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Summary

The objectives of this paper are to review the key drivers and issues behind the greener building movement, identify the most appropriate green building standards in Hong Kong; understand the issues, discuss measures organizations could take to turn a building green, and share CLP's experience on green building management.

Green building is not only an energy efficient building, it is an environmentally-friendly and resource-efficient building. However, it should be noted that some well- designed buildings do not necessarily translate to green performance due to a variety of reasons.

Therefore it is important for organisations to assess and establish the environmental aspects of a building prior to determining approaches to transforming their building. The results will pave the way for identifying and adopting a recognised building performance standard and benchmark performance. This paper identifies critical factors and proposes a framework for a green building. These include integrating key issues of a building into the ISO 14001 environmental management system, conducting regular carbon and energy audit, implementing high energy efficiency building installations, and setting up performance indicators for continuous monitoring.

This paper also shares WBCSD's Manifesto for Energy Efficiency in Buildings and how CLP promotes energy efficiency and efforts to achieve green buildings.

Introduction

Much of our lives is spent inside buildings, yet most of us tend to pay little attention to the energy consumed by buildings, the amount of waste generated on a daily basis, the efficiency of the air conditioning system, and the impacts of buildings to the surrounding and global environment. Needless to say, the benefits delivered in terms of energy efficiency attributable to a good building design are often overlooked. Thanks to concerns over climate change, recent air quality issues and increase of environmental awareness as well as enforcement of more regulatory control, this situation is changing.

In some countries, moving towards a green building has progressed surprisingly fast as evidenced by the rapid releasing of more new or revised polices and regulations related to energy efficiency and performance of green buildings. For example, the compulsory requirement for large building to display energy certificate under the Energy Performance of Building Directive since 2008 and implementation of green deal scheme in 2013 in UK.

The objectives of this paper are to review the key drivers behind the greener building movement, identify the most appropriate green building standards; understand the issues, discuss methods to turn a building green, and share CLP's experience on green building management.

In this paper, a green building is simply defined as low carbon (or energy efficiency) building and performing in an environmental responsible and resource efficient manner. At the same time it also meets the needs and expectations of the occupants and relevant stakeholders.

What is a green building?

The meaning of a green building and a sustainable building is best described and defined by the Building Environmental Assessment Method (BEAM)[1]. it also quotes from ASTM[2] which states that a "green building" is defined as "a building that provides the specified building performance requirements while minimising disturbance to and improving the functioning of local, regional, and global ecosystems both during and after its construction and specified service life. Furthermore, "a green building optimises efficiencies in resource management and operational performance; and, minimise risks to human and the environment".

In addition to the above definition, BEAM defines a sustainable buildings by including social and economic aspects BEAM considers that in the context of Hong Kong' sub-tropical climate and dense high-rise development, a sustainable building should meet the aspects of, in the priority order, safe, healthy, comfortable, functional and efficient. These definitions align with the definition and objectives of this paper except that the social and economic aspects are not included.

[1] BEAM is a Hong Kong standard that defines building quality and is owned and operated by BEAM society Limited. http://www.beamsociety.org.hk

[2] ASTM International E 2114-01. Standard Terminology for Sustainaibility Relative to the Performance of Buildings. 2001

Why do we need a green building?

According to the UK Committee on Climate Change, greenhouse gas (GHG) emissions from buildings contributed 35% of the UK's total in 2011. Its latest progress report on meeting UK's carbon targets reveals that 66% of GHG emissions from buildings are from residential ones, while commercial and public sector emissions accounts for 25% and 90% respectively[3]. In Hong Kong, the situation is even more critical. Over 60% of GHG emissions come from electricity, in which 90% of electricity is consumed by buildings[4].

Therefore, as Hong Kong strives to do its part in the Mainland's carbon intensity reduction goals, it is important to focus on GHG reductions from buildings. In addition to new and revised polices and regulatory requirements in relation to energy consumption, there are a number of factors and drivers, which will vary according to the needs and development of various countries, behind the green buildings movement In brief, key drivers to make such change are summarised in below table.

