

Australia Delegation 2008

- A Study on Sustainable Development



Delegation Report

Young Members Committee and
Continuing Professional Development Committee
The Hong Kong Institution of Engineers



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Message from Delegation Advisor



Ir Edmund K H LEUNG OBE JP
Delegation Advisor
Past President, HKIE

Back in the early 1990s, I led a YMC Delegation to Australia to look at railways, so this delegation helps me to re-live the pleasant memories of the previous event.

My role as a delegation advisor is not to lead or direct the planning or execution of the delegation activities. I focused more on providing information that helps to make the visits more meaningful, but more importantly, to provide advise to avoid pitfalls experienced in previous activities.

I found it most pleasant for this delegation that the leaders and members are most receptive of new and different ideas. They are always eager and positive to try them out, while noting the possible risks that may occur and take actions to minimize them. Needless to say, the actual visit has proven to be most informative and useful. There is stark contrast between a geographically compact city in Hong Kong and a vast country with scanty population in Australia. We may be subjected to the similar natural constraints, as Newton's Laws of physics do not differ in different countries, but we learned that application of such theories requires rather different engineering solutions. As an example, due to the low relative humidity in Australia, the use of chilled beams for room cooling is effective in Australia, but we would not apply this technology in Hong Kong as we heavily depend on forced air circulation to control humidity. Likewise, the successful application of surface water collection and storage for recyclable materials will find many hurdles in Hong Kong where we do not even have sufficient space for separate collection bins for domestic wastes. These observations proved most educational for us.

Overall, the benefits gained in this delegation extend far beyond the observations at the visits. The lessons learned and experience gained in collecting information, setting priorities to condense the wish-list to the actual visit programme, and the measures taken to circumvene problems encountered while firming up the programme, all helped to add useful experience to all.

Finally, the concerted efforts spent in compiling this report, which hopefully will be used not only as an information booklet for other engineers, but also as a useful reference book for future delegations, serves to complete the whole process of experience build up for our delegation team members.

I thoroughly enjoyed my participation.

Message from Delegation Manager



Ir Johnson K C LEE

Delegation Manager
Immediate Past Chairman,
Young Members Committee
(YMC), HKIE

Young engineers understand the importance of achieving sustainable development of our city and at the same time equipping themselves with up-to-date knowledge. In this regard, the Young Members Committee (YMC) took the lead to organise a delegation to Australia with a view to studying the country's achievements in sustainable development. In particular, the delegation has investigated the infrastructure development, green buildings design and water and energy resources management through meetings with various engineering professional bodies and companies and visits to major engineering infrastructures and production plants in three of the fast-growing cities - Sydney, Brisbane and Gold Coast.

The delegation also organised two gatherings with the HKIE Australian Chapter in Sydney and Brisbane, attended by our members currently working there. Besides, a series of local seminars and visits were organised to enrich members' knowledge on key sustainable development issues.

On behalf of the Delegation Team, I would like to take this opportunity to thank all our hosting organizations which gave us the chance to meet their professionals and to visit their renowned projects. Their kind arrangements have made to realize our overseas trip.

We have gained the support from a team of advisors. I am very pleased that two of our advisors, Ir Dr WK Lo, the HKIE President and Ir Edmund Leung, Past President of HKIE, who was also the advisor leading the first YMC delegation to Australia, have traveled with us in the Australia trip and participated in the core programme of the delegation. We are also privileged to have invited another advisor, Ir Otto Poon, Past President of the Institution, to share with us in a local seminar on the ways to achieve sustainable development in the 21st Century from an engineering perspective. The delegation was organised in collaboration with the Continuing Professional Development Committee (CPDC). We are honoured to have three other advisors nominated from the Committee, Ir Victor Lo, Ir CS Lam and Ir WK Leung, who are very dedicated to our Delegation. Special thanks should also be given to CPDC Chairman, Ir Peter PF Chan.

Our advisors have shown their full support to this event from planning the delegation events, advising on our programme, and, finally, to preparing the delegation report. Please let me express, once again, our truthful thanks to them. We really appreciate the financial support from all the sponsors. Their continuous support has given us a very big encouragement and has made the delegation a successful one.

This report is written by the whole delegation team and has been distributed to major engineering organizations and companies in Australia and Hong Kong. I hope you will find the information useful in equipping you with the latest knowledge of sustainable development with reference to Australia's experience.

Despite having finished this report, we have not ended our study. Our team of delegates will continue to endeavour to contribute to the sustainable development of the engineering profession and the Hong Kong society and to build a better world.



Introduction

B Introduction

Background

Since 1991, the Young Members Committee (YMC) of the Hong Kong Institution of Engineers (HKIE) has been organising delegations to different parts of the world, including Mainland China, Southeast Asia, Europe, the United States and Australia. Each delegation has its own theme related to some of the hotly debated engineering issues.

Theme of Australia Delegation 2008 – A Study on Sustainable Development

Sustainable development has become a hot topic to ensure the quality of our living environment for the next generation. Over the past two decades, there has been growing international recognition that future development should be sustainable. Many of the well-developed countries emphasize a lot and implement the concept of sustainable development in their future development plan. Hong Kong, as a well-developed city targeting to position itself as an Asia's world class city, should also introduce more sustainable development elements into its future planning. Citizens, different business sectors and government departments work in partnership to achieve sustainable development of Hong Kong.

Sustainable development has been defined in many ways, but the most frequently quoted definition is from *Our Common Future, also known as the Brundtland Report*: "Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs." It emphasizes the balance and integration of the three sustainability pillars of economic development, social harmony and environmental protection.

One of the key components of sustainable development is a conscious consideration of the needs of the future generations. Today's young people will inherit many of the environmental, social and economic problems that have been created over the last century. YMC has long recognized the importance of achieving sustainable development of our city and well understood the challenges to be faced by the young professionals. Young people will ultimately bear the responsibility for implementing the policies of sustainability and building a sustainable world.

In 2004, YMC organised a delegation to Shanghai, China and attended the World Engineers' Convention to study the global sustainable development issues. Following the success of the Shanghai Delegation 2004, YMC in collaboration with the Continuing Professional Development Committee (CPDC) of HKIE organised a delegation to Australia, a more advanced country in respect of sustainable development in March 2008, with the following objectives:

- To acquire new experience on sustainable development from Australia with particular focus on investigating the state policies, infrastructure development as well as new technologies towards sustainable development;
- To encourage young engineers' participation in international arena by meeting Australia's engineering bodies, policy organisations and practicing engineers;
- To arouse the attention of HKIE members to the importance of sustainable development; and
- To promote the professional image of HKIE and Hong Kong engineers.

Composition of Delegates

The whole delegation process started from the selection of delegates. A total of 14 delegates were selected from applicants who are young engineers of the Institution. The selected delegates are specialized in a wide variety of engineering disciplines, including civil, structural, geotechnical, building services, environmental, electrical, gas and energy. Currently they work in different sectors of the engineering profession, including government departments, public organizations, consulting companies, utility undertakers and universities. The composition makes the delegation a representative one from Hong Kong young engineers.



Choice of Cities in Australia – Sydney, Brisbane and Gold Coast

Most of the population in Australia lives along the temperate southeastern coastline. Sydney, Brisbane and Gold Coast are three of the most populous cities located in the region. A brief description of the cities and the reasons for choosing these cities as our destinations are given below.

Sydney, New South Wales

Sydney is the largest and the most populous city in Australia, with a metropolitan area population of approximately 4.3 million. It is also the state capital of New South Wales. Sydney is a major international tourist destination notable for its beaches and twin landmarks: the Sydney Opera House and Harbour Bridge. The metropolitan area is surrounded by national parks and contains many bays, rivers and inlets.

Sydney is the most important business hub in Australia. Most major Australian companies, as well as numerous international companies, have their offices and even headquarters in the city. Various engineering institutions and organizations also have most of their members working and residing there. Sydney was chosen as one of our visiting cities as it is an ideal

place for Hong Kong engineers to meet Australian professionals and visit major engineering companies and organizations.

Brisbane and Gold Coast, Queensland

Queensland's economy has enjoyed a boom in the tourism and mining industries over the last twenty years and the state will remain Australia's fastest growing economy in the foreseeable future. Among various cities in Queensland, two of the fast-growing cities in the State, Brisbane and Gold Coast, have been chosen as our destinations for studying. Both cities are now undergoing rapid growth and there are ample opportunities for advanced engineering development.

