

# Sustainable Design and Feng Shui: A Case Study of an Office Building in Sydney

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## Abstract

Interactions between humans and environments are a part of an everyday process. In the western contemporary architecture, these interactions with the natural and man-made environment called Sustainable or Green Design. In the East, the ancient Chinese knowledge of Feng Shui aims at creating a harmony between environment, buildings and people. It has influenced most traditional building design in China for thousands of years. With a desire to improve the relationship between human and the environment, there is an increasing interest for architects and other building professionals to apply the concepts of Feng Shui into building design and the built environment. It is suggested that interpreting Feng Shui knowledge would embrace the western concept of sustainable design. This paper analyzes and compares the concepts of sustainable design with Feng Shui. A case study of a well recognized sustainable designed office building, Workplace6 in Sydney is used to illustrate the similarities and differences between concepts of sustainable design and Feng Shui in terms of environmental design. The findings indicated that both sustainable design and Feng Shui concepts are aimed at the creation of the enjoyable space and balance between natural and the built environment. However, sustainable design focused on the measurement and performance of physical attributes, whereas Feng Shui concepts emphasized on the balance and harmony of physical forms and spatial arrangement which are difficult to be measured and quantified.

**Keywords:** sustainable design, Feng Shui, green star, Workplace6

# 1. Introduction

Sustainable design is the philosophy of design the built environment to comply with the principles of economic, social and ecological sustainability (McLennan, 2004). Sustainable design emphasizes on a holistic approach to eliminate negative environmental impact through skillful and sensitive design. The goal of sustainable design is to look at all the systems together and to make sure they work in harmony. This integrative design process is similar to the Chinese holistic view and the Feng Shui approach to the built environment (Humphreys, 1976).

Feng Shui is a body of ancient Chinese wisdom in knowledge and experience related to the built environment that has been accumulated for more than three thousand years. The principles and practices of Feng Shui aimed at creating a harmonised built environment for people to live in, and it represents a traditional Chinese architectural theory for selecting favourable sites as well as a theory for designing cities and buildings (Lee, 1986). There are two main schools of thought and practice in Feng Shui: the Compass School and the Form School. The Form School approach has been well recognized and widely accepted by Feng Shui researchers as comprising the scientific bases in the analysis of built environment (He, 1990; Cheng and Kong, 1993). The Form school established a holistic approach that allows integrated components and elements to be considered for the built environment (Mak and Ng, 2008).

Since the late 1960's the impact of western civilisation and technology has grown to global proportions, more western scholars became aware of the limitations of the modern scientific paradigms that failed to explain the whole realm of natural phenomena and began to recognize that there are similarities between modern science and eastern philosophy (Capra, 1975). Joseph Needham (1959), in his book series "Science and Civilisation in China" began to appreciate the value of Feng Shui in ecology and landscape aesthetics. According to Needham (1959, p.361) Feng Shui "embodied ... a marked aesthetic component, which accounts for the great beauty of the siting of so many farms, houses and villages throughout China".

Kevin Lynch, a pioneer of environmental behaviour research, in his book, "The Image of the City", concluded that Feng Shui is an open-ended analysis of the environment where new meanings, new poetry, and further developments are always possible (Lynch, 1960). Anderson and Anderson (1973) recognized that Feng Shui is an aspect of Chinese cultural ecology, and called Feng Shui "the traditional Chinese science of site planning", containing "an organized body of knowledge, intensely practiced in application, and of specific intent" (Anderson, 1973, pp.127-128).

Furthermore, Freedman (1979) accepted that Feng Shui is based on self-evident propositions and the expertise of scientific men and called it "mystical ecology". Nemeth (1993) recognized that "cosmographic interpretations of geomancy maps can both teach Western peoples and remind East Asians that in the organization of human activities in physical space, principles that engender productive economic, ecological, and ethical relationships may be governed by a natural law" (Nemeth, 1993, p.94). Bruun (1995) suggested that Feng Shui is a system of statements on the man-

nature relationship in an environment of holistic thought, and man and landscape are linked together in a system of “immanent order”.