Table 1 : Key drivers to change a building green

Driver	Past	Present	Future
Regulatory Requirements	♣	♣♣	♣♣♣♣
Policies (government & private)	♣	♣♣♣	♣♣♣♣
Green group's agenda	?	♣	♣♣
People's awareness	♣	♣♣	♣♣
Money saving	♣	♣♣	♣♣♣♣
Stakeholder expectations (Feeling green, company initiative)	?	♣♣	♣♣♣♣♣

[3] Paul Suff, Makeover SOS, the Environmentalist, October 2012.
[4] Page 2-3. CCBF, Carbon-Smart Building. Tackling Energy Efficiency in HK's Commercial Buildings

♣ intensity of the driver, e.g. more regulatory requirements and policies in future than in the past. ? means not aware of.

Regardless of whether it is regulatory compliance or environmental stewardship, there will be some changes for the design, construction, operation and maintenance of buildings.

Furthermore, driving forces from developers, occupants and relevant stakeholders should not be overlooked. With the increasing environmental awareness and appreciation for the concept of sustainable development among the public, expectations for an environmentally friendly and quality working and living environment within a building are higher today.

How long has this change been started? It is difficult to have an exact answer. However, it is likely to have started in early to mid 2000s when the film "The Day after tomorrow" was broadcasted and Al Gore launched his global warming and climate change programme as well as his book & film "Inconvenient Truth". People started to realise the importance to protect our environment and that contribution from each of us as an individual is crucial. These changes gradually lead to concept of a green building and protect the global environment.

How green is green?

There have already been many national and international standards to specify the design, construction, operation and maintenance of a building. To make a building green, it is necessary to identify and adopt an appropriate standard and then benchmark performance.

In Hong Kong, the Electrical and Mechanical Services Department has already launched the Energy Efficiency Registration Scheme for Buildings since 1998 and also its fifth code - Performance-based Building Energy Code in 2003. Under this Scheme, there are five sets of code covering lighting, air conditioning, electrical and lift & escalator installation and the minimum energy performance standards of these installations.

These Codes form the basis of energy efficiency for a building if it is designed, retro-fitted and operated according to the requirements. If a wider set of environmental aspects is considered, more consideration, measures and initiatives are needed.

Adopting a recognised building performance standard

Every country and city has its unique climate, culture and development. Factors like temperature, rainfall, humidity, rain storm, geographical location, etc. highly affect the performance of a building.

There are some recognised international standards (e.g. LEED[5]) and local standards (e.g. BEAM) that can be adopted for a green building. If Hong Kong's sub-tropical climate and dense high-rise environment is considered, the latest version of BEAM Standard, the BEAM Plus Version 1.2, seems to be more appropriate. BEAM embraces a wide range of sustainability issues, environmental issues (including climate change and global warming in the latest version) and covers the whole-life performance of buildings. The standard is

[5] Leadership in Energy and Environmental Design developed by the US Green Building Council

applied to assessing new buildings upon completion; and certifies actual performance. Furthermore, it embraces management, operation and maintenance practices to ensure high level of building performance.

Under BEAM, a comprehensive set of performance standards are provided and can be pursued by developers and owners. These standards are separated into 5 key aspects, namely:

- site aspects;
- materials aspects;
- energy use;
- water use; and
- indoor environmental quality.

Each category has a different rating. Depending on how a building is to follow these standards and its final performance, a building joining this scheme will be assessed and an overall grade will be determined by the percentage of the applicable credits gained under each performance category and its weighting factor. The best performer will be awarded a Platinum grade if the overall percentage is 75% or above while a Bronze is given to an above average performer with an overall percentage of 40.

In principle, this kind of building performance standard can provide the basic requirement to turn a building (new or existing) green and provide guidance for a building to perform in a responsible and environmentally friendly manner throughout the building's life cycle.

A well-designed building does not necessarily translate to green performance

"*Few buildings perform as efficiently and effectively as they are designed to. And not just by an inconsequential margin but by a factor of two or three when it comes to energy use*" mentioned in an article written by Richenda Wilson[6]. It also quoted a comment from the Building Services Research and Information Association (BSRIA) that "*the greenest buildings on paper tend to be the biggest disappointment*." This article further mentions that many new buildings disappoint, not only in energy use but also have higher than expected running cost and disappointment levels of occupant satisfaction.

It is not difficult to recognise these facts when the tenants move in to a new building. The differences in energy use are likely because of the method of energy consumption estimation. If a building, during its design and construction stage, is to estimate based on fixed building installations such as air conditioning, ventilation, lift and escalator, lighting, etc, it will not account for the appliances/ equipment plugged into the sockets, from the IT equipment and more unpredictably the behaviour of the occupants. If a building has a data centre, many display rooms / restaurants, storage of items (e.g. food and beverage) in low temperature environment, the overall electricity bill can be high.