Brisbane is the state capital of Queensland. It has a population of about 1.8 million people, and is the third-largest in Australia, and most populous city in Queensland. Since the late 1990s and early 2000s, the State government has been developing technology and science industries in Queensland as a whole, and Brisbane in particular, as part of its "Smart State" initiative.

Gold Coast is a city and local government area in the southeast corner of Queensland. It is the second most





Introduction

populous city in the state and the sixth most populous city in the country. Currently, it has a population of about 0.5 million people. Gold Coast City is renowned for its sunny subtropical climate, popular surfing beaches, a skyline dominated by high-rise apartment buildings, and a wide variety of tourist attractions.

Both cities are ideal places for HK engineers to study new technology regarding sustainable development and to visit major engineering projects and production plants.

Topics of our Study

Sustainable Development is a large subject and for effective study outcomes we have confined the study in four areas, namely

- Infrastructure Development (Details can be found in Section C1 of the Report)
- Green Building Design (Details can be found in Section C2),
- Energy Resources Management (Details can be found in Section C3) and
- Water Resources Management (Details can be found in Section C4)

The Australia Delegation 2008 comprises the following three elements:

1. Organising a delegation to Sydney, Brisbane and Gold Coast cities in Australia from 2 March to 9 March 2008. The

overseas programmes included meetings with engineering professional bodies and related public organisations, visits to engineering infrastructures and plants as well as attending technical seminars presented by prominent speakers.

2. Organising a series of local seminars and visits related to the theme of the delegation in HKIE. The local events aimed to enrich members' knowledge on key sustainable development issues in Hong Kong and to arouse the attention of the members to the importance of achieving sustainable development of our city.
3. Publishing this Report and organising a presentation reporting the findings from the delegation study, drawing analogy with the Hong Kong practices. This report has been distributed to the visiting organizations and companies in Australia and major engineering organizations and companies in Hong Kong.



Fig B1.1 Group photo at Sydney Opera House



Fig B1.2 Group photo at Brisbane



Contents of the Report

This Report documents the findings and the events that were held locally and overseas.

It is divided into six sections. Section A records the messages from the delegation advisors, the chairmen of the organisers and the delegation manager. The introduction in Section B provides an overview of the delegation study, its theme and activities organised. The next section (Section C) looks more closely at the successes and challenges in respect of sustainable development in Australia in four areas, namely infrastructure development, green building design, water resources management and energy resources management. A comparison with the situation in Hong Kong is integrated in each of the areas discussed. Section D records the technical and social events that were held with the engineering organizations in Australia. Section E summarises the local seminars and visits organised. Section F provides a conclusion of the delegation study discussed. Followed by that will be the appendices to the Report, including profile of advisors and delegates, messages from delegates, acknowledgements to the supporting organisations, companies and sponsors and finally the financial statement.



Fig B1.4 Delegates attending a site visit in Gold Coast



Fig B1.3 Ir Dr W K LO shared his experience with HKIE Australian Chapter



Fig B1.5 Ir Edmund LEUNG shared his experience at Engineers Australia

Study on Sustainable Development

C1 Infrastructure Development

C1.1 General

Sustainable infrastructure development not only benefits to the people in the long run but also symbolises a city's wisdom in ensuring a sustainable city growth. Both the governments in Hong Kong and Australia make lots of efforts in improving their infrastructures. In the 2007-08 Policy Address of Hong Kong - A New Direction for Hong Kong, the Chief Executive Mr. Donald Tsang focused on promoting infrastructure development and emphasized that 'Infrastructure development can bring about huge economic benefits. It is equally applicable to Australia. Exploring the sustainable infrastructure development in Australia is one of the main focuses in the delegation. We are pleased to have the opportunities to meet the engineers in the Sydney Office of Maunsell Australia Pty Ltd and the Trackstar Alliance Office in Brisbane. Besides the delegation has visited some of the sustainable elements during the design and construction of the Sydney Olympic Park, from which HK engineers can learn a lot.

Brief descriptions on the organizations and projects that we have visited will be given below, followed by detailed explanation on how the Australian engineers deal with the engineering challenges from a sustainable development perspective.

C1.2 Introduction of Organizations Visited

C1.2.1 Maunsell Australia Pty Ltd – Sydney Office (Fig. C1.1)

On 2 March 2008, the delegates visited the Maunsell Australia Pty Ltd's Sydney Office. We are pleased to have Mr Stephen Bargwanna, Technical Director –Sustainability of Maunsell Australia Pty Ltd, to introduce Maunsell's achievements in ensuring the infrastructure projects' sustainability. Besides, the company's young engineers were invited to share their working experience and knowledge to the delegates.



Fig C1.1 Photo taken in Maunsell Australia Pty Ltd

One hotly debated subject which drives the need to provide engineering solutions in a more sustainable way as mentioned by Stephen is the climate change that the whole world experiences. Stephen introduced the climate change issues and addressed its associated effects on the existing and future infrastructure design. Stephen also demonstrated their efforts in coping with the engineering challenges in some of their projects in a sustainable manner. Examples of Maunsell's projects included Trackstar Railway Project, Northern Hume Highway Upgrade and Gerringong to Bomaderry Prices Highway Upgrade Projects. After having a fruitful discussion, we have the chance to visit a green building construction site in Sydney. The project visited was Skyvue Project. During the visit, we could learn the updated technology related to sustainability in the construction industry as well as the building services sector, e.g. chilled beam. Details of the visit can be referred to the section C2 under "Green Building Design".



Maunsell Australia Pty Ltd, has developed a tool called “The Agile Sustainable Development Process” to ensure the sustainability of infrastructure projects. This approach could provide a flexible and adaptable process for making large and complex projects more sustainable. The approach is summarized in the flow chart (Fig. C1.2) in which guidelines are given and questions are asked so as to access the projects’ sustainable considerations in the early design stage.

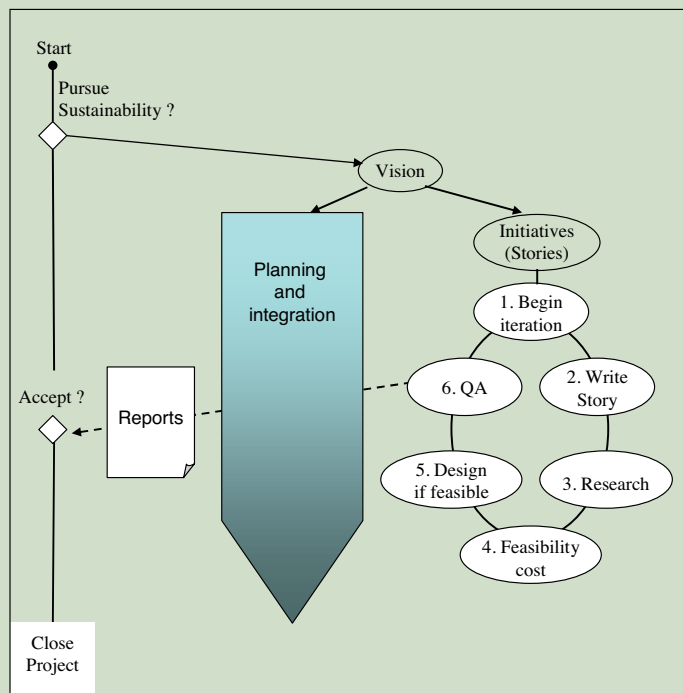


Fig C1.2 The Agile Sustainable Development Process

C1.2.2 Trackstar Alliance Milton Office in Brisbane (Fig. C1.3)

The TrackStar Alliance was created in June 2006 in response to the Queensland Government’s challenge to deliver rail infrastructure differently. It is a long term infrastructure delivery business that harnesses the best skills of five experienced business partners. They are QR, Thiess, United Group, Connell Wagner and Maunsell.

The TrackStar Alliance has a long term focus and is now delivering projects totalling more than \$1 billion as part of the South East Queensland Infrastructure Plan Rail’s (SEQIPRAIL) AUD\$7 Billion program. This is the largest ever investment in the future of rail in South East Queensland. SEQIPRAIL forms an important part of the Queensland Government’s South East Queensland Infrastructure Plan and Program (SEQIPP), which is a State Government’s \$82 billion 20-year programme to provide the necessary infrastructure to sustainably manage growth and enhance access to services and facilities in South East Queensland.

