# SUSTAINABILITY OF OLYMPIC BUILDINGS – GUIDELINES FOR SUSTAINABLE ARCHITECTURE OF MEGA-SPORTING EVENTS

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## Summary

The guidelines for "Sustainable Architecture of Mega-sporting Events" are the outcomes of a dissertation, which were done at the University of Technology, Darmstadt (Germany) in cooperation with the German Sports Federation (DOSB), sponsored by the scholarship programme of the German Federal Environmental Foundation (DBU). The study has analysed Olympic Architecture and its ecological, economical, social and architectural sustainability. The intention was to create an international study about sustainable Olympic Buildings and to develop indicators (checklist for sustainable design) for the planning (masterplan) of Olympic Architecture to guarantee a permanent, constant and sustainable development for further Olympic Games.

**Keywords:** Sustainable Building, Sport Facilities, Olympic Games, Olympic Buildings, Indicators

## 1 Introduction

"Faster – higher – stronger" is not only the slogan for most of the Olympic Games, but is also the idea for the planning of Olympic architecture in the last years. Olympic buildings are not only sport facilities, they stand for national and regional representation and shall show the competence of technology, engineering and architecture of the Olympic Cities. In the last years more and more of the Olympic planning is based on sustainable and ecological ideas, but most times rivalry and competition between the host cities decided the design.

"The `Green Games´ concept is increasingly a reality," said Jacques Rogge, President of the International Olympic Committee (IOC), at the award ceremony of the United Nations Environmental Programme (UNEP) [1]. "Champion of the Earth 2007" is the title of the international environment award, the IOC and its President Jacques Rogge was honoured with for their work in the field "Olympic Games and sustainable

development". Rogge added that since the early 90s the IOC and the Olympic Movement had progressively taken the environment and sustainability into account throughout the lifecycle of an Olympic Games project. Today environmental protection and sustainability were prime elements of Games planning and operations [2].

The main reasons of getting the award were the important environmental outcomes of the Olympic Games of the last years, which had been achieved through efficient ecological and sustainable planning. Olympic Games, like the Green Games 2000 of Sydney and the Winter Games of Torino 2006, had provided sustainable legacies, such as rehabilitated and revitalised sites, had increased environmental awareness, and had improved environmental policies and practices [3].

Future Olympic Venues, like Beijing 2008 (Summer Games), Vancouver (Winter Games) and London 2012 (Summer Games) appear to compete for the "Greenest Games". The Olympic City London campaigns with the slogan "The Greenest Games in modern times" [4]. Low Carbon, low waste, green transportation and re-use of materials during the construction of the Olympic Buildings are the basis of the Sustainable-Development-Strategy, which was published by the Olympic Delivery Authority 2012 days to go until the start of the London 2012 Olympic Games.

## 2 Intention

But sustainability of Olympic Buildings is not only depending on ecological, economic and cultural planning of the mega-event. Also the architectural realization is responsible for the "sustainable development" and the "sustainable design"of buildings. Sustainability could also be achieved trough the architectural design and an efficient re-use of the buildings after the Games.

Intention of the project was the development of an international guide for Olympic Buidlings. These guidelines shall be available for planers/architects in form of a checklist (based on indicators) to assure an international standard for sustainable sport architecture of Olympic Games already in the pre-design phase (master planning).

The main focus of the project are Olympic Summer Games starting with the Games of Barcelona 1992. Positive and negative outcomes of former Olympic Games, like Munich 1972 (architectural design), Montreal 1976 (financial fiasco) or Atlanta 1984 (temporary buildings) has been included in the results of the study.

Planning and re-using concepts of Sport Facilities of former and further Olympic Summer Games has been analysed of on their ecological and architectural sustainability, like the Sydney Games of 2000.

Sustainable guidelines and indicators for buildings [5], architectural guidelines of former and further Olympic Games [6], the IOC Agenda 21 and discussion with architects (sport facilities) has been proofed on their application on Olympic Buildings and has been modified in international guidelines for sustainable sport facilities.

## 3 Terms

The main object of the research projects are **Olympic Buildings** in their context to Mega-Events and their **Sustainable Design**. For more specific classification the terms "Olympic Buildings" and "Sustainable Design" will be defined.

### 3.1 Olympic Buildings

There is no specific definition for Olympic Buildings of the modern era. The Olympic Charter [7] only defines that all sports competition and the Opening and Closing Ceremonies, i.e. all sport and event facilities and accommodations, had to take place in the host city of the Olympic Games and that the location, sites and venues for any sports or other events of any kind had to be all approved by the IOC Executive Board.

In the Candidature Acceptance Procedure and Questionnaires of the IOC for further Olympic Games Olympic Buildings are only differed in competition and training venues and accommodations [8]. The following description will show how the topic "Olympic Building" is defined by the research project.