Energy efficiency is only one key aspect of a green building. If other aspects are considered such as solid waste and water management, the operation and maintenance of a green

[6] Richenda Wilson, Buildings on the best laid plans, the Environmentalist, Oct 2012, IEMA

building can be made more difficult and complicated. As such it is not only a design issue but also an implementation and sometimes cultural issue.

How about buildings not following a recognised building performance standard?

Furthermore, the majority of buildings, at least in Hong Kong, do not follow a recognised building performance standard (e.g. BEAM or LEED) in particular existing buildings (both commercial and residential) or buildings occupied by small and medium enterprise. Then are there any green building framework or standards that these buildings / companies can follow and implement? For a long run this will definitely help reduce the GHG emissions and resource depletion and finally contribute to the national GHG target.

To answer these questions and understand the issue, it should be started from reviewing the environmental aspects of a building before looking into solutions for a green building.

Understanding the issue

To identify and evaluate significant environmental aspects, the most widely adopted and recognised method is to follow Section 4.3.1 of ISO 14001 and 14004 Environmental Management System (EMS) standard.

Considering the life cycle of a building, it can be broadly separated into 3 phases, i.e.

- Design and construction
- Operation and Maintenance
- Decommissioning

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For simplicity, this paper only focuses on the operation and maintenance phase of a building.

Environmental Aspect of a Building

Based on professional judgement, desktop review, site visit and previous experience, environmental aspects of a building during the operational and maintenance stage are established and summarised in Table 2 below. It is noted that the proposed aspect list :

- is not a comprehensive list
- only identifies key issues
- is applicable to a typical commercial and residential building rather than mixed-type buildings with industrial processes.

Below is only a summary of key activities of a building that interact with the environment and the associated environmental aspects. Details of their impacts, operational control and monitoring are listed in Appendix 1.

Table 2 : Key activities & the associated environmental aspect of a typical building

	Activities	Environmental Considerations
1	**Operation and Maintenance of Ventilation and air conditioning**	a. Consumption of energy
		b. Use of refrigerants
		c. Handling and disposal of chemical waste
2	**Operation and Maintenance of Lift and escalator**	a. Consumption of electricity
		c. Handling and disposal of chemical waste
3	**Lighting**	a. Consumption of electricity

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	Activities	Environmental Considerations
		c. Handling and disposal of chemical waste
4	**Solid waste management**	d. Solid waste Storage and disposal
		e. Waste segregation, reuse and recycling
		f. Food waste collection or composting
5	**Effluent generated from sewage, car washing, cleaning, etc.**	g. Wastewater treatment and recycling
6	**Water conservation**	h. Water re-use and harvest
7	**Managing a comfort and healthy indoor air quality**	i. Indoor air quality performance indicator
8	**Greening the building environment**	j. A more diverse and natural environment
9	**Operation and maintenance of electrical appliance, Office & IT equipment**	a. Consumption of electricity
		c. Handling and disposal of chemical waste
10	**Practising green behaviour**	k. Performing in an environmentally responsible manner, e.g energy saving, waste recycling, etc.
11	**Selection and use of environmentally friendly appliances and products**	l. Green procurement
12	**Operation and maintenance of backup diesel generator**	m. Fuel consumption and emissions

Evaluation of significant environmental aspects

Selection of criteria is based on :

- Scale and severity of environmental impacts, i.e. high energy and natural resources consumption

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- Whether the aspect is subject to regulatory control or internal policy, e.g. Chemical Waste Regulation; internal Energy Policy;
- Measures that have beneficial impacts, e.g. saving natural resources and reducing the amount for disposal
- Factors that affect the health and quality of a working and living environment

From an energy consumption context, all building fix installations are significant aspects as they consumed most of the energy. Waste management and effluent discharge are also key aspects as they have regulatory control, at least for the part of collection and disposal. As a green building, more consideration and initiatives are needed to go beyond compliance. Therefore most of the existing environmental initiatives and practices on recycling in such as paper recycling, metal reuse, etc. should be included. The next important aspect is Indoor Air Quality (IAQ) as it will affect the health and efficiency of the occupants. For others, it depends on the expectations of the occupants/building owner and how green they would like to go.

Finally it also depends on whether the building owner or property management will establish and implement an Environmental Policy (and / or an Energy Policy) and an Environmental Management System (and / or an Energy Management System). It also depends whether there are any incentive / green deals offered by the government.