Nowadays, as many researchers seek to establish a deeper understanding of these relationships between the human and natural environments, architects and building professionals begin to recognize Feng Shui as a broad ecologically and architecturally connected paradigm. Hwangbo (1999) believed that the practice of Feng Shui is an intuitive matter involving site selection and spatial organization, and it has strong parallels with the western concept of geometry in architectural design.

This paper explores the relationships between the concepts of sustainable design and Feng Shui in environmental design using a case study of an office building in Sydney. Firstly, a set of five concepts of sustainable design and five Feng Shui concepts in terms of environmental design are identified and compared. Hence, a well recognized sustainable designed office building, Workplace6 in Sydney is used as a case study to illustrate the similarities and differences between the concepts of sustainable design and Feng Shui environmental design.

## 2. Comparison of sustainable design and Feng Shui

The sustainable design includes many areas such as waste and recycling, energy, water, building design, emission, indoor environmental quality (IEQ), alternative transport, landscaping, and about everything that do affects everything around human, aims to eliminate negative environmental impact and maintain ecologically sustainable completely through skillful and sensitive design (McLennan, 2004). Many of these ecological sustainable design concepts are quite similar to the traditional views that were derived from the eastern philosophy and Feng Shui principles and practice. Dong and Zuehl (2009) recognized that there is a set of five fundamental concepts for sustainable development. They are constructivism, circular design, energy efficiency, balance between natural and the built environment, and thinking global and buying local. These five fundamental concepts are then compared with the five Feng Shui concepts in terms of environmental design.

### 2.1 Sustainable design concepts

**(1) Constructivism:** Sustainable design is based on studies from constructivism (an approach to cognitive psychology and social psychology) to create spaces that built knowledge and skills for the end user. This concept is based on human interactions with their environment to enhance the environment to make the space more enjoyable for the people using it (Dong and Zuehl, 2009).

**(2) Circular design:** This circular design concept is based upon the idea of “cradle to cradle” (McDonough and Braungart, 2002). It is a new design paradigm of “reduce, reuse, recycle” through the intelligence of natural systems (i.e. the effectiveness of nutrient cycling, the abundance of the sun’s energy, etc.). McDonough and Braungart explained how to put eco-effectiveness into practice to create products, systems, and buildings that allow nature and commerce to fruitfully co-exist.

**(3) Energy efficiency:** Energy efficiency can be achieved by site planning and building design in accordance to sunlight and the use of various building materials and technology. Buildings and environments that are adapting energy efficient ideas are increasing environmental satisfaction from its end users as well as decreasing the consumption of natural resources.

**(4) Balance between natural and the built environment:** Studies done by U.S. Green Building Council and other green design advocates have shown that by bringing natural elements (such as sunlight, plants, water features, etc.) into a person's environment will change the behavior of the user in the environment to a more harmonious and enjoyable space (Widener, 2009).

**(5) Thinking Global and Buying Local:** Dong and Zuehl (2009) recognized that all the concepts of green design can be bottled up into this concept. It comes from the ideas of thinking about the global economy, environment and well being which in result should allow the design world to buy from local markets to reduce energy costs, wasted materials and increase the environments overall well being.

## 2.2 Feng Shui concepts

The concept of sustainable design in the western world only dates back three decades ago to deals with the harmonious relationship between human and nature. However, Feng Shui, the ancient Chinese knowledge that aims at creating a harmony between heaven, earth and human has influenced most traditional built environmental design in China for thousands of years. Five fundamental Feng Shui concepts in terms of environmental design are summarized below.

**(1) Unity between Heaven and Human:** This is the fundamental principle of Feng Shui, means the harmony between the universe, earth and human energy. Energy is valued in both the physical and the invisible forms known as “*Qi*” (natural energy or breath of life) in the traditional Chinese Feng Shui culture. Feng Shui designs are aimed at a balance and harmonious environments that can produce an ample amount of good *Qi* and filter out the bad *Qi* (Skinner, 1982).