**Olympic Buildings** are facilities:
- which are built or renovated for an Olympic Mega-Sporting Event as competition or training venues in the host city for short (temporary) or long term
- which had been approved by the IOC Executive Board
- and which will get another or a similar Re-Using Concept after the Mega-Event.

### 3.2 Sustainable Architecture

The fundamental idea of sustainable development encompasses the three balanced areas: economic, environmental and social. The idea of this scheme is also the bases of Sustainable Olympic Buildings.

The definition of sustainable development of architecture will be documented by the explanation of the **Japanese Institute of Architects** (JIA) [9] of 1997, which is based on the **Declaration of Interdependence for a Sustainable Future** [10], (**World Congress of Architects of the International Union for Architects** (UIA) and of the **American Institute of Architects** (AIA) in 1993. This definition for sustainable architecture was also shown on the last **2005 World Sustainable Building Conference** (SB05) in Tokyo [11]:

A sustainable building is one which is designed:
- to save energy and resources, recycle materials and minimize the emission of toxic substances throughout its life cycle
- to harmonize with the local climate, traditions, culture and the surrounding environment, and
- to be able to sustain and improve the quality life while maintaining the capacity of the ecosystem at the local and global levels

## 4 Development of Olympic Buildings

### 4.1 Increase of the number of Olympic Sport Facilities

The idea of Pierre de Coubertin [12], that Olympic Games (international sport event) would foster international communication and peace, transformed in the Mega-Event Olympic Games. Every four years more and more competitions, athletes, National Olympic Committees and media participate at the Games. During the first Games in Athens (1896) fourteen nations with 245 athletes took part in 43 sport competitions. At the

2004 Games of Athens the number of athletes increased on more than 11 000 persons (301 competitions and 202 nations) [13].

This development to a Mega-Event implicates an increasing number of required sport facilities and accommodations for the Host Cities and accordingly bigger influences on the urban development/ planning.

If you look on the development of the Olympic Games in the last 100 years, you will see how different the Host Cities are in reference to their cultural and historical urban development and to their population figure.

The dimensions of the Winter Host Cities differ in three types:

- Winter Sport Resorts (St. Moritz 1928/1948, Lake Placid 1980)
- Main Towns (Salt Lake City 2002, Turin 2006)
- and small towns or regional significance (Lillehammer 1994, Albertville 1992).

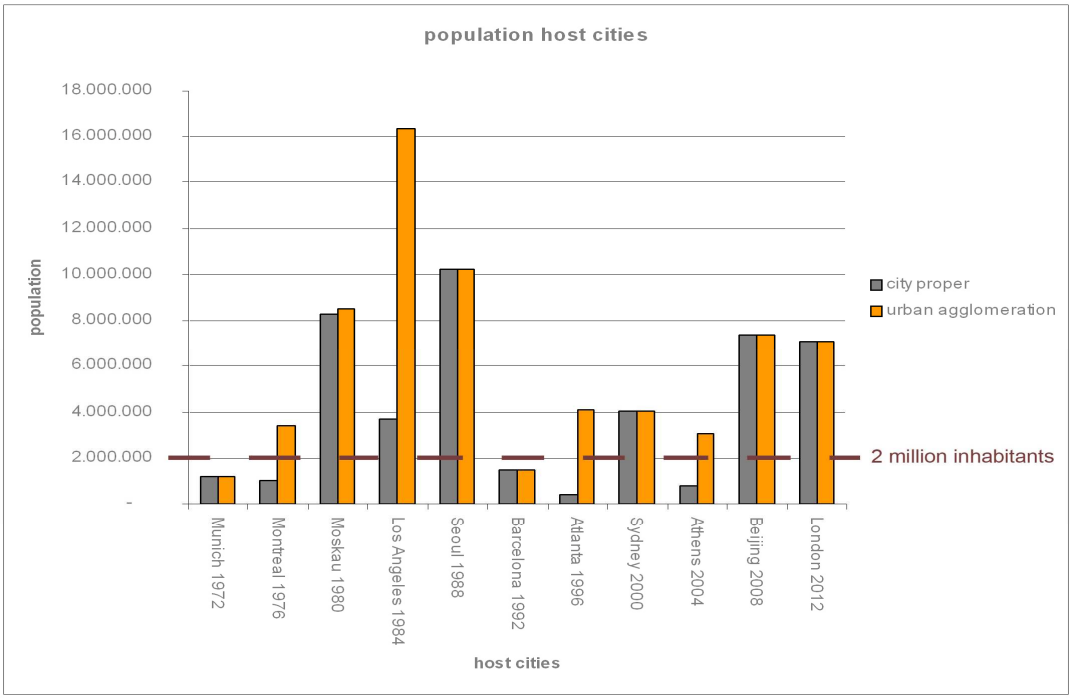


**Fig. 1** Population of Host Cities (Olympic Summer Games) [14]

As opposed to the Winter Games the differences in the urban conditions for Summer Games are equal. In the last 40 years only cities with a population of more than 2.5 millions (except for Munich 1972 and Barcelona 1992) had hosted the Olympic Summer Games. The following figure (**Fig. 1**) will demonstrate this thesis.