How to turn a building green (or build a green building)

There are many ways to turn a building green. It may start from the design and construction stage or retrofitting the existing building. Below sections propose a framework to turn a building green.

Adopting an appropriate and local building performance standard

As mentioned earlier, to adopt directly the BEAM Plus grading system for instance, is one of the best ways to attain the basic requirement of a green building and benchmark performance. This is applicable to both new and existing buildings. The advantage of this approach is that a recognised building performance standard has already provided a comprehensive and fair assessment of the overall performance of a building in most of the environmental aspects as well as sustainability areas. It also recognises best practices and demonstrates performance qualities to end users.

Its method of quantifying overall performance can provide an easy to understand energy saving and environmental protection efforts. It also identifies areas for continual improvement.

Retrofitting existing buildings

According to the Intergovernmental Panel on Climate Change, retrofitting existing buildings has the largest potential of all measures to reduce GHG emissions by 2030. Therefore, retrofitting of existing building by addressing part of the significant environmental issues defined above can make a big different and reduce lots of its carbon

footprint. For example, if all incandescent lamps are replaced by T5 florescence tube or LED lamp, the reduction of energy consumed could reach over 80%. If a glass recycle bin can be provided, hundreds of empty glass bottles can be reused for other materials, such as bricks that are used to pave pedestrian sidewalks. If water can be harvested, both the carbon footprint and water consumption can be reduced. .

Below two tables provide a brief account on energy saving and environmental control measures for a green building. Key information is based on the Energy Management in Buildings[7], BEAM Plus and CCBF[8].

Building services installation / equipment :

Table 3 : Standard of Key Building Services Installation

Building Installations / Equipment	Recommended Standards	Others initiatives / standards
Air Conditioning and Mechanical Ventilation	Building Energy Codes; energy label	Chilller dynamic control; ultra-efficiency air conditioning, e.g. water-cooled chillers with oil-free magnetic bearing compressors or with a control variable speed systesm
Lighting	Building Energy Codes; energy label	No incandescence lamps; T5 and LED Integrated controls for occupancy, smart energy metering systems
Office Equipment & IT equipment	Green Label; Energy Label	Integrated controls for occupancy, smart energy metering systems
Life & escalator	Building Energy Codes	
Renewal Energy & energy efficiency equipment		Use of solar energy; heat pump, etc. Facade treatment with solar film
Material use		Use environmentally friendly refrigerants

[7] Best Practice Series, Vol 4 2003, IEMA : Energy Management in Buildings
[8] CCBF, Carbon-Smart Buildings – Tackling Energy Efficiency in HK's Commercial Buildings

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Building Installations / Equipment	Recommended Standards	Others initiatives / standards
		Use of rapidly renewal materials or sustainable forest product DO not use prohibited substances such as asbestos, ozone depleting substances, etc.

Environmentally friendly measures : beyond compliance

Table 4 : Key Environmental Measures for a Green Building

Environmental measures	Recommended Standards	Others initiatives / standards
Water conservation and wastewater treatment	NA	Water conservation plan, water saving devices, water audit, etc.
Solid Waste Management	NA	Waste management plan; demonstrating reduction in waste disposal and increased recycling; providing facilities for collection, sorting, etc.
Noise barrier	Hong Kong Planning Standards and Guideline	
Indoor Air Quality	EPD's IAQ scheme.	Suggest at least good class for existing building and excellent class for new or retro-fitted buildings

How to sustain a green building

To sustain a green building, a consistent and systematic process to manage the key environmental aspects as well as influencing stakeholders is needed in addition to adopting energy efficiency building services installations descripted above. It is proposed that a recognised environmental management system with setting up of key building performance indicator should be adopted.

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Adopting the ISO 14001

For most of the buildings that do not (or cannot) follow a recognised building performance standard and its grading system, the most straightforward approach is to adopt and ISO 14001 EMS and conduct regular carbon / energy audit.

Does a green building need ISO 50001?

With the introduction of a specific system - ISO 50001 - for energy management, building owner or occupant can further explore the opportunity to follow this standard and review its applicability to a green building. However, it is considered that ISO 14001, with an appropriate policy, and identification of a set of performance indicator are the basic system / platform to manage the key environmental aspects, including energy consumption, for a green building.