**(2) The Five Elements Cycles:** Ancient Chinese believed that in the universe, including heaven, earth and human beings, every thing has an attribute according the five elemental groups of substances. These five elements are fire, water, metal, wood and earth. The characteristics of each of these five elements and their mutual relationships are based on observed natural phenomena, and their relationships are identified as productive and destructive cycles as shown in Figure 1.

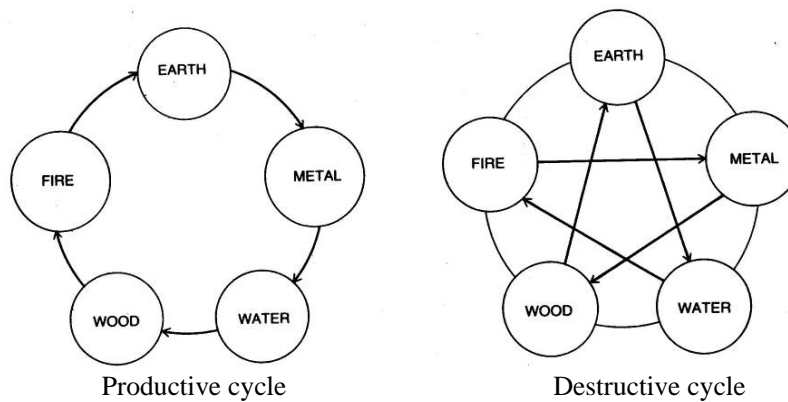


Figure 1: Productive and Destructive Cycles of the Five Elements (Walters, 1989)

**(3) Yin and Yang Harmony:** Ancient Chinese believed that in everything there are two opposing parts: Yin and Yang. Yin represents the passive principles in nature exhibited as darkness, cold and wetness. On a human level, Yin symbolizes femininity and passive, and also represents the realm of the dead. Yang represents the active principles in nature exhibited by light, heat and dryness. On the human level, Yang symbolizes masculinity and active, and also represents the realm of the living. Yin and Yang are about balance and harmony within a space, designed to create balance in the users' life when engaging in the space (Feuchtwang, 1974).

**(4) Form School Model:** The Form School is primarily based on the verification of the physical configuration of mountains and watercourses surrounding sites and buildings. These elements comprised the basics of the Form School approach and were known as the "Five Geographical Secrets", namely, dragon, sand, water, cave and direction (Lip, 1979). Contemporarily, Form school approach has been recognized as comprising scientific basis in the analysis of the built environment (He, 1990; Wang, 1992; Cheng and Kong, 1993; Mak and Ng, 2005; Mak and Ng, 2008). The combination of these five Feng Shui geographical elements and the four emblems (green dragon, white tiger, black tortoise and red bird as the four cardinal directions) produced the classic Feng Shui model. This model has been interpreted in diagrams of spatial organization of auspicious mountains and watercourses in most of the ancient Feng Shui literature (Shang, 1992; Cheng and Kong, 1993; Han, 1995; Yi et al., 1996; He, 1998). A simplified model was established by Mak (2009) to illustrate the relationships between the key elements of the five Feng Shui geographical secrets being considered and how dragon vein, four emblems in sand, water feature, cave and bright court, and their directions were integrated (Figure 2).

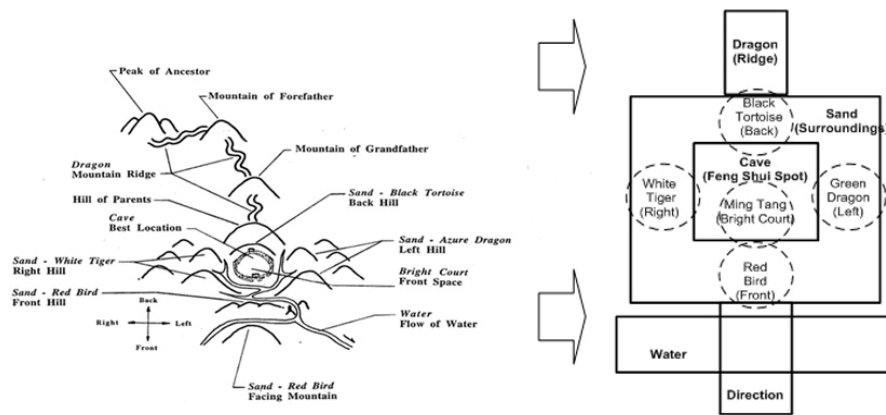


Figure 2: Simplified Feng Shui Model (Yi et al., 1996 and Mak, 2009)