## 4.2 Changing requirements for Olympic Sport Facilities

The effect of the increase of necessary sport facilities is also caused by changing requirements for Olympic Sport Facilities. After the first Olympic Games in 1896 (Athens) the following Olympics had been part of World Exhibitions and Fairs. With the new architecture of a sport park for the Stockholm Games in 1912 a new type, the “Olympic Building”, was developed.

The first Games were outdoor competitions, but now more and more competitions are held indoor. The Olympic facilities matured in special sport facilities, which had to been built under the rules of the International Federations of Sports. Also this development of better quality- and functional requirements impacts the increase and the design of Olympic sport facilities.

## 4.3 Influences on the Host Cities

### 4.3.1 Climate and Culture

The Olympic Summer Games take part every four year in different climate and cultural zone, which will be seen in **Fig. 2**. While Greece had wanted to host the new Olympic Games in its ancient area, Pierre de Coubertin promoted the staging of the Games in different countries and cultures: “Olympism would benefit more from the Games taking place around the world“[15].

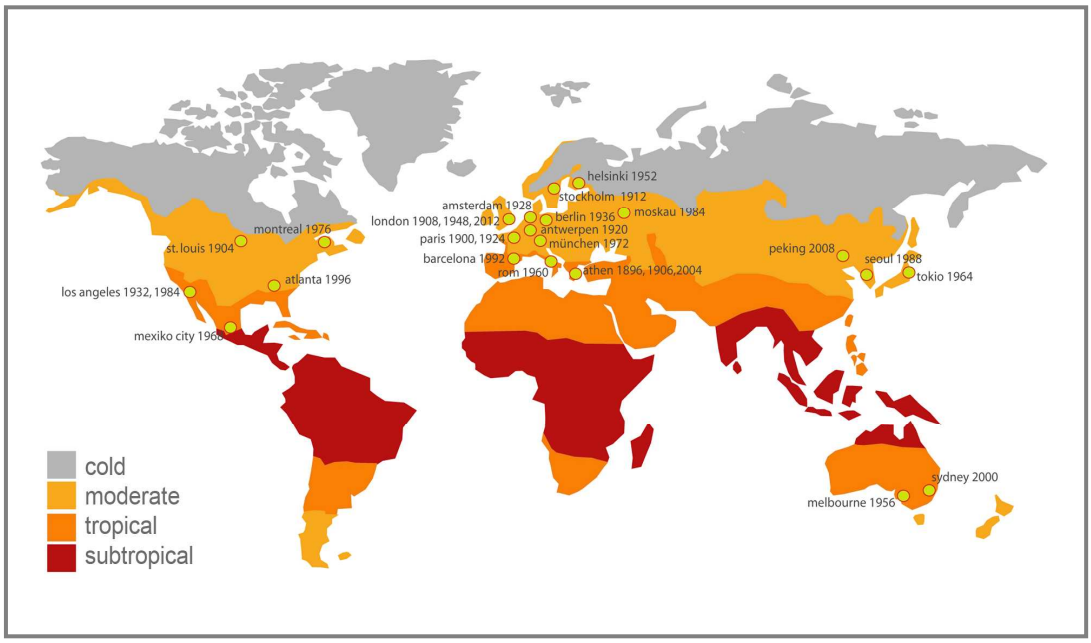


**Fig. 2** Olympic Cities (Summer Games) and Climate Zones

This is the reason, why the planning and the design of the Olympic Buildings are influenced by different factors, like climate, culture and traditions. The energy efficiency design of Olympic sport facilities is defined through the climate conditions of the host city, which means the architecture must be harmonized with the special climate zone of the Host City (subtropical climate zones, like Sydney 2000: cooling – moderate climate zones, like Munich 1972: heating).

Olympic Games always have high ecological, economical and social influences on the host cities. These different impacts will show the following figure on the basis of the Sydney 2000 Games. The impact-matrix is structured in visible and invisible “short- and long-ter” influences. It will be seen that “housing” and “sport facilities” have the biggest visible long-term impacts on the Olympic Cities. This means that Olympic Buildings could influence the urban development of Host Cities positive as well as negative.