Setting up performance indicators and ISO 14064

The weakness of ISO 14001 EMS in the context of green building is that:

- it does not have a mandatory process to capture and monitor building performance indicators (e.g. energy consumption and greenhouse gas emissions)
- it is not detailed enough to provide a systematic framework and processes for data capture, compilation and calculation

Therefore, it is highly recommended that the process is supported by ISO 14064[9] (preferably cum energy audit) to quantify the carbon footprint, at least for scope 1 and scope 2 greenhouse gases.

[9] ISO 14064 is an ISO standard for quantification and reporting of Greenhouse Gas Emissions and Removals

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Quantifying GHG emissions is not a complicated process and there are many useful guidelines and templates to assist a company or a premise to evaluate its own carbon footprint. For example, the guideline to account for and report on GHG issued by the Hong Kong Government[10] is a good reference for this purpose.

Based on the significant environmental aspects defined in Table 2, key performance indicators can be determined for continuous monitoring, for example, energy consumption, solid waste (both hazardous and non-hazardous waste) recycling, disposal, water consumption / reuse, wastewater discharge, etc. These indicators are summarised in below table.

Table 5 : Suggested key performance indicators for a green building

	Environmental Aspect	Key Performance Indicators
a	Consumption of energy	Electricity consumption monitoring
b	Use of refrigerants	Consumption of HFC
c	Handling and disposal of chemical waste	Chemical waste disposal quantities
d	Solid waste Storage and disposal	Construction waste and other solid waste disposal quantities
e	Waste segregation, reuse and recycling	Solid waste reuse/recycle quantities, e.g. WEEE, plastics, paper, metals, Recycling & Reuse to disposal ratio
f	Food waste collection or composting	Food waste disposal or composting records
g	Wastewater treatment and recycling	Effluent discharge quantities

[10] EMSD & EPD. Guidelines to Account for and Report on Greenhouse Gas Emissions and Removals for Buildings (Commercial, Residential or Institutional Purposes) in Hong Kong.

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	Environmental Aspect	Key Performance Indicators
h	Water re-use and harvest	Water recycling and reuse quantities
i	Indoor air quality performance indicator	Regular monitoring and follow-up action
j	A more diverse and natural environment	No. of tree planted.
k	Perform in an environmentally responsible manner	Training hours
l	Green procurement	% of products with green labels and % of contractor/supplier with ISO 14001

Conducting Energy Audit

Whether a building is new or existing, building performance evaluation is necessary to evaluate energy consumption and identify problems and energy saving opportunities. It can be conducted through regular walkthrough or site inspection; occupant satisfaction survey and finally energy and environmental audit. If an ISO 14001 EMS is implemented, this process can be integrated into existing practices.

The recent enforcement of energy audit for commercial building in Hong Kong is a big step to monitor energy efficiency and towards a green building.

Other Green Initiatives

Other areas of importance for successfully implementation of a green building include :

- The Indoor Air Quality Certification
- Green procurement

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- Green IT
- Performance contracting

WBCSD – Manifesto for Energy Efficiency in Building

In addition to above initiatives, there are also some voluntary programmes that promote building energy efficiency in a strategic manner, for example, the World Business Council for Sustainable Development (WBCSD)[11]. It initiated a Manifesto for Energy Efficiency in Buildings and aims to guide WBCSD member companies to improve the energy performance of their commercial buildings. This manifesto is to be signed by the CEO of a company; thus reflecting commitment from top management.

This kind of programme allows member companies, based on their own business nature and environment, set out and report the energy reduction target. Its five proposed actions are good reference to set medium to long term targets for any company. Key actions include:

- Create a baseline of the company's building and set time based energy/and CO2 reduction targets;
- Publish the company policy for minimum energy performance levels;
- Define and carry out the company's audit program and implementation strategy to meet energy targets for its commercial buildings;
- Publish annually, building energy use, CO2 emissions and progress against reduction targets, in the company's respective CSR or other report;

[11] The WBCSD brings together some 200 international companies in a shared commitment to sustainable development through economic growth, ecological balance and social progress. www.wbcsd.org

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- Further promote building energy efficiency among suppliers, employees, and other stakeholders through advocacy, marketing activity, R&D, education and training.

There are also some key points to note :

- There is a commitment to publish the annual energy or CO2 emissions results, usually through its CSR or Sustainability Report. As such, public disclosure reflects the company's commitment to the target and commitment to transparency
- Minimum energy performance level is also required to be set and published. Therefore benchmarking of performance and adopting reasonable and recognised standards such as Building Energy Code is needed.

