system is given in appendix 2.

The five main areas contains of procurement, accommodation, venues, transportation, and recycling and waste management. The chapter will provide a brief introduction to each area and its main attributes.

Procurement

It is complicated to deliver a complete environmental accounting design of procurements of the YOG Lillehammer because of the early stage of the process, and it is highly dependent on which products that are chosen. An example could be to analyse the total carbon footprint on each product bought. It can further be established a benchmarking of which product that has the biggest footprint and present the total carbon footprint in an official report.

Accommodation

The accommodation sites have its key performance indicators on energy- and water consumption, as well as waste generation.

Venues

Each venue has key performance indicators on the same environmental aspects as accommodation.

Transportation

Most vehicles have the same environmental aspects connected to it, in terms of particle pollution. The differences are therefore connected to the efficiency of its engine and how much it uses during the period. With that concern it is chosen to add distance fuel consumption and CO₂ emissions as a key performance indicator.

Recycling and Waste Management

The recycling and waste management are handled by GLØR, except for the Hamar sites, which are handled by HRR. It is therefore necessary to chose and select performance indicators that suits the renovation companies.

5.7 The Social Perspectives of the Games

The thesis has until now had a wide focus on environment and sustainability, but it is important to understand that the term “sustainability” in this context has a larger meaning than only recycling bins and reduction of resources. In its most generic form, “sustainability” refers to activities that can be sustained indefinitely. The term is appropriately applied to environmental concerns as an antidote to non-renewable resources, non-recyclable products, and pollution of air and water supply, and all activities that lead to an ecological dead end. Cities however, are also concerned with social and economic sustainability. Practices that help ensure the long-term viability of the region in terms of attracting residents and businesses. Hosting the event costs the nation 228 million NOK, including the Municipality investments for a student accommodation and a new ice rink, which most likely not will be recaptured during the games themselves. What happens at the site and across the city after the games is what ultimately decides whether hosting the youth Olympics was financially worthwhile. Because the environmental issues of the games is highly represented in the rest of the thesis this analysis will focus on assessing the social perspectives of the Youth Olympic Games, seen in the light of CSR. The next sections will provide some specific examples of social benefits related to hosting the Youth Olympic Games in the region.

The youth Olympic games are small compared to the Olympic games, and will likewise set a smaller social impact. However, in other circumstances the YOG can be considered as a large event, inviting 1,000 athletes, 500 officials, (LYOGOC, 2012) and while the amount of spectators are unknown it is worth to mention that Innsbruck 2012 had 100,000 spectators during its ten days. The same amount of spectators cannot be expected in Lillehammer, given the size differences of the two cities. The gathering could possibly create a stronger commitment and engagement within the local community.

The event will provide for about 70 new workplaces until 2016 and an unknown amount of volunteers, in addition to generating 328 million NOK. From a local point of view it would be beneficial to create contracts with Norwegian firms to support and stimulate the local companies. The issue is also relevant in an environmental perspective considering short travelling merchandise.

The event will leave a new student accommodation and a new ice rink for curling and hockey. The new accommodations will by all means increase the popularity of Lillehammer College, contributing to 360 new residents in the city, which again might stimulate local stores and businesses. The new ice rinks will add capacity to an already large amount of winter sports activities with a possibility to establish a wider commitment to sports and activities for children. If allocated with precession, it can help to accelerate the development of getting children in activity. Healthy children mean less health problems, which again result in decreased expenses on health care for the community.

The biggest difference on the ”program” between the Olympic games and youth Olympic games is the culture and education programme. As mentioned in chapter 3.3 the programme will undertake the themes of Olympism, skill development, well-being and healthy lifestyle, social responsibility and expression. If the programme is conducted in the right way the LYOGOC will have the opportunity of putting social

issues on the agenda, and transfer knowledge of ethics and environment to the future generation of winter sports athletes and role models.

The attention of the area will also hopefully bring back some of the staggering moments of the Lillehammer Olympic games in 1994, and to ensure that Lillehammer region maintain their position as one of the leading winter sports resorts in the country.

The mentioned benefits require determination and effort, and it is important to notice that none of the benefits occur automatically. The LYOGOC can influence the engagement of local procurement and creation of a thorough culture and education programme, as an accelerator for further progression. It is therefore important to provide a positive legacy with knowledge that the users and stakeholders can redirect after the end of the event.

6 Results

The results of the thesis are the deliverance of a design proposal of an environmental management system and an environmental accounting system. Because of the size of the two documents it is chosen to present them in an appendix.

The EMS contains the basic requirements of ISO 14001, ISO 20121 and EMAS. The system is not fully completed to one specific standard because of the uncertainty of which one that is preferred by the LYOGOC and for future organisers. This implies that the organiser needs to add specific details from the preferred standard to make it accurate. The system contains the following main themes:

1. Introduction
2. Planning
3. Implementation and Operation
4. EMS Procedures, Monitoring and Measurement
 1. Procurement
 2. Transportation
 3. Accommodation
 4. Venues
 5. Recycling and Waste Management
5. Management Review

Each chapter is connected to a section of the organisation, which has the responsibility of revising and updating the document. The arena managers and YOVMajor has the responsibility of monitoring and measuring of KPIs at their respective sites.

The environmental accounting system supports the EMS with KPIs to each section in chapter four in order to control the environmental aspects during the life cycle of the event.

7 Discussion

The thesis is based on a qualitative approach interviewing key informants related to the Olympic games in London 2012, arena managers from the present sites, workshops with the LYOGOC and focus groups with Multiconsult. There has also been performed a literature study on the field of environmental management systems in the presents of sports. The gathered information is based on past experience of the informants, so the results might differ if the author asked other informants. The environmental focus in sporting events does also differ depending on cultural and geographical position in the way of handling environmental issues. The information on the specific subject of YOG is limited and it is therefore necessary to conduct qualitative interviews with key informants. New investigations often begins with qualitative studies exploring new phenomena and, later on, quantitative studies follows to test the validity of propositions formulated in previous qualitative studies. However, this study is based on former knowledge from the Olympic games, transferred into the context of a youth Olympic game, and it was therefore not necessary to conduct a quantitative study to gather the results.

The highest uncertainty connected to the thesis is setting of boundaries from a systemic perspective. Bringing on or cutting off one or more subjects would eventually influence the extent of the management system and the presented environmental impact from the environmental accounting. The systemic approach reduces the risk of omitting vital environmental subjects, and gives a structured view that increases the possibilities of meeting its objectives. A systemic approach can also contribute to improved stakeholder participation. It will also be more adaptable because of better documentation, and a higher level of knowledge will be transferable to future YOG events.

The life cycle perspective gives an opportunity to break down the organising of the event into several phases. The approach enables the organisation to highlight the most important environmental challenges at the given time.

The research questions of the thesis has worked as a road map to the final destination, from the overview of relevant standards and frameworks to the creation of a suitable management system and eventually the identification of specific measures to control and reduce the environmental impact of the event. The thesis provides information on each research question. However, given the early stage of the organising, it will be vital to follow up the management system and accounting system with updated details and numbers during the run up to the event. The procurement of goods and services, and transportation plan is deficient because of inadequate information and could be a possible field of future studies. Another issue for future research is to estimate the values of each KPIs in the environmental accounting system.

It is hard to achieve huge environmental changes in YOG compared to the Olympic games. YOG rents and use former arenas and venues, and therefor has a relatively small influence on them. The event is therefore considered as an event where it from an environmental point of view circles around the thoughts of minimising consumption through the event period, perform green procurements, and create an efficient waste- and recycling system. The arenas used in the YOG 2016 are in use daily, so the consumption at each venue would probably lie on the same level even if the event were not held at all. The Olympic games, on the other hand, has a

significantly higher impact on the environment with massive construction sites and higher amounts of spectators during the event period. The positive side of the Olympic games is its economical power to change the host area completely. This could of course go either way, but London 2012 is a good example on how to develop an environmentally bad site in to a green park with healthy eco-systems and positive environmental impact in the long run. The event has thus influenced the area to go from being a forgotten and low priority area to become a hotspot with high development rates and potential.

That being said, it is necessary to take the tasks seriously and make sure that environmental awareness is communicated throughout the organisation and to the spectators of the event to ensure that the consumptions are being kept at a minimum. This also implies the importance of creating a legacy where participants and locals adopt the environmental knowledge and a wish to promote the attitude after the event.