**(5) Balance between Interior and Exterior Spaces:** When describing the site conditions and the design of buildings, most of the Feng Shui texts, such as *Yang Zhai Shi Shu* (Ten Books on Dwellings of Living) categorized space into “Outer Form” (exterior) and “Inner Form” (interior). According to Lee (1986), the Outer Form can be identified as the location of the site, conditions that surround the site, topographical conditions of the site and the shape of the site. The Inner Form can be identified as the layout of the building, elevations of the building, and elements of building. The concept of a Feng Shui model not only applied to landscape and site selection, but it can also be applied to the internal layout of buildings. Therefore, whether it is dealing with physical or topographical elements, or housing structure, or the proportional relationships of the interior of a building, the same principles and relationships of the Feng Shui model are still applied. Feng Shui scholars, Cheng and Kong (1993) provided a further classification of space into four design modules: surrounding environment, external layout, internal layout and interior arrangement (Figure 3).

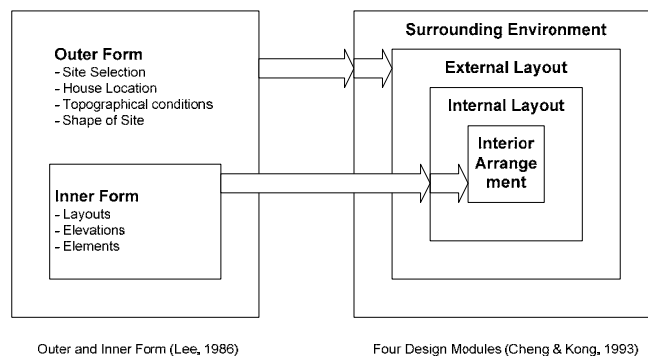


Figure 3: Four Design Modules (Mak, 2009)

## 2.3 Comparison of sustainable design and Feng Shui concepts

When comparing the concepts of sustainable design and Feng Shui, there are similarities and differences. Firstly, the concept of constructivism translates well into the principles of harmony between universe, earth and human in Feng Shui. The ideal environment for Feng Shui is these three

aspects as they intersect and overlap. These three circles can be found in sustainable design as social contexts, environment and human as shown in Figure 4.

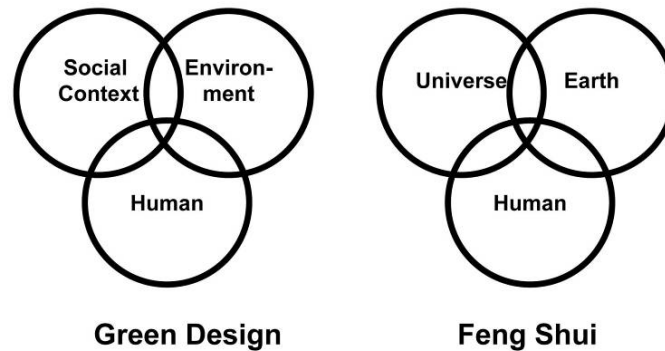


Figure 4: Comparison of Principles of Green Design and Feng Shui (Dong and Zuehl, 2009)

The second principle of Feng Shui is the productive and destructive cycles of five elements, which is similar to the circular design or McDonough's "Cradle to Cradle" concept. The third Feng Shui concept is the balance and harmony between Yin and Yang, which also matches with the concept of sustainable design of balancing between natural environment and the built environment. For the fourth and fifth concepts in sustainable design, the energy efficiency and buying local concepts are focused explicitly on the sources and consumptions of natural resources. However, the Feng Shui concepts of Form school model and balance between interior & exterior spaces are focused on the physical form and spatial arrangement of the built environment.