Actions proposed in this programme are worth reviewing and highly recommended to all large corporation and utility companies.

Involvement of Local Government : Incentive & Green Deal

To motivate all occupants and building owners to adopt energy efficiency measures (e.g. converting incandescence lamp to compact fluorescence lamp / T5 tube, etc.), effective governmental policies and incentive (or punishment) are sometimes needed.

It is noted that the first green deal in UK will be signed in 2013[12][13]. The scheme allows the cost of installing energy-efficiency measures to be financed through a charge attached to a property's electricity meter. This kind of deal provides a solution for those occupants and business unwilling to invest in energy efficiency because of initial cost.

[12] Page 3, Deal or no deal?, the Environmentalist, Oct 2012
[13] Paul Stuff, The Great Deal – Makeover SOS, the Environmentalist, Oct 2012

Best Practice and Information Sharing

To encourage best practices and information sharing among building services professional, platforms like Usable Building Trust [usablebuildings.co.uk] and Carbon Buzz [cabronbuzz.org], etc. should be set up and promoted locally.

Conclusion - Critical factors for a green building

Based on the above discussion, it is a trend that buildings will become more energy efficient and environmentally friendly in future. This not only meets the expectations of stakeholders but also meets the upcoming carbon reduction target and more stringent building management regulatory requirements. Therefore it is time to act now and critically review how to reduce the carbon footprint and turn a building green.

Recognising that some buildings or companies may not opt to fully adopt and implement building performance standards such as BEAM Plus, there are still a number of measures that organisations could apply to enhance the environmental performances of their buildings:

- Adopt and implement the ISO 14001 Environmental Management System to manage the significant environmental aspect of a building and preferably supported by an ISO 14064 to quantify the carbon footprint;
- Set out minimum energy performance standard based on the Building Energy Codes
- Through building performance evaluation, identifying energy saving opportunities and improvement areas for environmental aspects

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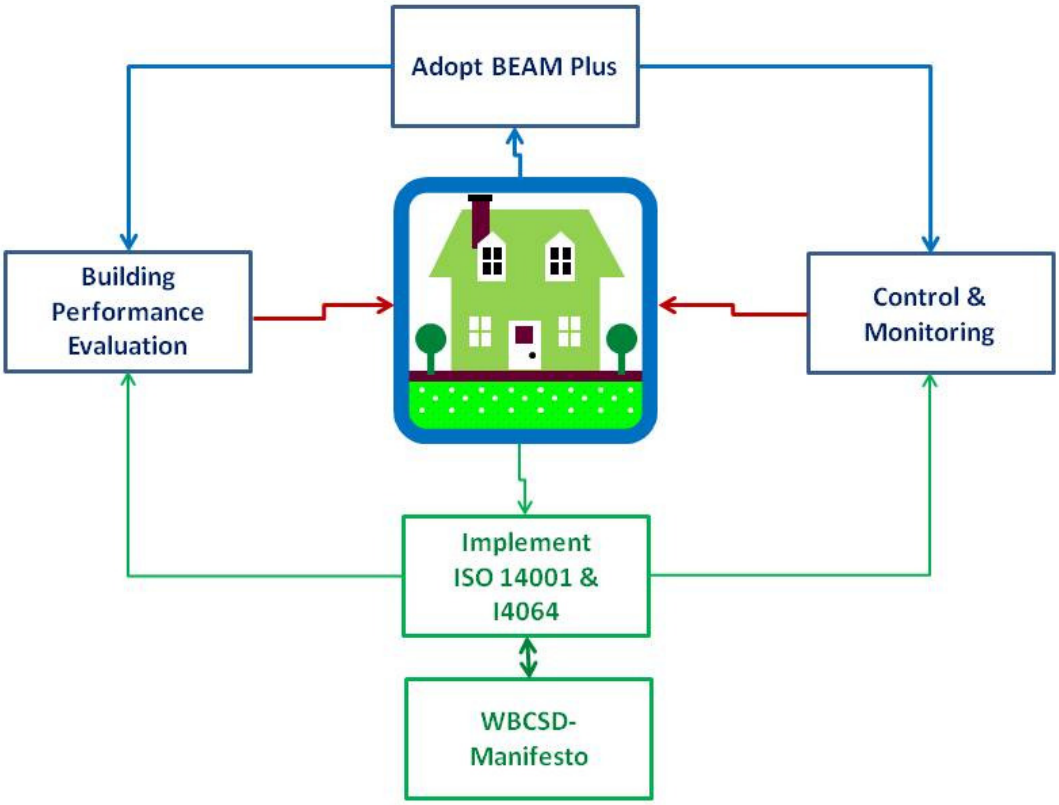
- Setting up building performance indicator and monitor the performance on a regular basis
- With reference to or following the proposed actions and strategy of WBCSD Manifesto
    - Below diagram illustrate the management framework for a green building