As a part of assessing the context of LYOGOC and its activities during the life cycle of the event, the environmental impacts that LYOGOC has the most influence over would be in connection with procurement of temporary equipment and its recycling attributes and waste- and recycling management, selection of transportation options, and to secure optimised operations of the ice rinks.

The EMS is dependent on close monitoring to be able to make an environmental difference. Communication of the environmental aspects to the sharp end of the organisation and the spectators will contribute to a mutual understanding of the environmental issues. The EMS works as a support mechanism and tool in order to achieve its objectives. The EMS in it self will not contribute to sustainable events, but it will structure the organisation to be more resilient in order to handle its environmental challenges. Implementing the EMS and the needed competence to conduct all phases of the event in an environmental friendly manner rely on the resources of the organisation. This implies to attract personnel with the right competence in an early stage of the planning, and the ability to communicate the issues during the organising.

8 Conclusion and Recommendations

After assessing the context of LYOGOC and its activities during the life cycle of the event several possible environmental impacts occur. However, there are some impacts that are more controllable than others in terms of the jurisdiction of the organisation. The LYOGOC has mostly influence over the activities connected with the procurement of temporary equipment and its recycling attributes, waste- and recycling management, selection of transportation options, and to secure optimised operations of the ice rinks. Investment options for improved performance on the arenas are small because they are rented during the period and would therefore have minimal effect.

To secure an optimal environmental performance during the games it is advised to keep extra focus on environmental awareness in the procurement process, with recycling or reuse options for temporary equipment. Environmental awareness should also be addressed when selecting transportation options and routes. In order to create a sustainable event it is vital to create a resilient organisation that promotes the idea of environmental solutions and transfers the environmental knowledge of the top management to sharp end. Communication of the environmental aspects to the sharp end of the organisation and the spectators will contribute to a mutual understanding of the environmental issues. The tracking of physical units through the procedures of the EMS will help the organisation to control and improve its consumptions and emissions, and further give standard units for benchmarking of environmental performance and progress of future YOG events.

Given the early stage of the organising, it will be vital to follow up the management system and accounting system with updated details and numbers during the run up to the event. Future challenges and study on the environmental impact of procurement is necessary to provide a complete understanding on the environmental impact of YOG. Another issue for future research is to estimate the values of each KPIs in the environmental accounting system.

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Appendix 1: Environmental Management System

1 Introduction

This appendix is meant as a design of an Environmental Management System to the Youth Olympic Games at Lillehammer 2016. The system is intended to be applicable for future YOG events because of the similarities of the events and the common frame of it. The reason for not completing the whole system is because some of the requirements are related to applying a specific policy, goals and targets, which is a question of what the organisation wants and not a decision for the author to make. Chapter 4 will therefore have the main focus of the EMS, while chapter 1-3 are presented to give a thorough picture of the requirements of ISO 14001 and ISO 20121.

YOG Lillehammer 2016	EMS-Manual	Cap 1.1
Foreword		
Revised:	Approved by:	
	Date:	Sign:

The design is developed after the EMS concepts of EMAS, ISO 14001 and ISO 20121 and their recommendations for an EMS. The established system will cover the main issues from the three standards with relevance to the research questions of the thesis and is therefore not a fully completed EMS according to the requirements of ISO 14001, ISO 20121 and EMAS.

The scope of the EMS applies to the context of the organisation and its activities described in chapter 1.4 of the report.

The purpose of the system is to control the activities of the organisation and the environmental outcomes in order to reach the objectives and targets set in chapter 2.3 of the report.

YOG Lillehammer 2016	EMS- manual	Chap 1.2
Table of Content		
Prepared:	Prepared by:	Responsible:
Revised	Approved: Date:	Sign:

Chapter	Procedure nr	Content	Ref. ISO 14001/20121	Ref. IK-regulations
1		Introduction		
1.1		Foreword		
1.2		Table of Content		
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1.4		Context of the Organisation		
1.5		Environmental Policy		
1.6		Document Governance		
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4.4.8		Lillehammer Olympic Bobsleigh and Luge track, Hunderfossen		
4.4.9		Lillehammer Olympic Alpine Centre		
4.4.10		Lillehammer Olympic Park		
4.4.11		Håkon Hall		
4.5		Recycling and Waste Management		
5		Management Review		

YOG Lillehammer 2016	EMS- manual	Cap. 1.4
Context of the Organisation		
Prepared:	Prepared by:	Responsible: Board
Revised	Approved:	
	Date:	Sign:

The organisation responsible for the games, Lillehammer Youth Olympic Games Organising Committee (LYOGOC), is a corporation owned by three different associations given in table 1 beneath.

Table 1: Ownership of Lillehammer YOG 2016

Owner	Share
Ministry of Culture	51 %
Lillehammer municipality	24,5 %
Norwegian Sports Association (NIF)	24,5 %

The LYOGOC has the responsibility of planning, staging and closure of the event. In short terms it implies that the organisation needs to handle the following fields of the arrangement:

- Procurement of necessary items and equipment
- Transportation of goods
- Instalment of temporary equipment
- Gather a workforce of employees and volunteers during the event
- Transportation of athletes, officials and accredited people from the arrival at Gardermoen airport to the departure at the same place
- Accommodation and food to athletes and officials during the stay at Lillehammer and Hamar
- Operation of the rented venues within the period of the event
- Ensure a safe environment at the venues
- Ensure that the environmental impacts of the event are kept at a minimum
- Hosting the Culture and Education programme, staging of opening/closing and medal ceremonies

YOG Lillehammer 2016	EMS- manual	Chap 1.5
Sustainability/Environmental Policy		
Prepared:	Prepared by:	Responsible: Board
Revised	Approved: Date:	Sign:

The following is a proposed environmental policy for the YOG:

LYOGOC, the organisers of the II Youth Olympic Winter Games, Lillehammer 2016, are conscious that our activities will affect environmental resources and the area in which the event are held. At the same time, we acknowledge the environment as the third dimension of the Olympic Movement, convinced that there is no future for sport unless environmental values are central to all intervention policies.

We are therefore committed to organise the Youth Olympic Games according to the principles of environmental sustainability, in line with those set forth in the candidature file for Lillehammer YOG 2016. The LYOGOC pledges to deliver an event that sets an exemplary environmental precedent as to how an event should be planned and staged, built on the principle of sustainable development, with a minimal impact on the environment (LYOGOC, 2012).

Throughout all stages of the Olympic Games' organisation, we shall take care to minimise the negative impacts of the environmental components: air, water, land, energy and natural resources and ecosystems. Not only shall we operate in accordance with the relevant laws, whenever possible, we shall also make use of innovative environmental management tools and processes.

If we are to achieve our objectives, we require the assent and co-operation of all the public and private organisations involved. We shall therefore develop projects and initiatives with the institutions in the Olympic area to improve the sustainability of the 2016 Youth Olympic Games, and enhance the image of Lillehammer and Norway in the world.

We shall promote these principles among all those who take part in this Olympic adventure and share the emotions of this event with us: the athletes, sports federations, suppliers, sponsors and the public. However, our most ambitious goal is to leave an environmental legacy, once the torch has gone out, characterised by best practice and sustainable technical solutions; in short, a new way of conceiving, planning and managing major sports event that will set an example for future organisers. In order to achieve this, we shall implement an environmental management system.

YOG Lillehammer 2016	EMS- manual	Chap 1.6
Document Governance		
Prepared:	Prepared by:	Responsible: CFO & PMO
Revised	Approved: Date:	Sign:

The document of governance procedures shall describe how document with environmental issues are handled and stored. The organisation shall maintain the following guidelines:

- All managed documents shall be performed electronically
- If documents are received on paper it shall be scanned and stored electronically
- Contents of documents shall be continuously updated as the document changes
- Procedures and documents that do not contain records shall be kept as long as they are relevant to the current operation
- All documents must be labelled with the file name and path so that they are easily identified

YOG Lillehammer 2016	EMS- manual	Chap. 2
Planning		
Prepared:	Prepared by:	Responsible: Environmental Manager
Revised	Approved: Date:	Sign:

Chapter two gives an assessment of the environmental aspects of the games and procedures to handle environmental laws and regulations related to the event. Further, objectives and targets that reflect the environmental policy are set to reach as good environmental performance as possible.