The rail projects undertaken by Trackstar Alliance included the followings:

- Caboolture to Beeburrum Track Duplication Rail
- Robina to Varsity Lakes Rail Extension
- Corinda to Darra Third Track Construction
- Beerburum to Landsborough Track Duplication Rail



Fig C1.3 Photo taken in Trackstar Alliance Office

Alliance formation is one of the special features for Trackstar Alliance. The formation of Trackstar Alliance is a long-term business partner that can provide comprehensive project delivery starting from conceptual design to project commissioning. The personnels from the alliance partner work under the same roof and quickly form partnering relationship under collaborative environment. The experienced and multi-disciplinary project teams work together from the early stage of the projects. Better cost planning and constructability are well incorporated in the project during preliminary design stage. Contrary to the conventional project procurement methods, alliance formation eliminates the disadvantages of the traditional adversarial process, in which designers and contractors are usually in confronting positions.

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C1.2.3 Sydney Olympic Park (Fig. C1.4)

Sydney was the host of the 2000 Olympic and Paralympic Games. While Sydney Olympic Park has several world class sporting and recreational venues and facilities, all of these facilities have been planned and constructed in a manner that maximises their environmental sustainability.



Fig C1.4 Photo taken in Sydney Olympic Park

During the visit to the Olympic Park, the delegates understood and appreciated that the Park has established a best practice example of sustainable urban development, world-class initiatives in energy management, water management and ecological management are offered by the Park's wide array of sporting facilities and 425-hectares of urban parkland.

C1.3 Sustainability considerations in the infrastructure project development

Through the presentations by Maunsell and Trackstar's officials and a visit to some of the facilities in the Olympic Park, delegates appreciated that in the Australian approach to best practice sustainability they strive to balance environmental, social and economic factors in a way that will ensure resource conservation and protection of the environment now and for future generations. In the following sections, we will elaborate how the infrastructure construction in Australia has taken environmental, social and economic factors into the account by making reference to some of the projects undertaken by Maunsell and Trackstar and our visit to the Sydney Olympic Park.

C 1.4 Sustainability Elements in the Sydney Olympic Park

C 1.4.1 Environmental Aspects

Maintaining Biodiversity - Species and Ecosystems Conservation

The parklands of the Sydney Olympic Park have been recognized and appreciated as a place that contains high species diversity and abundance, including species of local, regional, national and international conservation significance. The biological diversity of the remnant and constructed landscapes of Sydney Olympic Park is protected and enhanced through careful planning and design.

The Green and Golden Bell Frog is a ground-dwelling tree frog native to eastern Australia. (Fig C1.5 & C1.6) Many populations, particularly in the Sydney region, inhabit areas of frequent disturbance, such as golf courses, disused industrial land, brick pits and landfill areas. Though once one of the most common frogs in south-east Australia, the Green and Golden Bell Frog has endured major declines in population, leading to its current classification as globally vulnerable. Its numbers have continued to decline and they are threatened by habitat loss and degradation pollution.

Demonstrating the sustainability awareness in the design of the Olympic Park, the Green and Golden Bell Frog survives in the Brickpit at Sydney Olympic Park. Originally, this was the proposed site for the tennis courts for the 2000 Sydney Olympics. However, when the Green and Golden Bell Frog was found there, the tennis courts were built elsewhere, and the population has since been monitored. The Green and Golden Bell Frog has become an unofficial mascot for the area now. To allow visitors of the Olympic Park to discover the history of the Brickpit with the evolution of the Green and Golden Bell Frog's habitat along with the unique geology, the Brickpit Ring Walk was constructed.

The Brickpit Ring Walk (Fig C1.7), the 2006 National Trust Heritage Award Winner, is an elevated circular walkway that allows visitors to access and view the Brickpit from above while preserving the habitat of the endangered Green and Golden Bell frog. The Ring Walk is 550 metres in circumference and is raised 18.5 metres above the sandstone floor of the Brickpit.



The Ring Walk allows many people to experience the Brickpit while fully recognising it as a fragile habitat; it is like an Environmental Interpretive Centre and outdoor exhibition. On the circular viewing platform visitors can discover the history of the Brickpit with the evolution of the Green and Golden Bell Frog's habitat along with the unique geology. The interpretive materials are digitally printed directly on to the outer panel of the ring (Fig C1.8) with soundscapes of frog and bird calls. Located just outside the two entrances to the Brickpit Ring Walk are pieces of machinery that were salvaged from the original Brickpit (Fig C1.9).



Fig C1.7 Brickpit Ring Walk



Fig C1.8 Exhibition Board in Ring Walk on Green and Golden Bell Frog



Fig C1.5 Preserved habitat



Fig C1.9 Machinery salvaged from the original Brickpit



Fig C1.6 Green and Golden Bell Frog

Study on Sustainable Development

Resources Conservation – Water and Energy Sources

To operate a lot of facilities in the Olympic Game, a substantial amount of water is used and it is important to save water. The Water Reclamation and Management Scheme (WRAMS) is an excellent example of how innovative environmental technology has been used for water recycling and conservation. Key elements of WRAMS include (1) a water reclamation plant that removes water from sewage; (2) water storage reservoirs (3) a water treatment plant to filter and disinfect water from the water reclamation plant and storage and (4) a separate, dedicated supply system to pipe water from the treatment plant through Sydney Olympic Park and the surrounding area of Newington. (Fig C1.10)

WRAMS is designed to save more than 850 million litres of drinking water annually and was Australia's first large scale urban water recycling scheme. WRAMS supplies high quality recycled water to all sporting venues, commercial facilities and parklands of Sydney Olympic Park and the neighbouring residential suburb of Newington. Approximately 40% is used for toilet flushing and the remaining 60% is used for irrigation and operational wash-down activities. In addition, the sewer mining function of WRAMS diverts a significant volume of sewage from ocean outfalls, which would have otherwise been discharged into the Pacific Ocean. The stormwater storage capacity of WRAMS further minimises stormwater pollution, assists in providing viable habitat for fauna and is utilised in the water recycling process. Overall WRAMS has contributed to (1) reduction in consumption of drinking water by an additional 50%; (2) supply of approximately 500 million litres of recycled water in 2001/02; (3) treatment of approximately 550 million litres of sewage, which would otherwise be discharged to ocean outlets (4) in the long term, WRAMS will halve the use of potable (drinking) water at the Park and Newington.

Sydney Olympic Park showcases a variety of energy-efficient building designs and technologies which include the 30 metre high photovoltaic towers lining Olympic Boulevard (Figure C1.11 & C1.12), extensive use of rooftop solar collection systems and solar hot water systems, extensive use of natural lighting and ventilation, innovative solar technology to power water pumps within the parklands and extensive use of renewable energy sources ("Green Power").

The entire site serves as a physical demonstration of how a commitment to energy conservation can continue to be realised in terms of its supply, management and use. The Photo-Voltaic Lighting collectors were developed by UNSW and manufactured by BP Solar. Each tower has a generating capacity of 23 kilowatt hours (kWh) per day, equivalent to the amount of energy used to power a small house. Power is fed into the main grid during the day and drawn from the grid at night. When all towers are operating they can produce between 130-160,000 kWh of energy each year, equivalent to their estimated annual energy consumption. The towers gained the Development Infrastructure Award and Environmental Engineering and Excellence Award for the innovative design.

The Olympic Park has been recognized nationally for its integrated approach to water and energy conservation, innovative water management practices and protection of biodiversity. It is clear that urban water recycling systems such as WRAMS are instrumental in resolving or sustainably managing much of the high priority urban water problems. Australia now needs to make schemes like WRAMS the norm not the exception.



Fig C1.10 Water Treatment Plant in Sydney Olympic Park



Fig C1.11 Photovoltaic towers lining Olympic Boulevard



Fig C1.12 High photovoltaic towers in Sydney Olympic Park

C1.4.2 Economic Aspects

Acting Sustainability as Business

In the planning and construction of Sydney Olympic Park, economy has been considered and it is worthwhile to act sustainability as business. For the Sydney Olympic Park, the selection of materials for use in new developments

and the modification, maintenance, repair and refurbishment of existing assets consider whole-of-life impacts on the environment. Development, events and management practices minimize the use of materials which deplete natural resources or create toxic pollution in their manufacture, use or disposal. Sustainability not only save our world, but also acts as a business which benefits different business organizations and boost the economy of the world. The successful delivery of the 'Green Economy' at Sydney Olympic Park saw the town established as a national destination for sustainable industries, businesses, research institutions, environmental organizations and government agencies. The Australian sustainability sector is projected to be worth \$40 billion per year by 2012. The Australian environment industry has national and international dimensions and involves participation by all levels of Australian government; incorporates large, medium and small enterprises; involves all major Australian Universities and, is supported by all education sectors.