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Case Study : CLP Green Buildings

In 2007, CLP issued its Climate Vision 2050, which sets out the company's commitment to reduce the carbon intensity of generating portfolio from 0.84 kg CO2/kWh in 2007 to 0.2 CO2/kWh by 2050. To achieve this goal, CLP has been increasing its investment in both the production and use of cleaner fuels such as renewable energy, natural gas; nuclear power and lower-calorific (You know the proper term) coal.

In Hong Kong, CLP Power published its Energy Vision, a roadmap for clean energy generation, which involves the strengthening of infrastructure integration with South China; adopting a cleaner fuel mix for cleaner air; and, promoting energy efficiency.

Energy savings is one of the most direct methods to help reduce CO2 emissions. As such CLP supports initiatives that maximise energy efficiency in buildings. Below are key measures and initiatives :

Adoption of Building Energy Codes

CLP Group or Power Hong Kong adopted the Building Energy Codes in accordance to local regulations whenever possible within its own buildings. As of end 2010, 29 registration for 11 CLP buildings have already been completed under the Energy Efficiency Registration Scheme.

Improving Overall Thermal Transfer Value (OTTV) Standards and Promoting Wider Adoption of Green Roofing

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CLP Power has incorporated key design features which can improve the OTTV value in our electricity substation building such as green roof, vertical greening and less window glazing. Green roof/ wall features are being incorporated into new and existing substations

Expanding Use of District Cooling or Water-cooled Air Conditioning

Water-cooled chiller is at least 30% more energy-efficient than older air-cooled equivalents. In Hong Kong, CLP has helped our commercial and industrial customers to convert air-cooled chillers to the more efficient water-cooled chiller.

Improving energy efficiency in commercial buildings

CLP Power assists our commercial and industrial customers to conduct energy audit and identify energy saving opportunities. It is estimated about 30GWh of electricity can be saved (equivalent to about 16 kT CO2) each year.

The GreenPLUS programme, launched in August 2010 aims to help small-to-medium enterprises and non-governmental organization (NGOs) to implement Energy Efficiency & Conservation measures. Through implementing the recommended improvement, about 5% to 20% of energy can be saved. Internally CLP has introduced an internal "Go Green" campaign to promote a green culture since 2005. Up to now, CLP offices have already reduced about 10% electricity consumption, cut about half dry cell consumption, recycled tonnes of paper, etc.

Towards the concept of green building

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In addition, there are many other initiatives, measures and programme implemented in CLP towards the concept of a green building. These include :

Implementation of an ISO 14001 EMS

- ISO 14001 is implemented in all power stations under CLP's operational control and key business units
- ISO 14064 is implemented for all buildings and carbon footprint is quantified annually
- Indoor Air Quality : Corporate guideline has been issued to set out Indoor Air Quality standards and requirements. Selected buildings are certified to the government's IAQ scheme
- Solid wastes are re-used, reduced, recycled, replaced through the Go Green Programme or other environmental programmes.

Committing to the WBCSD Manifesto

CLP also commits to the WBCSD Manifesto. Energy audits are being conducted in the CLP Group's commercial buildings to collect baseline data on energy consumption, identify saving opportunities, set targets and prepare for external reporting. Under this programme, about 50 premises will be measured for baseline and tracked in future years on their electricity consumptions.

With the implementation of all these initiatives and programmes, CLP is making sound progress towards green building.