YOG Lillehammer 2016	EMS- manual	Chap. 2.1
Environmental Aspects		
Prepared:	Prepared by:	Responsible: Environmental Manager
Revised	Approved: Date:	Sign:

The requirements of ISO 14001 state that the organisation shall establish and maintain procedures to identify the environmental aspects of its activities, products and services. It is expected that aspects under influence of the organisation should be determined in order to set its environmental objectives.

A systematic approach to identify environmental aspects is described in chapter 5 in the report. The approach is based on qualitative assessments. To achieve an ISO 14001 certification it is required to also evaluate them quantitatively.

It is important to identify significant environmental aspects resulting from all activities carried out by the organisation, as well as from its suppliers and contractors who are under the organisation's control or influence. In order to develop an effective EMS, environmental objectives and targets as well as the operational control and monitoring procedures are required to be consistent with the environmental significant aspects identified.

The objectives and targets are set in chapter 2.3 while the procedures for operational control and monitoring are set in chapter 4.

YOG Lillehammer 2016	EMS- manual	Chap. 2.2
Legal and other Requirements/ Environmental Laws and Regulations		
Prepared:	Prepared by:	Responsible: CFO & PMO
Revised	Approved: Date:	Sign:

LYOGOC defines its documented procedures to assure that relevant environmental legislations, agreements with local authorities and codes of practice applicable to activities directly controlled by LYOGOC are identified on regular basis, adopted and retained.

a) Identification of Legislation

Every two months the Environmental Department analyses several sources of legislation such as:

- Legislative data received
- Professional HSE journals or other internet data bases
- Other communications from industry associations, Chambers of Commerce and authorities.

b) Adoption of Applicable Legislation

If the legislation is identified as applicable to LYOGOC activities, the Environmental Department shall:

- Communicate the main implications of the new legislation to the other departments involved
- If necessary, organise a meeting with them to establish an adjustment plan
- If necessary, modify existing procedures. Moreover, every two months the Environmental Department inserts applicable legislation in a list of laws and regulations pertaining to its activities, available on LYOGOC's intranet

YOG Lillehammer 2016	EMS- manual	Chap. 2.3
Objectives and Targets		
Prepared:	Prepared by:	Responsible: CFO & PMO
Revised	Approved: Date:	Sign:

Objectives shall be defined on the basis of the LYOGOC's environmental policy and according to the results of the environmental review. Environmental targets shall be set out to achieve objectives defined within a specific time frame. When the objectives and targets are established, the LYOGOC should define measurable environmental performance indicators to keep track on the performance trends. The KPI are shown in the environmental accounting system (appendix 2). The objectives and targets shall be included in all phases of the event, and updated continuously, at least once a year at the annual meeting. The following objectives and targets are only suggestions since these should be developed by LYOGOC.

The objectives of YOG Lillehammer 2016 is to perform sound environmental management of the following:

- Procurement
- Accommodation
- Venues
- Transportation
- Recycling and waste management

The specific targets set for each objectives should be set by the LYOGOC, but suggested targets could be:

Procurement:

- Eco-labelled product whenever possible

Minimised resource consumption:

- 30 per cent of the energy consumption shall come from renewable energy sources

Waste generation:

- 90 per cent of the total waste generation shall be recycled

Transportation:

- 100 per cent of athletes and officials shall use organised transportation
- 70 per cent of visitors using public transportation

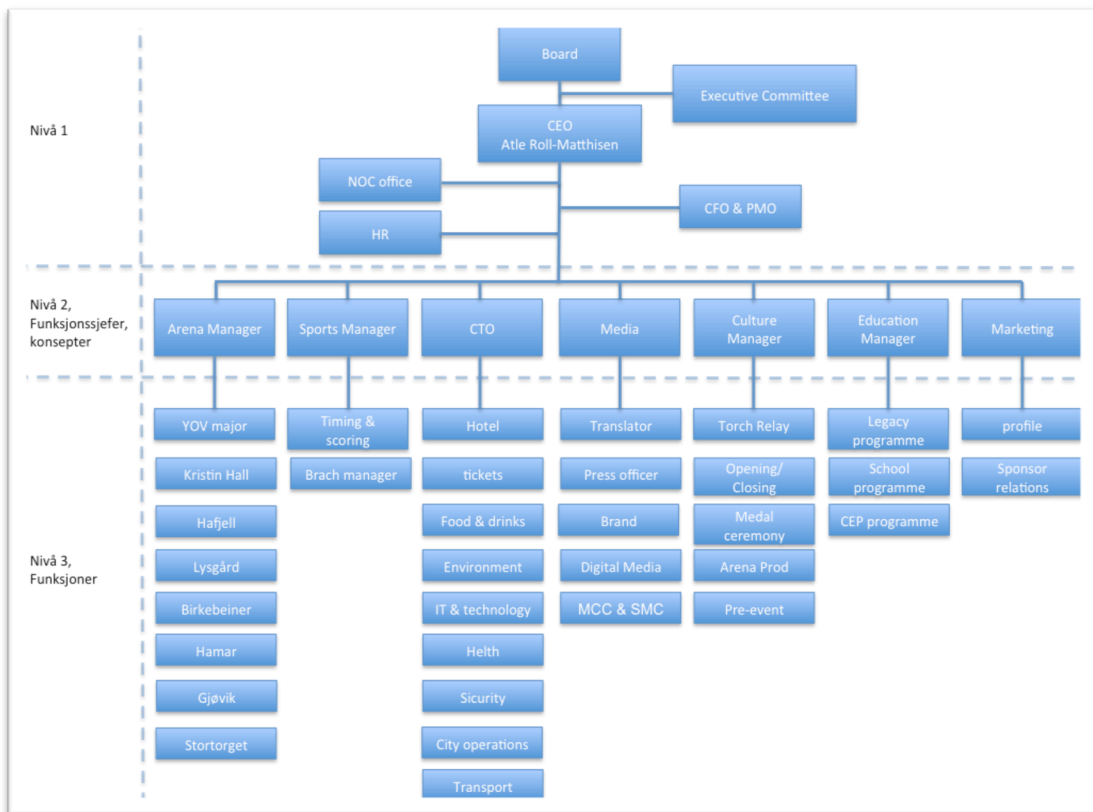
YOG Lillehammer 2016	EMS- manual	Chap. 3
Implementation and Operation		
Prepared:	Prepared by:	Responsible: CFO & PMO
Revised	Approved: Date:	Sign:

Chapter three intends to enlighten the structure and responsibilities of the LYOGOC. The chapter also contains procedure for training, awareness and competence. It also describes how this should be communicated internally with the athletes and spectators of the event.

YOG Lillehammer 2016	EMS- manual	Chap. 3.1
Structure and Responsibility		
Prepared:	Prepared by:	Responsible: CFO & PMO
Revised	Approved: Date:	Sign:

Roles, responsibilities and authorities shall be defined, documented and communicated in order to facilitate effective environmental management. Management shall provide resources essential to the implementation and control of the EMS. Resources include human resources and specialised skills, technology and financial resources.

The organisational chart is the current way of describing the future organisation. The organisation only consists of four people at the moment, but will increase to 70 employees closer to the games.



YOG Lillehammer 2016	EMS- manual	Chap. 3.2
Training, Awareness and Competence		
Prepared:	Prepared by:	Responsible: HR
Revised	Approved: Date:	Sign:

The LYOGOC shall identify training needs. It shall require that all personnel, whose work may create a significant impact upon the environment, have received appropriate training. It shall establish and maintain procedures to make its employees or members at each relevant function and level aware of conformance with the environmental policy and procedures and with the requirements of the environmental management systems.

- Top management shall identify environmental knowledge, skills and level of experience that are required for all relevant positions in the entire organisation with particular attention to dedicated environmental staff
- Identify training needs on a regular basis and plan routine training activities to fill knowledge and skill gaps
- The LYOGOC shall document the training and records to evaluate training effectiveness
- The training shall include the building of environmental awareness and motivation for the volunteers of the event
- Roles and responsibilities shall be in conformance with the stated environmental policy and procedures
- Personnel performing tasks which can cause significant environmental impacts shall be competent on the basis of appropriate education, training and/or experience

YOG Lillehammer 2016	EMS- manual	Chap. 3.3
Communication		
Prepared:	Prepared by:	Responsible: HR/Press Officer
Revised	Approved: Date:	Sign:

The intention of the communication section is to guarantee that internal communication as well as communication to or from external interested parties on significant environmental aspects takes place effectively, is recorded and, if necessary, evaluated for feedback.