### 3. Case study

#### 3.1 An office building in Sydney

A recently completed office building, Workplace6 in Sydney has set the highest standard in sustainable design in NSW. The site, as shown in Figure 5, opposite Star City Casino on the waterfront at Darling Island, is managed by the Sydney Harbour Foreshore Authority (SHFA). SHFA initiated the contract for a benchmark building in environmental design with owner the GPT Group, developer Citta Property Group, in conjunction with design and build contractor Buildcorp Australia.

The location of Workplace6, in the Sydney CBD fringe market of Pyrmont, is seen as an increasingly sought after destination for tenants seeking cost effective office space with close proximity to the CBD. With high profile frontage to Pirrama Road, Workplace6 is positioned on the highly visible South East corner of the Darling Island peninsula as shown in Figure 6. Accenture and Google have leased 96 per cent of the office space for 12 and 10 year terms respectively, while Doltone House has signed a 15 year lease for the 1,800 sqm retail space on level 1 (Sustainable Property News and Forum, 2009).



Figure 5: Location of Workplace6  
(Spears, 2009)



Figure 6: Front Elevation of Workplace6

Construction of Workplace6 commenced in April 2007 and completed in November 2008, it provides approximately 18,200 sq m of space over six storeys and offers some of the largest commercial floor plates in Sydney, of over 3600 sqm as shown in Figure 7. Main building features include:

- 16,200 sqm of office space over five levels, and 1,800 sqm of ground floor retail space
- large floor plates, with a typical floor area of 3,620 sqm
- open central atrium zone providing a sense of space in the lift lobby
- core zone, allowing light to reach the centre zone of each floor
- no point on the large floor plate is more than 12 metres from an external window or the atrium
- parking for 135 cars and provided 120 bike racks

Workplace6 is a prime grade office building achieving world leading standards in environmental design and resource efficiency. According to the nine categories of the Green Star rating scheme (Australian Green Building Council, 2009), the building has awarded a total score of 83 points (Spear, 2009). It is the first commercial development to achieve a 6 star Green Star rating for design in NSW and is targeted a 5 star NABERS energy and water rating, the highest rankings available in all ratings and classed as “world leading”. It is designed to reduce greenhouse emissions by 70% and cut drinking water consumption by almost 90% compared to an average existing office building (GPT, 2009). Key environmental initiatives include:

- a gas-fired generator to generate power for the building onsite, reducing the peak load by 25 per cent; the waste heat from the generator is then used to run an absorption chiller that will cool the building
- use 25 per cent Green Power drawn from wind and solar sources



- a black water recycling system that will treat sewage on-site. Potable water yielded from black water recycling will be used for toilet flushing, with excess water offered to the local community for irrigation of the adjacent parks and gardens (Figure 8)
- rejection of waste heat from the building to the adjacent harbour, in lieu of the use of cooling towers; this will have the effect of significantly reducing the water consumption of the building, as well as eliminating the risk of legionnaires disease
- roof mounted solar panels to heat the building's hot water supply
- the use of recycled materials, sustainable timber and minimal use of PVC and VOCs



Figure 7: Typical Floor Plan (Spears, 2009)



Figure 8: Grey water distribution (Spears, 2009)

- maximisation of natural light with central atrium and optimize indoor environment quality through the use of chilled beam technology (Figure 9)
- operable facades which allow tenants to install open and fresh air wintergardens in various locations,
- maximisation of window openings overlooking Sydney city and harbour
- high technology facade and sun shading devices to reduce heat load on the building.



Figure 9: View of Central Atrium (Spears, 2009)

### 3.2 Analysis and discussion

With all the sustainable design features, Workplace6 has achieved massive saving in energy and water consumption. As a result, the greenhouse gas emission of Workplace6 is 39 KgCO<sub>2</sub> per sqm, compared with an average standard building is 87 KgCO<sub>2</sub> per sqm. In addition, the water consumption is 2.1 million litres per annum compared with an average standard building is 31.1 million litres per annum (Spears, 2009). The analyses for the features of the case study according to the five sustainable design concepts are outlined in Table 1.