Appendix 1

	Activities	Env. Aspect	Env. Impact / Benefit	Regulation*	Control & Monitoring
1	**Operation and Maintenance of Ventilation and air conditioning**	a. Consumption of energy	Fossil fuel consumption leading to emission of air pollutants	NA	Electricity consumption monitoring
		b. Use of refrigerants	Global warming & ozone depleting	Montreal Protocol and Ozone Layer Protection Ordinance	Use of HFC
		c. Handling and disposal of chemical waste	Health hazards, land contamination, etc.	Chemical Waste Regulation	Control procedure and monitoring of disposal quantities
2	**Operation and Maintenance of Lift and escalator**	a. Consumption of electricity	Similar to Ventilation and air conditioning	NA	Electricity consumption monitoring
		c. Handling and disposal of chemical waste	Health hazards, land contamination, etc.	Chemical Waste Regulation	Control procedure and monitoring of disposal quantities
3	**Lighting**	a. Consumption of electricity	Fossil fuel consumption leading to emission of air pollutants	NA	Electricity consumption monitoring
		c. Handling and disposal of chemical waste	Health hazards, land contamination, etc.	Chemical Waste Regulation	Control procedure and monitoring of disposal quantities
4	**Solid waste management**	d. Solid waste Storage and disposal	Waste disposal to landfill	Waste Disposal Ordinance, etc.	Control procedure and monitoring of waste records
		e. Waste segregation, reuse and recycling	Resource conservation and saving landfill space	NA except chemical waste (not applicable to residential)	WEEE, plastics, paper, metals,
		f. Food waste collection or composting	Waste of natural resources and end up in landfill site	Waste Disposal Ordinance	Control procedure and monitoring of waste records

	Activities	Env. Aspect	Env. Impact / Benefit	Regulation*	Control & Monitoring
					Food waste composting
5	**Effluent generated from sewage, car washing, cleaning, etc.**	g. Wastewater treatment and recycling	Water pollution	Water Pollution Control Ordinance	Discharge limits and control procedure
6	**Water conservation**	h. Water re-use and harvest	Water saving	NA	Water recycling and reuse
7	**Managing a comfort and healthy indoor air quality**	i. Indoor air quality performance indicator	Deteriorating indoor air quality	Relevant indoor air quality standard.	Regular monitoring and follow-up action
8	**Greening the building environment**	j. A more diverse and natural environment	Enhance biodiversity	NA	Environmental Management Programme
9	**Operation and maintenance of electrical appliance, Office & IT equipment**	a. Consumption of electricity	Similar to Ventilation and air conditioning	NA	Electricity consumption monitoring
		c. Handling and disposal of chemical waste	Health hazards, land contamination, etc.	Chemical Waste Regulation	Control procedure and monitoring of disposal quantities
10	**Practising green behaviour**	k. Perform in an environmentally responsible manner	Less energy consumption and natural resources depletion	NA	Training; Awareness Programme.
11	**Selecting more environmentally friendly appliances**	l. Green procurement	Less energy consumption and natural resources depletion	NA	Green procurement guideline and training
12	**Operation and maintenance of backup diesel generator**	m. Fuel consumption and emissions	Air pollution	Air Pollution Control Ordinance	Fuel consumption; GHG estimation

* With reference to Hong Kong regulatory requirements

Appendix 2

Table 5 : Suggested key performance indicators for a green building

	Env. Aspect	Env. Impact / Benefit	Regulation*	Key Performance Indicators
a	Consumption of energy	Fossil fuel consumption leading to emission of air pollutants	NA	Electricity consumption monitoring
b	Use of refrigerants	Global warming & ozone depleting	Montreal Protocol and Ozone Layer Protection Ordinance	Consumption of HFC
c	Handling and disposal of chemical waste	Health hazards, land contamination, etc.	Chemical Waste Regulation	Chemical waste disposal quantities
d	Solid waste Storage and disposal	Waste disposal to landfill	Waste Disposal Ordinance, etc.	Construction waste and other solid waste disposal quantities
e	Waste segregation, reuse and recycling	Resource conservation and saving landfill space	NA except chemical waste (not applicable to residential)	Solid waste reuse/recycle quantities, e.g. WEEE, plastics, paper, metals, Recycling & Reuse to disposal ratio
f	Food waste collection or composting	Waste of natural resources and end up in landfill site	Waste Disposal Ordinance	Food waste disposal or composting records
g	Wastewater treatment and recycling	Water pollution	Water Pollution Control Ordinance	Effluent discharge quantities
h	Water re-use and harvest	Water saving	NA	Water recycling and reuse quantities
i	Indoor air quality performance indicator	Deteriorating indoor air quality	Relevant indoor air quality standard.	Regular monitoring and follow-up action
j	A more diverse and natural environment	Enhance biodiversity	NA	No. of tree planted.
k	Perform in an environmentally responsible manner	Less energy consumption and natural resources depletion	NA	Training hours
l	Green procurement	Less energy consumption and natural resources depletion	NA	% of products with green labels.