C1.4.3 Social Aspects

Enshrining the principles of social equity and opportunity into the future development of the township at the Park is a strong management priority for the Sydney Olympic Park Authority.

There are a range of existing management strategies to ensure an amenable, safe and accessible experience for visitors, workers and students at the Park. These include effective way-finding signage, accessible designs, access to public transport, extensive pedestrian/cycle networks, visitor services, interpretive tour products, educational programs and cultural experiences. In addition the Olympic Park has established strong partnerships with surrounding local government areas, State and Federal governments and community organisations.

The future development town at Sydney Olympic Park will embody the principles of social sustainability. The key social strategies address social infrastructure (facilities, services etc); social diversity (including housing mix); community engagement and participation; amenity safety and wellbeing; regional leadership and social equity and accessibility.

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C 1.5 Sustainability Elements in Highway and Railway Development Projects

Promoting the use of rail services

The Australia government aims at improving the public transportation system and in particular its railway system network from the main city to the neighboring regions and to the suburb areas. The government of different cities, including Brisbane has identified railway as a sustainable mode of transport. In order to reduce the carbon emission from transportation, the government encourages people to use the railway systems which are more environmentally friendly and have a large passenger carrying capacity.

C 1.5.1 Environmental Aspects

Every infrastructure project aims to provide convenience to the public and to improve people's quality of life. It is important to ensure that construction of the projects will not adversely affect the environment. Therefore minimizing environmental impacts arising from the highway and railway development projects is an important consideration during their design, construction and operation phases.

Offset planting

To offset the vegetation removed for the railway construction project in Queensland, some replanting has been undertaken within the Caboolture Shire to Beerburrum Track Duplication. Offset planting is a way to create new habitats that will maintain the regional ecosystem status. Offsetting can occur in different ways such as rehabilitating weed infested areas, planting vegetation or planting more vegetation than the amount removed to increase the size of a habitat. During the construction stage of the Caboolture to Beerburrum Track Duplication Project, the alliance's environmental team has spent much effort to compensate for the vegetation removed for the new rail corridor by implementing the project's off-set planting scheme.

Wildlife relocation

Each railway project undertaken by Trackstar has a detailed Environmental Management Plan outlining how impacts on the local environment can be minimized. In the Robina to Varsity Lakes Extension project, the project team formed partnerships with Gold Coast wildlife experts and indigenous communities as part of

the construction programme. The team worked with the experts to investigate and survey the construction sites and identify animals, their habitats and organic matters being affected prior to site clearance. The team incorporates sustainable wildlife relocation to ensure that the removed wildlife does not die or displace other animals living outside the rail corridor. Trackstar also implemented similar wildlife relocation scheme in other projects and in the Caboolture to Beeburrum Duplication project, more than 800 animals including amphibians, mammals and reptiles were successfully relocated from the construction site.

C 1.5.2 Economic Aspects

Reducing Capital Cost by adopting sustainable design

It is always making people hang back on sustainability as businessmen always think that it is costly as lots of researches are required and it is not worthwhile to invest on it. However, from the trip of Australia, we found that it is not a must to lose money when investing in sustainable design. With sustainability, we not only save the environment and gain the reputation, but are also able to reduce the capital cost if it is able to make use of the characteristics of sustainable development. In the example as introduced by Maunsell Sydney Office, the engineers were able to discover the merit of sustainable development and able to reduce the electricity expense by optimization.



Fig C1.13 Solar road studs



Take Northern Hume Highway Upgrade Project as an example, it was found that the overall life cycle cost of a sustainable design was lower than a traditional design. In this Highway Upgrade project, mast lighting was required to install on the road, which is the usual practice. By thinking the design in a sustainable way, an installation of solar road studs was raised out. (Fig 1.13) In comparing the solar road stud with the mast lighting, it was found that the construction cost of solar stud is a little bit higher. However, after calculating the whole life expense, which included, besides construction cost, the maintenance and operation costs of mast lighting, the solar stud is much more economical than the mast lighting. Therefore solar stud was installed instead of traditional mast lighting.

C 1.5.2 Social Aspects

Incorporating the principles of social equity and opportunity into the development of the highways and railway projects is an important management strategy for the project proponents.

There are a range of existing management strategies to ensure an amenable, safe and accessible experience for users. These include effective way-finding signage, establishing close relationship with surrounding local government areas and community organisations. Public engagement and local communities' participation are well considered throughout the planning, design, construction and operating stages of the projects. The measures taken address the concerns from the public at every project stage and as a result public's understanding and acceptance of the projects can be enhanced.

C1.5 Analogy with HK situation

C1.5.1 Latest Infrastructure Policy in HK

In the 2007-08 Policy Address - A New Direction for Hong Kong, the Chief Executive Mr. Donald Tsang focused on promoting infrastructure development and addressed that 'Infrastructure development can bring about huge economic benefits. Both employment opportunities and wages will increase during the construction stage, and, upon completion, the infrastructure projects will boost economic activities and improve the living environment.' The Chief Executive targets to push ahead with 10 large-scale infrastructure projects, in

which four of them are railway projects, within his term of office. These infrastructure developments will consolidate Hong Kong's status as a global city and lay a new foundation for our sustained development in the future.

Australia aims at improving the public transportation system and in particular its railway system network from the main city to the neighboring regions and to the suburb areas, this is evident from the railway projects undertaken by the Trackstar Alliance. This infrastructure strategy has put in place in Hong Kong at the same time. In order to reduce the carbon emission from transportation, both governments in Hong Kong and Australia are encouraging people to use the railway system which is more environmentally friendly and regarded as a sustainable mode of transport.

Besides, we can see at the Policy Address, the main focus in the railway system in Hong Kong will be to provide fast and direct cross border transportation to the neighboring Pearl River Delta Region and to extend the current railway network to medium-densed districts so as to improve connections between communities. The railway projects both in Australia and HK aim at providing transport to meet the fast growth in the new development area, vital to the sustainable development of the cities. Therefore, several railway projects are under construction and plan to construct in Australia and Hong Kong.

C1.5.2 Environmental Protection and Public Consultation

Through the meetings with engineers in Maunsell Sydney Office and Trackstar Alliance's Brisbane Office as well as the site visit to the Olympic Park, we can recognize that Australia puts lots of emphasis in ensuring the infrastructure development would not jeopardize the environment, this include offset planting, wildlife conservation as well as resources conservation.

In Hong Kong, the Environmental Impact Assessment Ordinance (EIAO) comes into operation on 1 April 1998, in which the Ordinance aims to avoid, minimize and control the adverse impact on the environment of projects. Under the Schedule 2 and 3 of the Ordinance, the Designated Projects, which are projects and proposals potentially, having adverse impact on the environment, are listed requiring Environmental Permits and requiring



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Environmental Impact Assessment reports.

Under the statutory EIA process, the person planning the designated project is required to apply for an EIA study brief, proceed with the EIA study and seek approval of the EIA report or seek a permission to apply directly for an environmental permit. Applying for an EIA study brief, the applicant is required to submit a Project Profile, addressing background information for the project, potential environmental impacts, existing and planned sensitive receivers and environmental protection measures. The Project Profile is then exhibited to the public for consultation. After the consultation period, the Director of Environmental Protection will issue an EIA study brief to the applicant within the statutory time limits, taking into account the information in the project profile, the public comments, and the comments from the Advisory Council on the Environment.

As noted above, Australia spends much effort in conserving the environment while developing the infrastructure, in particular their efforts to conserve the wildlife. In Hong Kong, we do share similar experience. With the continual effort from different parties, including the involvement of the public through the EIA process, the environmental impacts arising from the infrastructure development could be scrutinized and minimized. For example, in the Lok Ma Chau Spur Line Railway Extension, a number of possible horizontal and vertical alignments were considered. Selection of the tunnel option was based on the need to meet environmental, engineering, railway operation and safety requirements as described in its EIA. No above ground works were carried out within the ecologically sensitive Long Valley area. Additionally, as part of the long term mitigation measures to the disturbance of ecology, 4.9 ha of marsh was formed within the compensation area, the majority forming a buffer zone to the south of the Lok Ma Chau Station.