Table 1: Analysis of the Features in Case Study according to Sustainable Design Concepts

<i>Sustainable design concepts</i>	<i>Features in Case Study</i>
(1) <i>Constructivism</i>	<ul style="list-style-type: none"> <li>• <i>Achieved a 6 star Green Star rating for design</i></li> <li>• <i>Targeting a 5 star NABERS energy rating</i></li> <li>• <i>Central atrium and staircase provided a sense of space and communication</i></li> </ul>
(2) <i>Circular design</i>	<ul style="list-style-type: none"> <li>• <i>Use of recycle materials, sustainable timber and minimal use of PVC and VOCs</i></li> </ul>
(3) <i>Energy efficiency</i>	<ul style="list-style-type: none"> <li>• <i>Use of gas tri-generation to reduce peak load</i></li> <li>• <i>Use of solar power hot water system</i></li> <li>• <i>Use of chilled beams</i></li> </ul>
(4) <i>Balance between natural and the built environment</i>	<ul style="list-style-type: none"> <li>• <i>Use of open central atrium to provide natural light</i></li> <li>• <i>Operable facades which allow tenants to install open and fresh air wintergardens in various locations</i></li> </ul>
(5) <i>Thinking global and buying local</i>	<ul style="list-style-type: none"> <li>• <i>Use harbour water for heat rejection in lieu of the use of cooling tower</i></li> </ul>

In accordance with the Feng Shui concepts, the provision of an open central atrium is a prime feature of Workplace6. This design is similar to the traditional courtyard houses in Beijing that, under the Feng Shui principles, provided the balance between natural and built environment, Yin and Yang

harmony and the sense of unity between heaven and human (Xu, 1998). The analyses of the features of the case study according to the five Feng Shui concepts are tabulated in Table 2.

*Table 2: Analysis of the Features in Case Study according to Feng Shui Concepts*

<b><i>Feng Shui concepts</i></b>	<b><i>Features in Case Study</i></b>
<i>(1) Unity between heaven and human</i>	<ul style="list-style-type: none"> <li>• <i>Use of open central atrium to bring the natural environment inside the building, however, natural features, such as plant or water features are not provided in the building</i></li> </ul>
<i>(2) The five elements cycles</i>	<ul style="list-style-type: none"> <li>• <i>Use of open central atrium and staircase to provide communication and circulation pattern, however, the five elements and their features are not provided</i></li> </ul>
<i>(3) Yin and Yang harmony</i>	<ul style="list-style-type: none"> <li>• <i>Use of open central atrium to provide a balance between natural and built environment, and sense of space, however, the size of the atrium is in relatively small proportion of the large floor plate area</i></li> </ul>
<i>(4) Form School model</i>	<ul style="list-style-type: none"> <li>• <i>The building is located between the community park on the North and Pyrmont Bay Park on the South-East, and backed by the StarCity Casino complex on the South and South-West</i></li> <li>• <i>Use of curtain wall system to provide maximized Sydney harbour view to the North and East</i></li> <li>• <i>Open space provided in front of the entrance to the building</i></li> </ul>
<i>(5) Balance between Interior and exterior spaces</i>	<ul style="list-style-type: none"> <li>• <i>The entrance door to office at each floor opens to a corridor that connecting to the open central atrium provided a balance between interior and exterior spaces</i></li> <li>• <i>Operable facades which allow tenants to install open and fresh air wintergardens in various locations</i></li> <li>• <i>Connecting interior spaces to exterior through natural light from windows and central atrium, maximized external view to Sydney harbour, and greater fresh air supply</i></li> </ul>

There are similarities and differences between sustainable design and Feng Shui concepts. From the analysis of the case study, the sustainable design concepts aimed at the creation of the enjoyable space for human interactions and balance between natural and the built environment, which can be translated to, under the Feng Shui concepts, the unity of heaven and human and the Ying and Yang harmony. In this case study, the provision of the open central atrium is a prime feature to satisfy these concepts from both sustainable design and Feng Shui considerations.