The LYOGOC shall provide procedures for clear information to all employees addressing the top management environment commitment, significant environmental aspects and any environmental issues of concern, objectives and targets, specific operations and/or managerial requirements. At the same time the organisation should support and stimulate “bottom-up” communication on the same issues providing evidence that any request/observations and/or suggestions coming from internal employees is received, assessed and that any decision is communicated to involved employees.

With regards to its environmental aspects and environmental management system, the LYOGOC shall:

- Communicate its procedures for handling environmental aspects internally through the training programme of relevant personnel and volunteers
- Receiving documents from external parties considering environmental aspects shall be stored and communicated through the intranet to the LYOGOC
- Communication of environmental issues to the press shall be done through the press officer after briefing with the environmental manager

YOG Lillehammer 2016	EMS- manual	Chap. 4
EMS Procedures, Monitoring and Measurements		
Prepared:	Prepared by:	Responsible: Environmental Manager
Revised	Approved: Date:	Sign:

Chapter four gives procedures from every area and site described in the LYOGOC-system. This includes procedures for maintenance, monitoring and measurement of the KPI given in the environmental accounting system. The system will go through in the following order:

- Procurement
- Transportation
- Accommodation
- Venues
- Recycling and waste management

YOG Lillehammer 2016	EMS- manual	Chap 4.1
Procurement		
Prepared:	Prepared by:	Responsible: CFO & PMO
Revised	Approved: Date:	Sign:

Sustainable choice of materials is an important aspect that includes substances and products' impact on health and the environment in all phases throughout the event life cycle. All subjects must adhere to the defined requirements and goals, already when the conceptual choices are made. It is recommended that materials with low health and environmental impact with low greenhouse gas emissions becomes a priority.

The LYOGOC wants to carry out its procurement activities in an environmentally responsible manner. The organisation commits to extend the incorporation of environmental criteria into the procurement process to ensure that, when possible, goods and works purchased minimise environmental damage and, where possible, maximise their beneficial environmental effects. Directing an increasing amount of spending towards the purchase of more environmentally sound alternatives will contribute to a reduction of the negative environmental impact of our activities.

The following shall be evaluated through a procurement process:

- **Improvement in local air quality** through the purchasing of low-emission vehicles fulfilling the latest EURO norm.
- **Improvement in local water quality** through the maximisation of use of environmentally friendly cleaning products.
- **Supporting a healthy working environment** through proposing organic food and considering indoor air quality in construction works.
- **Environmental declaration:** There are requirements for environmental product declarations (EPDs) ass. ISO 14025/EN-NS 15804 for the five to ten most used materials purchased. It should be selected eco products like "The Nordic Swan" or "EU Flower" when possible. Alternatively green/white Eco Products where there are more than three options available in the market.
- **Resource consumption:** It shall not be purchased materials from endangered species and/or scarce non-renewable resources. Material from vulnerable/limited resources of soil and rocks are not acceptable.
- **Ethical and responsible procurement:** Products shall not be produced by children or personnel without adequate labour rights according to UN and ILO conventions. At least 80 per cent of purchased materials should be documented with traceability certificates or similar.
- **Distance:** short travelled products and services shall be prioritised if selecting between to similar suppliers.

YOG Lillehammer 2016	EMS- manual	Chap 4.2.1
Transportation of Goods		
Prepared:	Prepared by:	Responsible: CFO & PMO
Revised	Approved: Date:	Sign:

The transportation of goods is heavily connected to the procurement of each product and where it is bought. To measure the environmental impacts of the transportation the LYOGOC shall:

What:

- Document the distance travelled
- Document the type of vehicle
- Measure its fuel consumption of the distance

How:

- Track the distance travelled by assessing its route or description in the invoice of the procurement
- The total fuel consumption shall be measured by calculating the fuel consumption of the vehicle pr. Km times the distance travelled

Where:

- The statistics from each delivery shall be noted in the environmental accounting system for transportation of goods

YOG Lillehammer 2016	EMS- manual	Chap 4.2.2
Transportation of Athletes, Officials and Spectators		
Prepared:	Prepared by:	Responsible: Transport Manager
Revised	Approved: Date:	Sign:

Transportation of athletes and officials depends on the choice of vehicles and its distance travelled. To measure the environmental impacts of the transportation the LYOGOC shall:

What:

- Document the distance travelled
- Document the type of vehicle
- Measure its fuel consumption of the distance

How:

- Track the distance travelled by assessing its route.
- The total fuel consumption shall be measured by calculating the fuel consumption of the vehicle pr. Km times the distance travelled

Where:

- The Statistics from each route shall be noted in the environmental accounting system for transportation of athletes and officials

Innsbruck 2012 gave every person with an arena ticket the benefit of free admission to shuttle busses. Recyclable electronic tickets could work as a ticket for both the arenas and shuttle busses. The electronic tickets will then give to organiser a possibility of registering the amount of tickets used on the busses and the frequency of the usage. If the solution is chosen it shall be required to:

- Measure the amount of ticket holders using shuttle busses
- The data shall be revised every day to identifies the needed routes

YOG Lillehammer 2016	EMS- manual	Chap 4.2.3
Vehicles at Venue		
Prepared:	Prepared by:	Responsible: Site Manager
Revised	Approved: Date:	Sign:

Vehicle activities depend on the choice of vehicles and its distance travelled. This section is addressed especially for track machines and ice surfacers at each site. To measure the environmental impacts of the preparation work at venues performed by vehicles the LYOGOC shall:

What:

- Document the distance travelled
- Document the type of vehicle
- Measure its fuel consumption of the distance

How:

- Track the distance travelled by noting the mileage of the vehicle before and after use
- The total fuel consumption shall be measured by calculating the fuel consumption of the vehicle pr. Km times the distance travelled

Where:

- The Statistics from each route shall be noted in the environmental accounting system for vehicle activities at venues

YOG Lillehammer 2016	EMS- manual	Chap 4.3.1
YOG Village Lillehammer		
Prepared:	Prepared by:	Responsible: YOV major
Revised	Approved: Date:	Sign:

The YOY contains of five constructions and during the event period it is preferable to keep the resource consumption at a minimum. Tracking of energy and water consumption in addition to waste generation at each building is required to control the environmental aspects at the site. The LYOGOC shall therefore:

What:

- Tracking of energy consumption each day
 - o Measured in kWh
- Tracking of water consumption each day
 - o Measured in litre
- Tracking of waste generation each day
 - o Measured in kg

How:

- Tracking of energy consumption shall be done by documenting the electricity meter when the first guests arrive at the accommodation site. After the last guests have left, the electricity meter will once again be documented to see the total energy consumption during the period.
- Tracking of water consumption shall be done by documenting the flow meter when the first guests arrive at the accommodation site. After the last guests have left, the water flow meter will once again be documented to see the total water consumption during the period.
- The waste generation will be measured in kg every time it is disposed from each site.

Where:

- The data will be stored electronically in the environmental accounting system for accommodation

YOG Lillehammer 2016	EMS- manual	Chap 4.3.2
Birkebeineren Hotel & Apartments		
Prepared:	Prepared by:	Responsible: YOV Major
Revised	Approved: Date:	Sign:

Birkebeineren Hotel & Apartments is a rented hotel for the occasion and during the event period it is preferable to keep the resource consumption to a minimum. Tracking of energy and water consumption in addition to waste generation at each building is required to control the environmental aspects at the site. The LYOGOC shall therefore:

What:

- Tracking of energy consumption each day
 - o Measured in kWh
- Tracking of water consumption each day
 - o Measured in litre
- Tracking of waste generation each
 - o Measured in kg

How:

- Tracking of energy consumption shall be done by documenting the electricity meter when the first guests arrive at the accommodation site. After the last guests have left, the electricity meter will once again be documented to see the total energy consumption during the period.
- Tracking of water consumption shall be done by documenting the flow meter when the first guests arrive at the accommodation site. After the last guests have left, the water flow meter will once again be documented to see the total water consumption during the period.
- The waste generation will be measured in kg every time it is disposed from each site.