Furthermore, the protection of biodiversity and heritage is getting more and more important in Hong Kong and many infrastructure development considered the environment preservation important. Similar to Australia, the Hong Kong government pays more attention on public engagement in which the government would gather citizens' opinions in

constructing the infrastructure with incorporation of their comments.

C1.5.3 Economy

From the macro point of view, the infrastructure projects both in Australia and HK add significant value to the economy. For the railway projects handled by the Trackstar Alliance, more than 1000 jobs have been created with this part of SEQIPRAIL's \$7 billion program. The local community would be benefited from the projects by recruiting from local community, selecting local contractors and advocating the use of local services and goods providers. As stated in the Chief Executive's Policy Address, a rough estimate of the added value to the economy brought about by the 10 infrastructure projects would be more than HK\$100 billion annually, amounting to some 7% of our GDP in 2006. In addition, some 250 000 additional jobs would be created.

References

- [1] Hong Kong 2030: Planning Vision and Strategy Final Report, Hong Kong [available at <http://www.devb-plb.gov.hk/eng/business/pdf/LegCoBriefHK2030.pdf>]
- [2] 2007-2008 Hong Kong Policy Address, Hong Kong [available at <http://www.policyaddress.gov.hk/07-08/chi/policy.html>]
- [3] Trackstar, Australia [available at <http://www.trackstar.com.au>]
- [4] Sydney Olympic Park, Australia [available at <http://www.sydneyolympicpark.com.au/>]



C2 Green Building Design

C2.1 Introduction

There has been a rising concern of energy consumption by buildings and built environment as it is related to the environmental sustainability of a city. In this delegation, some of the green building elements in Australia were studied and identified. They include building energy codes and assessment schemes and chilled beam system in some of the major buildings in Sydney and Brisbane. Details of these subjects are described in the following sections.

C2.2 Green Building Codes and Assessment Tools in Australia

C2.2.1 Building Code Australia

The Australian Building Codes Board (ABCB) has developed "Building Code Australia" (BCA). (Fig C2.1) This code aims to enable the achievement of nationally consistent, minimum necessary standards of health, safety, amenity and sustainability objectives efficiently. The code consists of technical provisions for the design and construction of buildings and other structures, covering matters such as structure, fire resistance, access and egress, building services and equipment, energy efficiency as well as certain aspects of health and amenity.

There is a section which covers the building energy efficiency in BCA. The areas covered by this code include the building fabric, glazing, building sealing, air movement, air conditioning & ventilation, artificial lighting and power and hot water supply system. There are two additional handbooks on energy efficiency of the building, namely Efficiency Provisions for BCA 2006 – Volume One Information Handbook and Efficiency Provisions for BCA 2006 – Volume Two Information Handbook. These information handbooks are developed by ABCB and the Australian Greenhouse Office (AGO).



Fig C2.1 Building Code Australia (BCA)

C2.2.2 Green Building Assessment Tools

There are several green building assessment tools in Australia, for example, Green Star, Australian Building Greenhouse Rating, AccuRate, Building and Sustainability Index (BASIX), Building Energy Rating Scheme (BERS), etc [1]. In this report, two of the most common assessment methods are discussed.

Green Star (Fig C2.2)

It is the first and most comprehensive green building assessment tool in Australia. It is developed based on the Leadership in Energy and Environmental Design (LEED) and Building Research Establishment Environmental Assessment Method (BREEAM)[2]. The aims of developing Green Star are to define a green building by establishing a common language and standard of measurement, to promote an integrated and whole building design, to identify building life-cycle impacts, to raise awareness of green building benefits, to recognise and reward environmental leadership and to transform the built environment.

Green Star has six star ratings: four-star represents the best practice, five-star represents "Australian Excellence" and a six-star building is recognised as "World Leadership".

Green Building Council Australia (GBCA) is in-charge of the Green Star assessment in Australia. GBCA is a national, not-for-profit organization that is uniquely supported by both industry and government across the country. Launched in 2002, the Council's mission is to develop a sustainable property industry for Australia and to drive the adoption of green building practices through market-based solutions.



Fig C2.2 Green Star Award



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Australian Building Greenhouse Rating (ABGR)

The Australian Building Greenhouse Rating (Fig C2.3) provides assessments of the greenhouse intensity of office buildings by awarding a star rating on a scale of one to five. It is the first assessment scheme to help building owners and tenants in Australia to benchmark their building's greenhouse gases performance. Buildings identified by the Australian Building Greenhouse Rating scheme [3] with a high star rating will be more energy efficient and cheaper to run, and will result in lower greenhouse gas emissions.

Separate components of a building can be rated based on 12 months energy consumption data. A base building rating measures the performance of those services provided by the building manager/landlord; and a tenancy rating measures the services for which the tenant is responsible. A whole building rating measures the combined effect.



Fig C2.3 – Australian Building Greenhouse Rating

The Australian Building Greenhouse Rating scheme is a national programme. It is administrated regionally by various government agencies. The NSW Department of Environment and Climate Change (DECC), as the developer of the scheme, acts as the National Administrator.

C2.2.3 Visit to Green Square

Special thanks are expressed to Prof David Hood and Mr Ed Crouch for arranging a visit to Green Square South Tower (Fig C2.4) so as to allow us to appreciate the sustainable features in a green building. (Fig C2.5) Green Square South Tower is the first commercial building in Queensland to be awarded a Green Star rating from the Green Building Council of Australia and has set new benchmarks for sustainable commercial construction within Queensland. The project was awarded a five-star Green Star rating for Office Design in July 2006 representing Australian's excellence. The building is of 17,340m² with four levels (including the ground floor). Some of the achievements in certain green building components are tabulated in Table C2.1.

Table C2.1 – Major Green Building components for Green Square [6]

<p>Management</p> <p>Green Star Accredited Professional on consulting team</p> <p>Extensive commissioning and involvement of an independent commissioning agent</p> <p>Comprehensive environment and waste management plans (80% diversion from landfills)</p>	<p>Transport</p> <p>Archived maximum points under the Transport category with excellent public transport amenity</p> <p>Cyclist facilities for staff (Fig. C2.7)</p>
<p>Indoor Environment Quality</p> <p>Daylight glare control</p> <p>Carbon dioxide monitoring and control</p> <p>Lighting system incorporating high frequency ballasts and limiting electric lighting levels to 400Lux maximum at the working place</p> <p>Acoustic performance within recommended limits</p> <p>Low-emission formaldehyde product sand low-VOC finishes</p>	<p>Water</p> <p>Full points achieved for occupant amenity potable water efficiency via water-efficient fittings and fixtures resulting in estimated water savings of 1,700,000 litres per year;</p> <p>Rainwater captured and used for landscape irrigation and toilet flushing</p>
<p>Energy</p> <p>Energy efficient T5 lamps used for the office lighting (Fig. C2.6)</p> <p>Electric lighting density of less than 2W/m² per 100 lux</p> <p>Perimeter lighting switched separately to take advantage of good natural light from the façade</p> <p>Lighting in car parks operated after hours by movement sensors</p> <p>Amenities lights on office floors activated by movement sensors in the access corridors</p>	<p>Materials</p> <p>Dedicated and adequately sized recycling areas</p> <p>Many recycled materials used</p>
	<p>Land use and Ecology</p> <p>Effective redevelopment of a site</p> <p>Preserving ecological value of the site</p>
	<p>Emission</p> <p>Zero-ODP refrigerants and insulants</p> <p>No light pollution from exterior lighting</p>



Fig C2.4 Green Square South Tower



Fig C2.6 Energy efficient T5 lamps used for the office lighting



Fig C2.7 Cyclist facilities in Green Square



Fig C2.5 Group photo taken at Green Square

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C2.2.4 Analogy with Hong Kong Practices

Building Energy Codes in Hong Kong (Fig C2.8)

In Hong Kong, there are several commonly used building energy codes. The earliest building energy code in Hong Kong is the Code of Practice for Overall Thermal Transfer Values (OTTV). This code was launched by the Buildings Department in 1995. It governs the building envelope design based on the assessment on thermal heat transfer. Currently, the maximum values allowed by the code are 30W/m² for office and 70W/m² for podium. Currently, this is the only code required compulsorily by the government.