According to sustainable design, the circular design concepts of “reduce, reuse and recycle” are key sustainable features of the case study that lead to the achievement of 6 star Green Star rating. However, following the Feng Shui concepts, the productive and destructive cycles of the five elements according to the nature of the elements, such as, material used, shapes, colour, orientation, are abstract and difficult to be identifiable.

For the sustainable design considerations, the energy efficiency and buying local concepts that focus on the sources and consumptions of natural resources are translated into measurement of physical

attributes, such as, light, thermal, water, air quality, etc. These concepts focused on how the man-made environment affects people and their performances. In contrast, the Feng Shui concepts of Form School model and balance between interior and exterior spaces are emphasized on the balance of physical forms and spatial arrangement. It is focused on the balance, harmony and experience of the environments but these aspects are difficult to be measured and quantified.

## 4. Conclusion

This paper has compared and contrasted the concepts and practices between western sustainable design and Chinese Feng Shui using an office building - Workplace6 in Sydney as a case study. The findings have suggested that both concepts are the same in term of focusing sustainable development that is to minimize impacts on natural environment. The distinct feature of western sustainable design has more emphasis on measurement of physical attributes such as efficiency of water and energy consumptions; whereas Feng Shui is unique and the emphases are on balance of Ying Yang, exterior and interior, the relationship between human and surrounding environment. However, the western sustainable design cannot avoid using of new technology and reinvestment, in which the effect of sustainability has been impaired. The interpreting Feng Shui knowledge has embraced the western concept of sustainable design. But Feng Shui concepts such as productive and destructive cycle are intangible and difficult to be measured. Ideally, if Feng Shui concepts can be considered and applied into the western sustainable design that will enhance the effect of sustainable development. Improving scientific research on Feng Shui and how Feng Shui concepts are measured and work together with western sustainable design are areas for further study.

## Reference

- Anderson, E. (1973) Feng-Shui: Ideology and Ecology. IN: Anderson, E. and Anderson, M (eds.) *Mountains and water: Essays on the Cultural Ecology of South Coastal China*. Taipei, Orient Cultural Service.
- Anderson, E. and Anderson, M. (1973) Changing Patterns of Land Use in Rural Hong Kong. IN: Anderson, E. and Anderson, M. (eds.) *Mountains and water: Essays on the Cultural Ecology of South Coastal China*. Taipei, Orient Cultural Service. pp.45-50.
- Australian Green Building Council (2009) *What is Green Star?* Accessed on 02 Dec 2009 at <http://www.gbca.org.au/green-star/green-star-overview/>.
- Bruun, O. (1995) Feng Shui and the Chinese Perception of Nature. IN: Bruun, O. and Kalland, A. (eds.) *Asian Perception of Nature: A Critical Approach*. London, Curzon Press, pp.173-188.
- Capra, F. (1975) *The Tao of Physics*. London, Wildwood House.
- Cheng, Jianjun and Kong, Shangpo (1993) *Feng Shui and Architecture*. Nanchang, Jiangxi Science and Technology Press [Chinese].

Dong, W. and Zuehl, R. (2009) The Comparison and Contract Between Green Design and Feng Shui. IN: Mak, M.Y. and So, A.T.P. (eds) *Research in Scientific Feng Shui and the Built Environment*. Hong Kong, City University of Hong Kong Press. pp.201-222.

Feuchtwang, S.D.R. (1974) *An Anthropological Analysis of Chinese Geomancy*. Vientiane, Laos, Vithagna.

Freedman, M. (1979) *Chinese Geomancy in the Study of Chinese Society: Essays by Maurice Freedman*. Stanford, Stanford University Press.