Where:

- The data will be stored electronically in the environmental accounting system accommodation

YOG Lillehammer 2016	EMS- manual	Chap 4.3.3
Hamar Hotel		
Prepared:	Prepared by:	Responsible: YOV Major
Revised	Approved: Date:	Sign:

The Hamar hotel is a rented hotel for the occasion and during the event period it is preferable to keep the resource consumption at a minimum. Tracking of energy and water consumption in addition to waste generation at each building is required to control the environmental aspects at the site. The LYOGOC shall therefore:

What:

- Tracking of energy consumption each day
 - o Measured in kWh
- Tracking of water consumption each day
 - o Measured in litre
- Tracking of waste generation each
 - o Measured in kg

How:

- Tracking of energy consumption shall be done by documenting the electricity meter when the first guests arrive at the accommodation site. After the last guests have left, the electricity meter will once again be documented to see the total energy consumption during the period.
- Tracking of water consumption shall be done by documenting the flow meter when the first guests arrive at the accommodation site. After the last guests have left, the water flow meter will once again be documented to see the total water consumption during the period.
- The waste generation will be measured in kg every time it is disposed from each site.

Where:

- The data will be stored electronically in the environmental accounting system for accommodation

YOG Lillehammer 2016	EMS- manual	Chap 4.4.1
Venue: Hamar Olympic Hall, “The Viking Ship”		
Prepared:	Prepared by:	Responsible: Arena Manager Hamar
Revised	Approved: Date:	Sign:

The Hamar Olympic Hall, “The Viking ship”, will be used for speed skating during three days of the event. The environmental aspects of the arena are energy consumption, water consumption and waste generation. Tracking of energy and water consumption in addition to waste generation at the arena is required to control the environmental aspects at the site.

What:

- Tracking of energy consumption
 - o Measured in kWh
- Tracking of water consumption
 - o Measured in litre
- Tracking of waste generation
 - o Measured in kg

How:

- Tracking of energy consumption shall be done by documenting the electricity meter when the first guests arrive at the accommodation site. After the last guests have left, the electricity meter will once again be documented to see the total energy consumption during the period.
- Tracking of water consumption shall be done by documenting the flow meter when the first guests arrive at the accommodation site. After the last guests have left, the water flow meter will once again be documented to see the total water consumption during the period.
- The waste generation will be measured in kg after disposal at each competition day

Where:

- The data will be stored electronically in the environmental accounting system for venues

Other precautions:

- The cooling system shall be audited before the event to prevent leakage

YOG Lillehammer 2016	EMS- manual	Chap 4.4.2
Venue: Hamar Olympic Amphitheatre		
Prepared:	Prepared by:	Responsible: Arena Manager Hamar
Revised	Approved: Date:	Sign:

The Hamar Olympic Amphitheatre will be used for figure skating during two days of the event. The environmental aspects of the arena are energy consumption, water consumption and waste generation. Tracking of energy and water consumption in addition to waste generation at the arena is required to control the environmental aspects at the site.

What:

- Tracking of energy consumption
 - o Measured in kWh
- Tracking of water consumption
 - o Measured in litre
- Tracking of waste generation
 - o Measured in kg

How:

- Tracking of energy consumption shall be done by documenting the electricity meter when the first guests arrive at the accommodation site. After the last guests have left, the electricity meter will once again be documented to see the total energy consumption during the period.
- Tracking of water consumption shall be done by documenting the flow meter when the first guests arrive at the accommodation site. After the last guests have left, the water flow meter will once again be documented to see the total water consumption during the period.
- The waste generation will be measured in kg after disposal at each competition day

Where:

- The data will be stored electronically in the environmental accounting system venues

Other precautions:

- The cooling system shall be audited before the event to prevent leakage

YOG Lillehammer 2016	EMS- manual	Chap 4.4.3
Venue: Gjøvik Olympic Cavern Hall		
Prepared:	Prepared by:	Responsible: Arena Manager Gjøvik
Revised	Approved: Date:	Sign:

Gjøvik Olympic Cavern Hall will be used for short track during two days of the event. The environmental aspects of the arena are energy consumption, water consumption and waste generation. Tracking of energy and water consumption in addition to waste generation at the arena is required to control the environmental aspects at the site.

What:

- Tracking of energy consumption
 - o Measured in kWh
- Tracking of water consumption
 - o Measured in litre
- Tracking of waste generation
 - o Measured in kg

How:

- Tracking of energy consumption shall be done by documenting the electricity meter when the first guests arrive at the accommodation site. After the last guests have left, the electricity meter will once again be documented to see the total energy consumption during the period.
- Tracking of water consumption shall be done by documenting the flow meter when the first guests arrive at the accommodation site. After the last guests have left, the water flow meter will once again be documented to see the total water consumption during the period.
- The waste generation will be measured in kg after disposal at each competition day

Where:

- The data will be stored electronically in the environmental accounting system for venues

Other precautions:

- The cooling system shall be audited before the event to prevent leakage

YOG Lillehammer 2016	EMS- manual	Chap 4.4.4
Venue: Lyngårdsbakkene Ski Jumping Arena		
Prepared:	Prepared by:	Responsible: Arena Manager Lysgaard
Revised	Approved: Date:	Sign:

Lyngårdsbakkene will be used for the ski jumping and Nordic combined competition under the Youth Olympic Games. The venue will have three competition days during the event period. The environmental aspects of operating the arena are energy consumption, water consumption and waste generation. Tracking of energy and water consumption in addition to waste generation at the arena is required to control the environmental aspects at the site.

What:

- Tracking of energy consumption
 - o Measured in kWh
- Tracking of water consumption
 - o Measured in litre
- Tracking of waste generation
 - o Measured in kg

How:

- Tracking of energy consumption shall be done by documenting the electricity meter when the first guests arrive at the accommodation site. After the last guests have left, the electricity meter will once again be documented to see the total energy consumption during the period.
- Tracking of water consumption shall be done by documenting the flow meter when the first guests arrive at the accommodation site. After the last guests have left, the water flow meter will once again be documented to see the total water consumption during the period.
- The waste generation will be measured in kg after disposal at each competition day

Where:

- The data will be stored electronically in the environmental accounting system venues

YOG Lillehammer 2016	EMS- manual	Chap 4.4.5
Venue: Kanthaugen freestyle Arena		
Prepared:	Prepared by:	Responsible: Arena Manager Lysgaard
Revised	Approved: Date:	Sign:

Kanthaugen freestyle arena will be used for the snowboard and freestyle half pipe competitions under the Youth Olympic Games. The venue will have two competition days during the event period. The environmental aspects of operating the arena are energy consumption, water consumption and waste generation. Tracking of energy and water consumption in addition to waste generation at the arena is required to control the environmental aspects at the site.

What:

- Tracking of energy consumption
 - o Measured in kWh
- Tracking of water consumption
 - o Measured in litre
- Tracking of waste generation
 - o Measured in kg

How:

- Tracking of energy consumption shall be done by documenting the electricity meter when the first guests arrive at the accommodation site. After the last guests have left, the electricity meter will once again be documented to see the total energy consumption during the period.
- Tracking of water consumption shall be done by documenting the flow meter when the first guests arrive at the accommodation site. After the last guests have left, the water flow meter will once again be documented to see the total water consumption during the period.
- The waste generation will be measured in kg after disposal at each competition day

Where:

- The data will be stored electronically in the environmental accounting system for venues

YOG Lillehammer 2016	EMS- manual	Chap 4.4.6
Venue: Kristin Hall		
Prepared:	Prepared by:	Responsible: Arena Manager Kristin Hall
Revised	Approved: Date:	Sign:

Kristin Hall will be used for ice hockey and curling during the event. The environmental aspects of the arena are energy consumption, water consumption and waste generation. Tracking of energy and water consumption in addition to waste generation at the arena is required to control the environmental aspects at the site.