From 1998, another four building energy codes (BECs) were introduced by the Electrical and Mechanical Services Department (EMSD). These codes govern building services related systems such as lighting, air-conditioning, electrical and lift & escalators. The aforesaid codes are prescriptive based, which may not be applicable to all building design. Therefore, a performance based energy code was launched in 2003, namely Performance Based Building Energy Code (PB-BEC). This code employs the concept of total energy budget which allows more flexible building design. However, these codes are not of mandatory implementation. Up to November 2007, only 1,981 certificates are issued in 791 buildings venues and over 75% are government buildings [4]. During the preparation of this delegation report, our government has finished the public consultation on the mandatory implementation of BEC. It is expected that with the mandatory implementation of BEC, more buildings will adopt the code of practice.



Fig C2.8 Building Energy Codes (BECs)

Green Building Assessment Tools in Hong Kong

Building Environment Assessment Method (BEAM, formally known as HK-BEAM) is a commonly used green building assessment tool in Hong Kong. The BEAM (Fig C2.9) was launched in 1996 which is maintained by Business Environment Council (BEC). BEC is an independent, non-profit organization set up by private sector as an environmental solution provider.

BEAM is developed based on Building Research Establishment Environmental Assessment Method (BREEAM) [5]. It is expected that after the assessment of BEAM, the building will be safer, more comfortable, more functional and more energy efficient than ordinary building. Occupants can be more healthier owing to the improved in air quality. BEAM covers several aspects, such as hygiene, health, comfort, amenity, land use, site impacts, transport, use of materials, recycling of waste, water quality, water conservation, water recycling, energy efficiency and energy conservation.

There are four ratings available in BEAM namely, Bronze, Silver, Gold and Platinum. For each class, it requires the building to have achievement on the overall aspects and to fulfil a minimum requirement in built environment. BEAM has two assessment schemes, one for new building and one for existing building.

During the past few years, BEAM has demonstrated its importance as a successful model for green building assessment for high-rise buildings. It is expected that as BEAM assessment is becoming more popular, the built environment standard in Hong Kong will be continuously improved.



Fig C2.9 Building Environment Assessment Method (BEAM)



C2.3 Chilled Beam Technology

Thanks to Mr Stephen Bargwanna, Technical Director - Sustainability of Maunsell Australia Pty Ltd, the delegation has a green building construction site visit of 'Skyvue Project' where chilled beam technology has been employed. A brief explanation of the principles of chill beam system will be given first, followed by description of the chilled beam system in Skyvue Project.

Chilled beam technology offers facility executives the opportunity to save energy, reduce mechanical noise and improve indoor air quality in retrofit, renovation and new construction projects. Chilled beams are not building structural elements. They are heating, ventilation and air-conditioning (HVAC) components that circulate chilled or hot water and are designed to induce room air flow to cool or heat the space. Chilled beams get their name from their typically long and slender shape. There are two main types of chilled beams: passive and active.

C2.3.1 Passive Chilled Beam

Passive chilled beam can be thought of simply as a fin tube radiator that is located in the ceiling cavity. [7] The primary application is used as a mechanism to treat the heat gain from a building's perimeter and to enhance the effectiveness of displacement ventilation system (underfloor air distribution). Passive chilled beams are located above perforated metal tiles so that air can flow from the occupied zone to the beam in the ceiling cavity. Fig C2.10 shows the air flow from a heat source to be cooled by a passive chilled beam. It uses the principle of natural convection - air between the coils inside the chilled beam cools and falls into

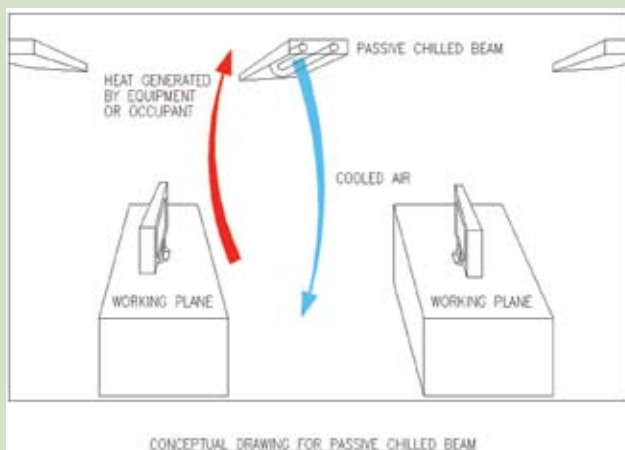


Fig C2.10 Air flow from a heat source to be cooled by a Passive Chilled Beam

the occupied zone (indicated as blue arrow) while air that is heated in the occupied zone rises (indicated as red arrow) and is drawn into the void created by the descending cool air. Ventilation air (100% outside air) can be supplied to everywhere in the working area.

C2.3.2 Active Chilled Beam

Active chilled beams are considered "active" because they are connected to an air handling unit and provide ventilation air to a space through nozzles as shown in Fig C2.11. The nozzles are referred to as "induction nozzles" because when they supply primary air into the occupied space, they create a pressure differential in the beam across a cooling coil. This pressure differential induces air flow across the coil thus providing cool air, recirculates air into the space (indicated as blue arrow) and turns into the engine which draws warm room air (indicated as red arrow) to the beam and across the radiator. Active chilled beams are mounted flush with an acoustical tile ceiling provide both locally recirculated air and 100% outside air. Fig C.2.12 illustrates the circulation pattern by using active chilled beams.

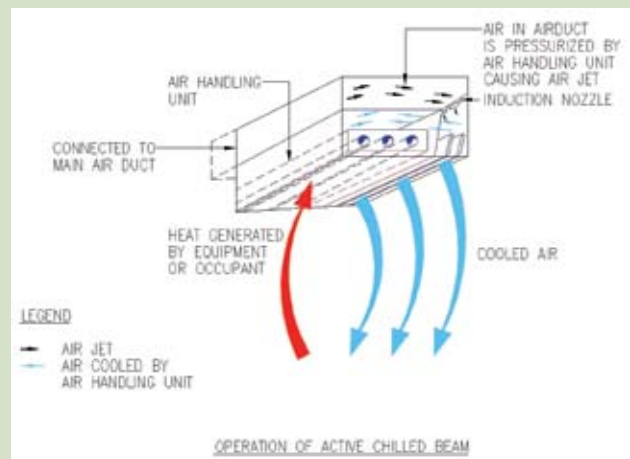


Fig C2.11 Operation of Active Chilled Beam

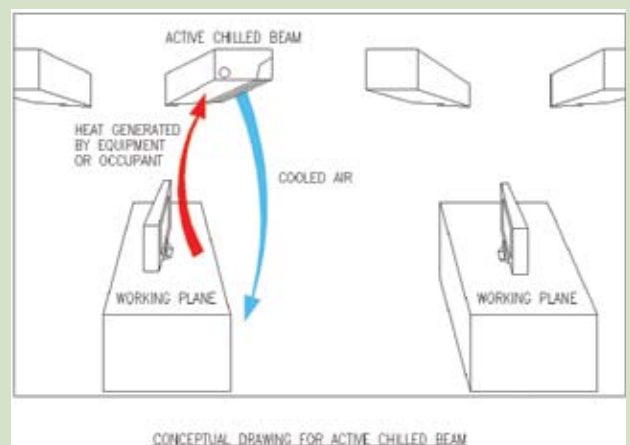


Fig C2.12 Air Flow from a heat source to be cooled by an Active Chilled Beam



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C2.3.3 Advantages of Chilled Beam Application

Some advantages of chilled beam technology [8] can be found as follows:

- The floor-to-slab height can be minimized, achieving space savings as no high-volume ductwork is occupied;
- Low running costs due to minimal maintenance requirements;
- Low maintenance/high life expectancy as no moving parts;
- Beam aesthetic can be customized to client requirements;
- High level of occupancy thermal comfort as well as no drafts, even cooling, and more pleasant cooling temperatures;
- Low fan speed used to deliver air to the outlet diffusers can lessen energy requirement (energy used by a fan is proportional to the cube of the fan speed).
- Operating at relatively high chilled water flow temperature meaning the chiller has to do less work than for, say, a fan coiling system.
- By using computerized building automation control system, humidity levels can be controlled and hence low risk of mold growth.