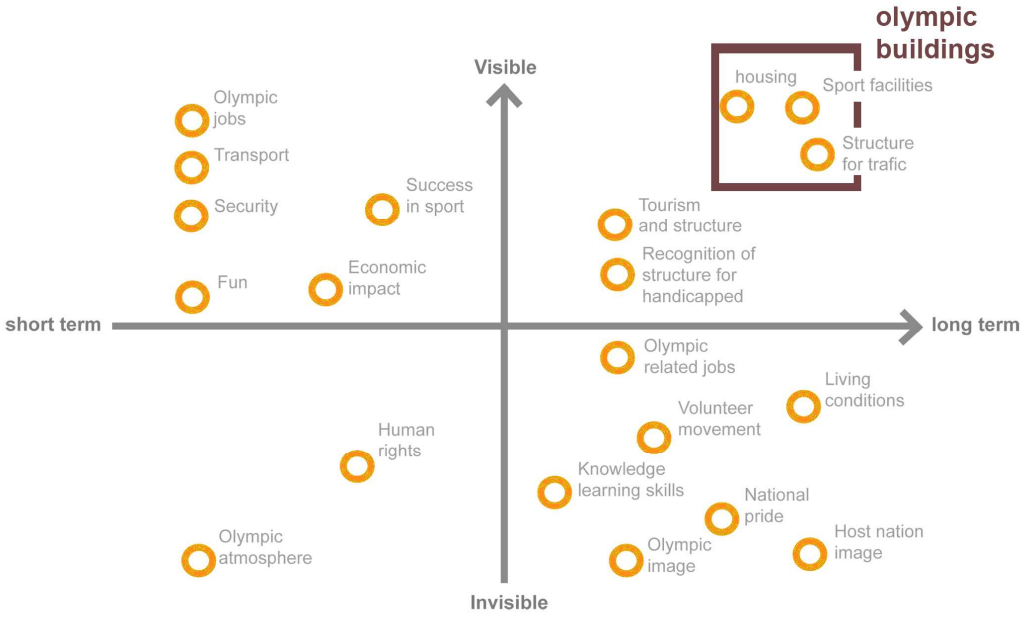


**Fig. 3** Short and Long Term Impacts of Olympic Games on Host Cities (Example: Sydney 2000 Games) [16]

Generally Olympic Planning speed up the urban development of the Olympic venues ten until fifteen years, this means the conception of the Olympic facilities could have an enourmous impulse on the urban development of the Host City.

Examples, like the Barcelona Games 1992 (revitalisation of brown field – "opening to the sea") [17] and the Games of Munich in 1972 (developing of a sport park – the town's landmark) [18] will clarify this thesis. Also the `Green Games´ of Sydney 2000 will demonstrate the sustainable legacy of ecological planning strategies.

## 5 Results

To develop Sustainable Olympic Buildings it is necessary to start at the basis of the planning – in the Pre-design phase, because this phase is the most important and deciding phase of the whole Design Process. Changes in the planning (site, dimensions, walls) could be done without having an enormous influence or impact on the sustainability of the building [19].

Because of this reason the guidelines for sustainable Olympic Buildings are developed for the Master planning of Olympic Venues to achieve sustainable sport facilities already at the beginning of the planning (e.g. Olympic Bid). These guidelines are available for all planers and architects of in form of a checklist, which is based on the following indicators:

**Sustainable Olympic Buildings**
**=**
(indicators for buildings + indicators for mega-events) * interviews with planers

**Indicators for buildings** (e.g. LEED) [20]:
1. Site Planning
2. Efficient Water Consumption
3. Energy & atmosphere
4. Materials and resource protection
5. Indoor air quality
6. Innovativeness & design/ construction process

**Indicators for Mega-Events** (e.g. Greenpeace Olympic Environmental Guidelines) [21]
1. Energy Consumption
2. Transport
3. Refrigeration and Air-conditioning
4. Ozone Depletion
5. Timber Use
6. Habitat Protection
7. Air, Water and Soil Pollution
8. Water Conservation
9. Indoor Air Quality
10. Consumption of natural Resources
11. Waste avoidance and minimisation
12. Genetically modified organisms (gmos)
13. Quality of life
14. Cultural and historical context
15. Transparency and monitoring of the guidelines

Therefore indicators of international rating and assessment methods for sustainable buildings, like BREEAM (United Kingdom) [22], LEED (USA) [23] or GBTool [24], has been checked for their adaptability on Olympic Sport Facilities as well as indicators of sustainable Mega-Events, like the Greenpeace Olympic Environmental Guidelines. Interviews with architects and planers of sport facilities and studies of former environment-friendly Olympic Buildings are completing the project and are forming an effective basis for forward-looking sustainable facilities of further Olympic Mega-Events.

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