What:

- Tracking of energy consumption
 - o Measured in kWh
- Tracking of water consumption
 - o Measured in litre
- Tracking of waste generation
 - o Measured in kg

How:

- Tracking of energy consumption shall be done by documenting the electricity meter when the first guests arrive at the accommodation site. After the last guests have left, the electricity meter will once again be documented to see the total energy consumption during the period.
- Tracking of water consumption shall be done by documenting the flow meter when the first guests arrive at the accommodation site. After the last guests have left, the water flow meter will once again be documented to see the total water consumption during the period.
- The waste generation will be measured in kg after disposal at each competition day

Where:

- The data will be stored electronically in the environmental accounting system for venues

Other precautions:

- The cooling system shall be audited before the event to prevent leakage

YOG Lillehammer 2016	EMS- manual	Chap 4.4.7
Venue: Birkebeineren Ski Stadium		
Prepared:	Prepared by:	Responsible: Arena Manager Birkebeineren
Revised	Approved: Date:	Sign:

Birkebeineren ski stadium will be used for cross-country, nordic combined and biathlon during five days of the event. The environmental aspects of the arena are energy consumption, water consumption and waste generation. Tracking of energy and water consumption in addition to waste generation at the arena is required to control the environmental aspects at the site.

What:

- Tracking of energy consumption
 - o Measured in kWh
- Tracking of water consumption
 - o Measured in litre
- Tracking of waste generation
 - o Measured in kg

How:

- Tracking of energy consumption shall be done by documenting the electricity meter when the first guests arrive at the accommodation site. After the last guests have left, the electricity meter will once again be documented to see the total energy consumption during the period.
- Tracking of water consumption shall be done by documenting the flow meter when the first guests arrive at the accommodation site. After the last guests have left, the water flow meter will once again be documented to see the total water consumption during the period.
- The waste generation will be measured in kg after disposal at each competition day

Where:

- The data will be stored electronically in the environmental accounting system for venues

YOG Lillehammer 2016	EMS- manual	Chap 4.4.8
Venue: Lillehammer Bobsleigh and Luge Track, Hunderfossen		
Prepared:	Prepared by:	Responsible: Arena Manager Hunderfossen
Revised	Approved: Date:	Sign:

Lillehammer Bobsleigh and Luge Track will be used for short track during two days of the event. The environmental aspects of the arena are energy consumption, water consumption and waste generation. Tracking of energy and water consumption in addition to waste generation at the arena is required to control the environmental aspects at the site.

What:

- Tracking of energy consumption
 - o Measured in kWh
- Tracking of water consumption
 - o Measured in litre
- Tracking of waste generation
 - o Measured in kg

How:

- Tracking of energy consumption shall be done by documenting the electricity meter when the first guests arrive at the accommodation site. After the last guests have left, the electricity meter will once again be documented to see the total energy consumption during the period.
- Tracking of water consumption shall be done by documenting the flow meter when the first guests arrive at the accommodation site. After the last guests have left, the water flow meter will once again be documented to see the total water consumption during the period.
- The waste generation will be measured in kg after disposal at each competition day

Where:

- The data will be stored electronically in the environmental accounting system for venues

Other precautions:

- The cooling system shall be audited before the event to prevent leakage

YOG Lillehammer 2016	EMS- manual	Chap 4.4.9
Venue: Hafjell Olympic Alpine Centre		
Prepared:	Prepared by:	Responsible: Arena Manager Hafjell
Revised	Approved: Date:	Sign:

Hafjell Olympic Alpine Centre will be used for alpine skiing, freestyle skicross and snowboard slopestyle during seven days of the event. The environmental aspects of the arena are energy consumption, water consumption and waste generation. Tracking of energy and water consumption in addition to waste generation at the arena is required to control the environmental aspects at the site.

What:

- Tracking of energy consumption
 - o Measured in kWh
- Tracking of water consumption
 - o Measured in litre
- Tracking of waste generation
 - o Measured in kg

How:

- Tracking of energy consumption shall be done by documenting the electricity meter when the first guests arrive at the accommodation site. After the last guests have left, the electricity meter will once again be documented to see the total energy consumption during the period.
- Tracking of water consumption shall be done by documenting the flow meter when the first guests arrive at the accommodation site. After the last guests have left, the water flow meter will once again be documented to see the total water consumption during the period.
- The waste generation will be measured in kg after disposal at each competition day

Where:

- The data will be stored electronically in the environmental accounting system for venues

YOG Lillehammer 2016	EMS- manual	Chap 4.4.10
Venue: Lillehammer Olympic Park		
Prepared:	Prepared by:	Responsible: Arena Manager Stortorget
Revised	Approved: Date:	Sign:

Lillehammer Olympic Park will be used for the opening and closing ceremony of the event. The environmental aspects of the arena are energy consumption, water consumption and waste generation. Tracking of energy and water consumption in addition to waste generation at the arena is required to control the environmental aspects at the site.

What:

- Tracking of energy consumption (diesel fuel, if aggregate)
 - o Measured in kWh
- Tracking of water consumption
 - o Measured in litre
- Tracking of waste generation
 - o Measured in kg

How:

- Tracking of energy consumption shall be done by documenting the electricity meter when the first guests arrive at the accommodation site. After the last guests have left, the electricity meter will once again be documented to see the total energy consumption during the period.
- Tracking of water consumption shall be done by documenting the flow meter when the first guests arrive at the accommodation site. After the last guests have left, the water flow meter will once again be documented to see the total water consumption during the period.
- The waste generation will be measured in kg after disposal at each competition day

Where:

- The data will be stored electronically in the environmental accounting system for venues

YOG Lillehammer 2016	EMS- manual	Chap 4.4.11
Venue: Håkon Hall		
Prepared:	Prepared by:	Responsible: YOY Major
Revised	Approved: Date:	Sign:

Håkon Hall will be used for the CEP and dining during the event. The environmental aspects of the arena are energy consumption, water consumption and waste generation. Tracking of energy and water consumption in addition to waste generation at the arena is required to control the environmental aspects at the site.

What:

- Tracking of energy consumption
 - o Measured in kWh
- Tracking of water consumption
 - o Measured in litre
- Tracking of waste generation
 - o Measured in kg

How:

- Tracking of energy consumption shall be done by documenting the electricity meter when the first guests arrive at the accommodation site. After the last guests have left, the electricity meter will once again be documented to see the total energy consumption during the period.
- Tracking of water consumption shall be done by documenting the electricity meter when the first guests arrive at the accommodation site. After the last guests have left, the water flow meter will once again be documented to see the total water consumption during the period.
- The waste generation will be measured in kg after disposal at each competition day

Where:

- The data will be stored electronically in the environmental accounting system for venues

YOG Lillehammer 2016	EMS- manual	Chap 4.5
Recycling and Waste Management		
Prepared:	Prepared by:	Responsible: Environmental Manager
Revised	Approved: Date:	Sign:

Recycling and waste management is a vital part of the total environmental impact of the YOG. It is therefore required to keep sound waste management during the event and facilitate it such that it is possible to recycle a high stake of the waste generated in addition to the temporary equipment used in the event. Tracking of different sorting options is required to control the environmental aspects at each site. The waste management shall be performed in cooperation with GLØR, HRR and the environmental manager of LYOGOC.

Each site shall therefor track the amount (kg) of:

- Plastic
- Paper
- Biodegradable
- Glass
- Metal
- Bottles
- Residual waste

How:

- Garbage cans with sorting will be placed around each venue, and the waste generation will be measured in kg after disposal at each competition day

Where:

- The data will be stored electronically in the environmental accounting system for recycling and waste management

YOG Lillehammer 2016	EMS- manual	Chap 5
Management Review		
Prepared:	Prepared by:	Responsible: CFO & PMO
Revised	Approved: Date:	Sign:

The top management of LYOGOC shall review the EMS to ensure continuing suitability and effectiveness. The review shall ensure that the necessary information is collected and they should address possible need for changes.

The management review shall be planned once a year until 2016. It consists of a meeting of all departments and the CEO. The meeting should review the following themes:

- General introduction
- Non conformances status
- Preventive and corrective actions status
- Objectives and targets status
- Training and communication activities
- Concerns or suggestions from relevant parties
- Update of significant environmental aspects
- Revising of environmental policy

Appendix 2: Environmental Accounting System

Area	Usage	Days in use	Environmental Aspect	KPI estimated	KPI Performed
				Carbon Footprint	Carbon Footprint
Procurement	Dressing the games	Run-up phase	Production of each item purchased		

It is complicated to deliver a complete environmental accounting design of procurements of the YOG Lillehammer because of the early stage of the process, and it is highly dependent on which products that are chosen. However, setting criteria's for carbon footprint of each product gives an opportunity to sum up the total impact of the procurements done.