There are some differences between using a passive and an active chilled beam. The following table (Table C2.2) shows the comparison between the two systems:

Table C2.2 – Comparison of using Passive Chilled Beam and Active Chilled Beam

Description	Passive Chilled Beam	Active Chilled Beam
Principle	Natural convection	Pressurization and heat induction
Component	Linear finned cooling or heating coil	Supply air duct; Air handling unit; Induction nozzles Fins
Operation	Warm air rises to the ceiling and enters the top of the beam, where it is cooled by contacting with the cold coil. The cool air descends into the room through outlet slots on the underside of the beam	The unit connected to the room's primary air supply ducts, mixing supply air with existing air that is cooled by the coils, which is then distributed through diffusers in the ceiling
Ceiling	Perforated metal tiles	Perforated metal tiles; Gypsum panel

C2.3.4 Visit to Skyvue Project

Skyvue Project, is a \$50 million, 17,500 m², project which involved the redevelopment of the former Nock & Kirby Building, located at 413-421 George Street, Sydney, into 12 levels of Grade A commercial building with two levels of retail tenancy and basement level as car parking.

There is an atrium in the centre of the building. Linear bar grille is adopted to transfer sufficient conditioned air to this large void. All the main HVAC equipments such as chillers, air handling units, exhaust fans, etc. are located at the basement as well as the topmost level of the building and discharge to the roof. A total of chillers serve the building: two for commercial area, one for retail and one for emergency. For the office, both passive and active chilled beams (Fig C2.13) have been adopted and the return air is treated by air handling unit at the corner of the building. Typical chilled beams are located above perforated metal tiles inside the ceiling void. (Fig C2.14) It was found that air diffusers in swirl type (Fig C2.15) were installed for the supply of air. The pattern (Fig C2.16) enhances the transfer of the supply air down to the lowest part of the room. The turbinate air can circulate throughout the headroom entirely. As a result, the heat convection can be more effective from the occupied zone to the beam in the



Fig C2.15 Swirl pattern of air diffuser at the back



Fig C2.16 Air diffuser at the perforated metal tiles



Fig C2.13 Active Chilled Beam



Fig C2.14 Cooling coils and fins of Passive Chilled Beam inside ceiling void

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ceiling void. The sufficient headroom provides enough time and space for the heat convection. The schematic diagram illustrates the operation of the chilled beam system used in the building. (Fig C2.17)

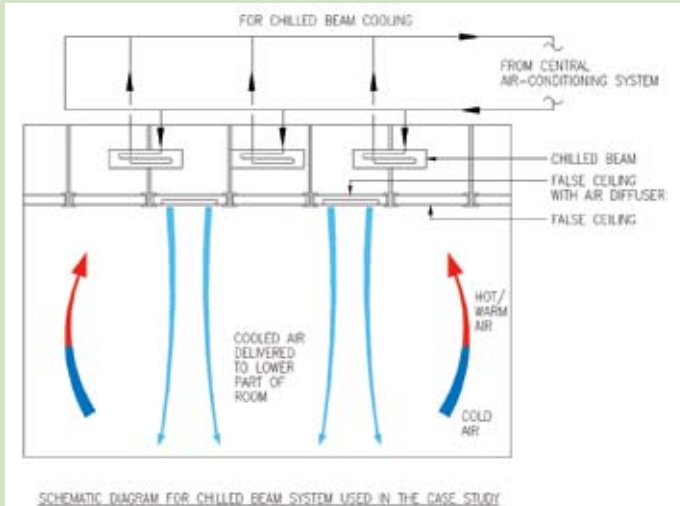


Fig C2.17 Schematic diagram for Chilled Beam system used in the case study

C2.3.5 Application of the chilled beam technology in Hong Kong

As mentioned above, there are many benefits of using chilled beams. However, there are limitations of using chilled beams in Hong Kong, which limits their application in Hong Kong. Hong Kong's high relative humidity in outdoor air reduces the efficiency of the chilled beam as more energy will be used for air dehumidification to a normal and comfortable level, rather than cooling. Due to the high humidity ratio, more condensations occur on the surface of the chilled beam. As a result, the occupants will be annoyed by the droplets from condensation at the area cooled with chilled beam. Since high relative humidity is recorded throughout the year, it is difficult to supply 100% outside air to the system.

Furthermore, the packed plan of the Hong Kong offices lessens the space for heat convection for local cooling. As mentioned above, the higher the floor-to-slab height, the more efficient the air circulation will be. The low floor height of the office in Hong Kong is not suitable for efficient circulation.

C2.4 Seminars presented by Professor David Hood

We are pleased to have the opportunity to attend two technical seminars on Green Buildings, presented by Prof David Hood in Sydney and Brisbane. In his presentations, Prof Hood introduced the background information about the building energy consumption in Australia, energy saving opportunities and related energy conservation measures.

Besides, the Low Energy High Rise (LEHR) project and net positive impact were introduced. The aims of the project are to bring different parties including commercial building owners, investors, tenants, contractors and suppliers together in order to develop a suite of initiatives to remove the barriers on improving the energy efficiency of existing commercial buildings. It is expected that the project can help reduce the energy consumption in commercial buildings by half and to reduce peak energy demand. And hence the related green house gases emission and water consumption will also be reduced.



Fig C2.18 Green Building seminar presented by Prof David Hood



References

- [1] Seo, S., Tucker, S., Ambrose, M., Mitchell, P. and Wang, C-H., Technical evaluation of environmental assessment rating tools, PN05.1019, Forest and Wood Products Research and Development Corporation, Australia Government, 2005.
- [2] Green Building Council of Australia, Green Star – Office Design v3 & Green Star – Office as Built v3.xls [available at www.gbca.org.au]
- [3] Australian Building Greenhouse Rating (2008) [available at www.abgr.com.au]
- [4] Environment Bureau, A proposal on the mandatory implementation of building energy codes, Hong Kong SAR Government, 2007.
- [5] HK-BEAM Society, Enhancing Hong Kong's Built Environment, HK-BEAM Society, 2005.
- [6] Green Building Council of Australia, Case study: Green Square South Tower accessed on 2007. [available at www.gbcaus.org]
- [7] Rumsey, P. and Weale, J., Chilled Beams in Labs, Eliminating Reheat & Saving Energy on a Budget, ASHRAE Journal Vol. 49, Jan. 2006. [available at http://www.rumseyengineers.com/pdf/ASHRAE_chilled_beams.pdf]
- [8] Multiservice Chilled Beams, MSCBs, MSCB's [available at <http://www.chilled-beams.co.uk>]
- [9] Warren Centre, Project plan for the low energy high rise project, 2007. [available at www.warren.usyd.edu.au]



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C3 Energy Resources Management

C3.1 Overview of Energy Policies in Australia

C3.1.1 Challenges in Australia

Australia has abundant coal resources and is the fourth-largest coal producing country in the world. It has a high reliance on fossil fuel as a source of electricity generation, with 85% of Australia's electricity production from coal. Though Australia has large resources in other forms of energy, such as gas, wind and solar, it is a challenge for the government to attract investments in alternative energy sources in the competitive market, where relatively cheaper coal is readily available.

Renewable energy commercialization in Australia is an area of relatively minor activity compared to the fossil fuels industry. Australia's renewable energy industries are diverse, covering numerous energy sources and scales of operation. The percentage of renewable energy in Australia's total energy supply is expected to increase with the government policies in reducing greenhouse gas emissions and promoting renewable energy.

C3.1.2 Energy Policies

The energy policies of Australia is subject to regulation and fiscal influence by all three levels of government, federal, state and local councils. However, the state and federal energy policy deals with the primary industries, such as coal. For renewable energy, the major area where it is growing is in electricity generation following the introduction of government Mandatory Renewable Energy Targets (MRET).

Key Policies

There are several highlights of key energy policies and targets. They are summarized below:

- Greenhouse gas emissions reduction targets
 - South Australia: legislated cuts of 60% in greenhouse pollution by 2050 and stabilization target by 2020.
 - Victoria: legislated cuts in greenhouse pollution of 60% by 2050 based on 2000 levels.
 - New South Wales (NSW): legislated cuts in greenhouse pollution of 60% by 2050 and stabilization target by 2025. And a legislated renewable energy target of 10% by 2010 and 15% by 2020.
- Mandatory renewable energy targets (MRET)
 - MRET allows wholesale purchasers of electricity to either pay a \$40/MWh tariff or adapt to the cheaper renewable energy sources
- Examples of programme launched by Department of Climate Change for supporting renewable energy
 - Photovoltaic Rebate Programme (PVRP): provide rebate for solar panels installations at homes (\$8 per watt and up to maximum \$8000)
 - Renewable Energy Development Initiative (REDI): funding up to \$100 million for research and development, proof of concept, early stage commercialization projects.
 - Renewable Remote Power Generation Programme (RRPGP): subsidy up to 50% of capital installation cost for remote renewable energy installations where electricity grids are not easy to reach.
 - Renewable Energy Equity Fund (REEF): provide venture capital for small innovative renewable energy companies such as commercializing direct or enabling renewable energy technologies and services.