GPT (2009). *Welcome to Workplace6*. GPT Wholesale Office Fund. Accessed on 03 Dec 2009 at <http://www.workplace6.com.au/Core/Content/Public-Home-Page/Content1699.aspx>

Han, Ke-Tsung (1995) *Basic Theory of Landscape Feng Shui*. Taipei, Lamper Enterprises [Chinese].

He, Xiaoxin (1990) *The Source of Feng Shui*. Nanjing, Southeast University Press [Chinese].

He, Xiaoxin (1998) *Feng Shui: Chinese Tradition in a Manchester Context*. Unpublished PhD Thesis, University of Manchester.

Humphreys, C. (1976) *Zen Buddhism*. London, Allen & Unwin.

Hwangbo, A. B. (1999) *In Search of Alternative Traditions in Architecture: a Cross-Cultural Interdisciplinary Study*. Unpublished PhD Thesis in Architecture, University of Sheffield.

Lee, Sang-Hae (1986) *Feng Shui: Its Context and Meaning*. Unpublished PhD Thesis, Cornell University.

Lip, E. (1979) *Chinese Geomancy*. Singapore, Times Books International.

Lynch, K. (1960) *Image of the City*. Cambridge, MIT Press.

Mak, M.Y. (2009) *Scientific Feng Shui: Application of Feng Shui Knowledge to Preliminary Building Design Evaluation Using Knowledge-Based Expert Systems Approach*. Saarbrücken, Germany, VDM Verlag Dr Muller.

Mak, M.Y. and Ng, S.T. (2005) The Art and Science of Feng Shui – A Study on Architects' Perception. *Building and Environment*, 40, pp.427-434.

Mak, M.Y. and Ng, S.T. (2008) Feng Shui: An Alternative Framework for Complexity in Design. *Architectural Engineering and Design Management*, 4 (1), pp.58-72.

McDonough, W. and Braungart, M. (2002) *Cradle to Cradle: Remaking the way we make things*. New York, North Point Press.

- McLennan, J.F. (2004) *The Philosophy of Sustainable Design*. Kansas City, Missouri, Ecotone Publishing.
- Needham, J. (1959) *Science and Civilisation in China, vol 3, Mathematics and the Sciences of the Heavens and the Earth*. Cambridge, Cambridge University Press.
- Nemeth, D.J. (1993) A Cross-cultural Cosmographic Interpretation of Some Korean Geomancy Maps. *Cartography*, Vol. 30, No. 1, Rundstrom.
- Shang, Kuo (1992) China's Pattern of Feng Shui: Its Formation, Relationship to Environment and Landscaping. IN: Wang, Qiheng (ed.) *Research of Feng Shui Theory*. Tianjin, Tianjin University Press, pp.26-32 [Chinese].
- Skinner, S. (1982) *The Living Earth Manual of Feng Shui Chinese Geomancy*. London, Arkana.
- Spears, A. (2009) *Workplace6 Presentation*. Buildcorp Australia Pty Ltd. Accessed on 03 Dec 2009 at <http://www.gbca.org.au/docs/workplace6%20Presentation%20BWTS3.pdf>.
- Sustainable Property News and Forum (2009). *Case Study - Workplace6 a star performer for Pyrmont*. The Fifth Estate. Accessed on 03 Dec 2009 at <http://www.thefifthestate.com.au/archives/1847>.
- Walters, D. (1989) *Chinese Geomancy*. Longmead, Element Books.
- Wang, Qiheng (ed.) (1992) *Research of Feng Shui Theory*. Tianjin, Tianjin University Press [Chinese].
- Widener, D. (2009) *Regional Green Building Case Study Project: A post-occupancy study of LEED projects in Illinois*. Chicago, U.S. Green Building Council – Chicago Chapter.
- Xu, P. (1998) Feng-Shui Models Structured Traditional Beijing Courtyard Houses. *Journal of Architectural and Planning Research*. 15:4 (Winter) pp.271-282.
- Yi, Ding, Yu, Lu and Hong, Yong (1996) *Geomancy and the Selection of Architecture Placement in Ancient China*. Shi Jia Zhuang, Hebei Science and Technology Press [Chinese].