Accommodation							
Site	Usage	Energy Consumption (kWh)		Water Consumption (l)		Waste Generation (kg)	
		Estimated	Performed	Estimated	Performed	Estimated	Performed
YOV 1							
YOV 2							
YOV 3							
YOV 4	Living						
YOV 5							
Birkebeineren hotel & apartments							
Hamar hotel							
Total							

Communication with the participants and users of the YOV through the CEP to promote environmental awareness can contribute to reduce values in the accommodation section.

Venues									
Site	Usage	Energy Consumption (kWh)		Water Consumption (l)		Waste Generation (kg)		Leakage of Ammoniac (l)	
		Estimated	Performed	Estimated	Performed	Estimated	Performed	Estimated	Performed
Hamar Olympic Hall "The Viking Ship"	Speed Skating								
Hamar Olympic Amphitheatre	Figure Skating								
Gjøvik Olympic Cavern Hall	Short Track								
Kristin Hall	Ice Hockey and Curling								
Lillehammer Olympic Bobsleigh and Luge Track, Hunderfossen	Bob and Skeleton								
Total									

Venues							
Site	Usage	Energy Consumption (kWh)		Water Consumption (l)		Waste Generation (kg)	
		Estimated	Performed	Estimated	Performed	Estimated	Performed
Lysgårdsbakkene ski jumping Arena	Speed Skating						
Kanthaugen Freestyle Arena	Half pipe						
Birkebeineren Ski Stadium	Cross-country, biathlon and combined						
Lillehammer Olympic Alpine Centre, Hafjell	Alpine skiing, freestyle						
Håkon Hall	C & E programme, breakfast and dining for athletes						
Lillehammer Olympic Park	Opening/closing and medal ceremony						
Main Media Centre	Press activities						
Total							

Transportation (Goods)						
From	To	Distance	Type of vehicle	Runs	Total distance	C0₂
Total						

The list shall be filled out after procurement of goods is transported in relation to the event.

Transportation (athletes and officials)						
From	To	Distance	Type of vehicle	Runs	Total distance	C0₂
Stampesletta	Lysgårdsbakkene and Kanthaugen	1 km	Bus			
Stampesletta	Birkebeineren ski stadium	4,5 km	Bus			
Stampesletta	Håkon Hall/Kristin Hall	0,5 km	Bus			
Stampesletta	Hafjell Olympic Alpine Centre	15 km	Bus			
Stampesletta	Lillehammer Olympic Bobsleigh- and Luge Track Hunderfossen	15 km	Bus			
Stampesletta	Lillehammer Olympic Park	1,5 km	Bus			
Stampesletta	Main Media Centre	0,5 km	Bus			
Total						

From	To	Distance	Type of vehicle	Runs	Total distance	C0₂
Hamar hotel	Hamar Olympic hall "The Viking Ship"	3,5 km	Bus			
Hamar hotel	Hamar Olympic Amphitheatre	3,5 km	Bus			
Hamar hotel	Håkon Hall	63 km	Bus			
Hamar hotel	Gjøvik Cavern Hall	50 km	Bus			
Hamar hotel	Main Media Centre	63 km	Bus			
Hamar hotel	Lillehammer Olympic Park	62 km	Bus			
Total						

From	To	Distance	Type of vehicle	Runs	Total distance	C0₂
Lillehammer	Gardermoen	143 km	Train			
Hamar hotel	Gardermoen	85 km	Train			

Transportation (Vehicle Activities at Site)						
Where	What	Distance	Type of vehicle	Runs	Total distance	C0₂
Lysgårdsbakkene and Kanthaugen	Preparation of ski jump and half pipe					
Birkebeineren ski stadium	Preparation of slopes					
Kristin Hall	Ice surface					
Hafjell Olympic Alpine Centre	Preparation of slopes					
Lillehammer Olympic Bobsleigh- and Luge Track Hunderfossen	Ice surface					
Hamar Olympic hall "The Viking Ship"	Ice surface					
Gjøvik Cavern Hall	Ice surface					
Hamar Olympic Amphitheatre	Ice surface					
Total						

Area	Site	Period	Possible sorting	KPI estimated	KPI Performed
				kg	kg
Waste Management and Re-cycling	Glør/HRR	Closure phase	Plastic		
			Paper		
			Biodegradable (food)		
			Glass		
			Metal		
			Bottles		
			Residual waste		
			Total		
			Recycling rate		

Appendix 3: Interview With David Stubbs, Head of Sustainability London 2012

I met David at a restaurant called “Inn the park” in St. James’ Park on Tuesday the 12th of February at 10:30. The meeting stretched out to 11:50.

I decided to have a semi-structured interview in order to discuss key topics connected to my dissertation and create a natural conversation that hopefully would bring up issues I had not expected or considered vital for my thesis. The fact that London 2012 was a summer Olympic and a huge event compared to YOG emphasises the main differences between the events. However, London 2012 is seen as the first sustainable games ever, and there are obviously some general advises that can be converted to a YOG-event in Lillehammer.

Firstly, I introduced my research questions and the extent of YOG Lillehammer 2016 before we started discussing the differences between the two events. We quickly switched over to the sustainability concept of London 2012. The concept contains more than just the environment and takes CSR issues under its wings as well. The importance of planning, creating a culture and a mind set throughout the organisation is important factors to reach your environmental goals, according to David Stubbs.

Secondly, we discussed boundaries of environmental accounting on both Lillehammer and London. The New venues at YOG Lillehammer 2016 event should be kept aside of the accounting since they would have been built even though the games had not been given to Lillehammer and are additionally performed by the Municipality of Lillehammer. David then brought up the issue of temporary equipment such as extra seating, toilets and tickets, which I had not give much too much thought at the moment. This issues needs to be taken inn to account as well.

London 2012 published their latest reports on sustainability on the 3rd of January 2013. David mentioned the “London 2012 Sustainability Guidelines for Corporate and Public Events – third edition” as a suitable tool for further work on my dissertation. The report on “lessons learned under the games” and a guideline for what to do before, during and after the games.

London 2012 did not get certified with ISO 14001 or EMAS, however they took part in developing the ISO 20121 standard for sustainable event management. The size and differences of the two events makes it hard to compare because certification is quite expensive, but of course, it is possible to act in compliance with a standard without getting a certificate. David Stubbs was of the opinion that I should have more focus on ISO 20121 than ISO 14001 because of the lack of specific details in ISO 14001. ISO 20121 are more suitable for sustainable event management and easier to relate to in these contexts.

I asked David what he considered to be the most significant environmental aspects during the event. He said that during the run-up stage the most significant aspect lies planning the location of venues and procurement of materials. The operational phase

however, which is more relevant for the YOG is the communication of environmental awareness and recycling at the stadiums. Tracking of Energy- and water consumption, in addition to waste generation are also important environmental aspects.

The last subject of the interview was the environmental accounting of the games and the importance of transparency and credibility. The Olympic games are in a bigger perspective a short-term event, and the time to develop during the games is minimal. London 2012 had estimated their KPI's for the construction phase and consumptions under the games before the event, and set references values to compete with. After the event the actual performance was presented in accordance to Global Reporting Initiative (GRI). David afterwards mentioned carbon footprint embodied impact as an effective key performance indicator.

David Stubbs suggested that I should get access to the Olympic Games Knowledge Management to gather more information, a database where IOC gather reports and information from previous organisers. Hopefully Tomas Holmestad or Magne Vikøren can help me with this.

Petter Nordby
12th of February

Appendix 4: Stadium Tour and Interviews with Operational Managers

The stadium tour was performed on Thursday the 21th and Friday the 22nd of March. The scope of the stadium tour was to establish a deeper understanding of each venue and the field of use under the youth Olympic games. At each venue the researchers met with one, or several, personnel from the venue visited. The respondent gave an introduction of the site and specific data, before the researchers started a semi-structured interview. The main content of each interview is given below.

Frame of the Semi-Structured Interview at the Stadium Tour

Nr.	Question
1	What is the most significant environmental aspect at the venue?
2	How are these aspects measured and controlled?
3	What is done to reduce the given values measured?
4	Is there any documentation on environmental performance at the site?
5	Does the site have an environmental certification?
6	Does the site have a plan to improve the environmental performance within the next three years?
7	What can be done to improve the environmental performance?
8	Are there any weaknesses at the arena?

Program

21.03.2013 Thursday:

10.30-12.00 Hamar Olympic Hall, "The Viking Ship"
14.00-15.30 Gjøvik Olympic Cavern Hall

22.03.2013 Friday:

09.00-10.45 Håkon Hall
11.00-11.35 Lyngårdbakkene Ski Jumping Arena
11.45-12.45 Birkebeineren Ski Stadium
13.30-14.30 Lillehammer Olympic Bobsleigh and Luge Track, Hunderfossen

Hamar Olympic Hall, "The Viking Ship"

Interviewing object: Viggo Sundmoen, managing director at Hamar Olympiske Anlegg (HOA)

What is the most significant environmental aspect at the venue?

- Energy consumption due to heating of air and cooling of the ice
- Water consumption due to ice production, showering etc.
- Waste generation due to spectators
- Ammoniac and brine due to the cooling of ice
- The stadium is also placed next to a bird's reservation area

How are these aspects measured and controlled?

The amount of energy, water, ammoniac and "salt lake" is measured and noted electronically.

Waste generation is handled by HRR

What is done to reduce the given values measured?

2002: 5,3 mill. Ice machine, refrigeration system and central heating

2003: 0,8 mill. Control unit refrigeration system

2006: 14,7 mill. New refrigeration- and heating system at Olympic Amphitheatre

2011: 5,5 mill. Energy savings Olympic Amphitheatre

Is there any documentation on environmental performance at the site?

Environmental performance is published in the annual report to the Municipality of Hamar, based on the accounting measures of consumption

Does the site have an environmental certification?

No certification at the given time, and it is not planned achieve one within the next three years either.

Does the site have a plan to improve the environmental performance within the next three years?

Between 2010 and 2020 it is planned to invest in upgrading at the arenas:

Hamar Ol Amfi, Nordlyshallen og Storhamar Ishall: 24 mill.

Hamar Olympiahall, Vikingskipet: 66 mill.

What can be done to improve the environmental performance?

The site has undergone a lot of improvement over the past years. The policy is to always have a continuous improvement.

Are there any weaknesses at the arena?

No certification

Gjøvik Olympic Cavern Hall

Interviewing object: Anders Motrøen, Driftsleder at Gjøvik Olympic Cavern Hall

What is the most significant environmental aspect at the venue?

- Energy consumption due to heating of air and cooling of the ice
- Water consumption due to ice production, showering etc.
- Waste generation due to spectators
- Ammoniac and “salt lake” due to the cooling of ice

How are these aspects measured and controlled?

The amount of energy is tracked to Eidsiva’s network portal

Water, ammoniac and salt brine is measured and noted manually

Waste generation is handled by GLØR (Gjøvik Lillehammer and Øyer Renovation)

What is done to reduce the given values measured?

It is installed frequency regulation on the ventilation system.

Is there any documentation on environmental performance at the site?

Internal control

Does the site have an environmental certification?

No certification at the given time, it is however a wish to get an environmental certification in the near future.

Does the site have a plan to improve the environmental performance within the next three years?

Evaluating the possibilities to achieve an environmental certification, need managed light steering and improved surveillance of the energy consumption at the site.

What can be done to improve the environmental performance?

Light regulations and improved surveillance of energy consumption

Are there any weaknesses at the arena?

No certification and old light installations

Håkon Hall

Interviewing object: Frode Linderud and Roar Olsen

What is the most significant environmental aspect at the venue?

- Energy consumption due to heating of air
- Waste generation due to dining and stand activities
- Procurement of food

How are these aspects measured and controlled?

Energy consumption is tracked.

Waste consumption needs to be arranged with GLØR and the LYOGOC in the event period.

Procurement of food is not settled yet, an alternative could be the catering firm stationed in the arena?

What is done to reduce the given values measured?

Tracing of energy consumption is acquired to manually judge which of the eight levels of the ventilation system that should be used at the given time.

Is there any documentation on environmental performance at the site?

The environmental performance is communicated through reports to the board at Olympiaparken.

Does the site have an environmental certification?

Eco-lighthouse certified in 2012 and “Grønt punkt”

Does the site have a plan to improve the environmental performance within the next three years?

Oil heating will be replaced with district heating.

What can be done to improve the environmental performance?

“Earth heating”, light technology, frequency convertor on the ventilation system

Are there any weaknesses at the arena?

Not mentioned

Lysgårdbakkene Ski Jumping Arena and Kanthaugen Freestyle Arena

Interviewing object: Olaf Pedersen

What is the most significant environmental aspect at the venue?

- Water consumption due to building the half pipe.
- Energy consumption due to lighting of the outdoor arena. The competitions will however, most likely, be performed in daylight.
- Waste generation from spectators.

How are these aspects measured and controlled?

Energy consumption is tracked.

No tracing of water consumption in connection to building the half pipe

Waste consumption needs to be arranged with GLØR and the LYOGOC in the event period.

What is done to reduce the given values measured?

Planned LED-lighting, four levels on lighting, waste sorting.

Is there any documentation on environmental performance at the site?

The environmental performance is communicated through reports to the board at Olympiaparken, and eventually through the Eco-lighthouse requirements.

Does the site have an environmental certification?

Eco-lighthouse is planned in 2013

Does the site have a plan to improve the environmental performance within the next three years?

LED-lighting. The profile on the small ski jump will be changed.

What can be done to improve the environmental performance?

Insulation in the school building

Are there any weaknesses at the arena?

Not mentioned

Birkebeineren Ski Stadium

Interviewing object: Lars Nes

What is the most significant environmental aspect at the venue?

- Making tracks in the slopes.
- Water consumption due to snow production (not likely)
- Energy consumption due to lighting of the outdoor arena. The competitions will however, most likely, be performed in daylight.
- Waste generation from spectators.

How are these aspects measured and controlled?

The environmental performance is communicated through annual reports to the board at Olympiaparken AS.

What is done to reduce the given values measured?

Litra gathers sheaths and lead. The new track machines meet the requirements.

Is there any documentation on environmental performance at the site?

The environmental performance is communicated through reports to the board at Olympiaparken, and eventually through the Eco-lighthouse requirements.

Does the site have an environmental certification?

Eco-lighthouse is planned in 2013

Does the site have a plan to improve the environmental performance within the next three years?

New bullet catchers at the shooting range

What can be done to improve the environmental performance?

LED-lighting at the central area of the arena

Are there any weaknesses at the arena?

Not mentioned

Lillehammer Olympic Bobsleigh and Luge Track, Hunderfossen

Interviewing object: Jan Oddvar Tangen,

What is the most significant environmental aspect at the venue?

- Energy consumption due to cooling of ice on the track
- Water consumption due to ice production
- Ammoniac due to the cooling of ice

How are these aspects measured and controlled?

The amount of energy, water, ammoniac and “salt lake” is measured and noted electronically.

What is done to reduce the given values measured?

Recently improved management system of the cooling machine

Is there any documentation on environmental performance at the site?

According to Jan Oddvar Tangen the Bobsleigh and Luge Track does not report or store any documentation on environmental performance.

Does the site have an environmental certification?

Eco-lighthouse is planned in 2013

Does the site have a plan to improve the environmental performance within the next three years?

LED lighting on the track is planned in the summer of 2013

What can be done to improve the environmental performance?

The site has undergone a lot of improvements over the past years. The policy is to always have a continuous improvement process.

Are there any weaknesses at the arena?

Not mentioned

Sites not Visited, but Included in the Event Period

Hamar Olympic Amphitheatre

Usage: figure skating

Days in use: 2

Certified: No certification

Similar to: Hamar Olympic Hall, "The Viking Ship"

Kristin Hall

Usage: hockey and Curling

Days in use: 4

Certified: Planned in 2013

Similar to: Hamar Olympic Hall, "The Viking Ship"

Lillehammer Olympic Alpine Centre, Hafjell

Usage: Alpine skiing, freestyle (ski-cross and snowboard slope style)

Days in use: 7

Certified: Planned in 2013

Similar to: Birkebeineren ski stadium

Lillehammer Olympic Park

Usage: Opening/closing ceremony. Including medal ceremony

Days in use: 10

Certified: Not certified

Similar to: place is not given at the moment