C3.2 Natural Gas

C3.2.1 Overview of Natural Gas

Natural gas is a gaseous fossil fuel consisting of typically 70-90% of methane (CH_4), some other heavier gaseous hydrocarbon such as ethane (C_2H_6), propane (C_3H_8) and butane (C_4H_{10}) and sulphur containing gases. It is colorless, shapeless, and odourless in its pure form. Before natural gas can be used as fuel, it must undergo extensive processing to remove almost all materials or impurities other than methane. Natural gas is measured in terms of cubic meters at normal condition (0°C at atmospheric pressure). The calorific value (CV) of natural gas is generally about 40 MJ/m^3 varying from gas fields.

Natural gas is commercially produced from oil fields or natural gas fields and is now one of the major energy sources for many of our day-to-day needs and activities. It emits low level of potentially harmful by-products to the atmosphere when combusting. It is considered as one of the cleanest, safest, and most useful energy sources.

While Hong Kong has no natural gas reserve, Australia is abundant in natural gas resources. Australia's natural gas reserves are estimated to be 3.921 trillion cubic metre, of which 20% are considered commercially proven (0.783 trillion cubic metre). Among all the world regions, Australia is projected to see one of the most rapid expansions in natural gas production. According to Energy Information Administration (EIA) of the US Government, production of natural gas in Australia Region is foreseen to grow by an average of about 4.3% per year from 2004 to 2030, and most of the increase is expected to be used for liquefied natural gas (LNG) exports. Australia currently has about 0.75 trillion cubic feet of LNG export capacity from five liquefaction trains. More than 2.5 trillion cubic feet per year of additional LNG liquefaction capacity has been proposed. Australia is projected to be responsible for about 5% of the growth in world natural gas production from 2004 to 2030 and 3% of total production in the year 2030.

C3.2.2 Natural Gas for Power Generation in Australia

GridX Power – The Vision Estate at Glenfield, NSW

In a deregulated energy marketplace like Australia, utilities need to differentiate themselves from others to generate energy with comparatively low-carbon footprint. Moreover, they face increasing demand on low-carbon energy from customers due to recent controversial debate on climate change. Therefore, there are reasons why emerging demand of distributed energy is encountered. To explore the application of natural gas in power generation in Australia, a technical visit to the Vision Estate at Glenfield, NSW, near the Sydney city, developed by GridX Power Pty Ltd. and Mirvac, was arranged on 4 March 2008.



Fig C3.1 Group Photo taken at the Vision Estate at Glenfield

GridX Power Pty Ltd. is a privately owned Australian licensed energy provider bringing sustainable solutions to communities using efficient, leading edge technologies. They supply electricity and thermal energy to the residential, commercial and industrial sectors. As a vertically integrated district energy utility, GridX can generate energy on-site, connecting residential, commercial and industrial customers to a reliable energy supply that also delivers high level of sustainable development outcome.

The Vision Estate is the first estate in Australia adopted the 'tri-generation' system which uses a single fuel source - natural gas to produce three forms of energy - electricity, heating and chilled water distributed to a total of 16 two-storey houses (Fig C3.2). Energy is supplied for hot water heating, appliance use and air conditioning purposes. The system can be operated independently or in parallel with the electricity grid.

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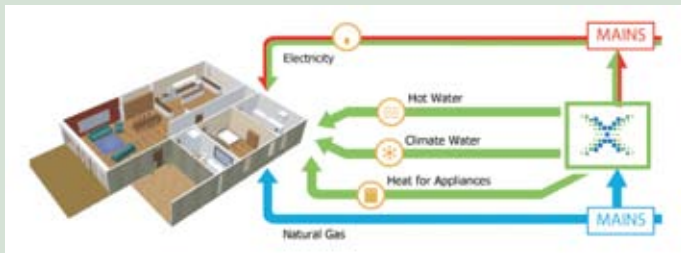


Fig C3.2a 'Tri-generation' system uses natural gas to produce electricity, heating and chilled water to households [Source: PowerPoint slide of GridX Power]



Fig C3.2b Hot water and heat for dry cleaners are generated from the 'Tri-generation' system

Environmental Benefits of Tri-generation

According to GridX, the environmental benefits of tri-generation include an immediate 33% reduction in greenhouse gas emissions compared to coal-fired electricity. For Glenfield's Vision Estate project, a saving of 4-7tonnes CO₂ per house per annum is claimed. The energy produced by the system, can bring the GridX System's energy conversion efficiency up to 80%. This is more than twice the efficiency of traditional coal-fired mains electricity and a more complete sustainable development outcome. Given the fact that there is large demand of district energy in NSW and other states, the tri-generation method can provide an infrastructure alternative to developers by taking the benefits of independent operation of main grid. The developer can also offer greener product to customers while meeting the mandated environmental building requirements under the building codes. With the system, the customers can enjoy the same power reliability and quality guarantee as the local power companies at a lower cost. Since the distribution network is installed underground, there is neither visual nor noise impact to the environment.

C3.2.3 Natural Gas for Vehicle Fuel in Australia

Brisbane City Council seeks to reduce emissions from vehicles by promoting the use of alternative modes of transportation and managing travel demand. We are pleased that with the assistance from Queensland Government Trade and Investment Office in Hong Kong, a technical visit to the "Green" Buses at Brisbane Transport's Toowong Bus Workshops was arranged on 7 March 2008.



Fig C3.4 Group photo at Brisbane Transport's Toowong Bus Workshops



Fig C3.3 Meter cabinet fitted with smart meters recording customer's energy consumption



Brisbane City Council is unique in Australia in owning and operating its urban bus (Fig. C3.5) and ferry network. In the year of 2006 to 2007, there were over 63 million customers travelling on Brisbane Transport's fleet of 850 buses and around 6 million customers travelling on the river with their fleet of 10 CityCats (Fig. C3.6) and 10 ferry boats. In the past 3 years, the Council was proud of its record patronage growth of 30%.



Fig C3.5 Photo of Bus



Fig C3.6 Photo of CityCat

Green Bus

There are many new technologies, including hydrogen fuel cells, electric-petrol hybrid vehicles and vehicles powered by alternative fuels such as compressed natural gas (CNG), liquefied petroleum gas (LPG), ethanol, methanol and biodiesel, which are capable of achieving massive emission reductions. The Brisbane City Council has been progressively rolling out new lower emission CNG buses. Currently, the buses in Brisbane are powered by either CNG or ultra-low sulphur diesel (ULSD), which can be collectively called "Green" Buses.

Compressed natural gas (CNG)

The Brisbane City Council has been leading the way for a cleaner and more accessible city by introducing CNG buses to its Brisbane Transport Bus fleet since 2000. The buses are assembled in the Brisbane Transport's Toowong Workshops or Gold Coast Facility of Custom Coaches. It takes altogether 36 days to assemble a CNG bus (Fig C3.7). The natural gas for the buses is being supplied by the city gas supplier of Brisbane and is compressed with the CNG facility at the Toowong depot.



Fig C3.8 Interconnected Gas Cylinders on top of Bus



Fig C3.7 Bus Assembly in progress



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The CNG buses are powered by gas engines with CNG stored at 20MPa in seven interconnected cylinders (Fig C3.8) on top of the buses. The seven cylinders are isolated from the interior of the buses so that the CNG, which is lighter than air, will be vented to the atmosphere if there happens to be a gas leak. Table C3.2 shows the advantages of a CNG bus over a standard diesel bus.

Different models and specifications of CNG buses used by the Brisbane City Council are summarised in Table C3.3.

Table C3.2 Advantages of CNG bus over standard diesel bus

Emissions	Reduction
Carbon Monoxide (CO)	> 90%
Nitrogen Oxide (NO)	> 85%
Particulates	> 85%
Hydrocarbons	> 75%
Carbon Dioxide (CO ₂)	> 10%
Noise	> 50%

Table C3.3 Different Models and Specifications of CNG Buses in Brisbane

	<p>Manufacturer: Scania Australia Pty Ltd Chassis: Scania L94UB Engine: Euro III, 9 Litre 6 cylinder gas engine CNG tanks: 6 tanks with 1110 litres of CNG at 200bar Performance: 190kW, 970Nm with a 450km range Body: Volgren, using extruded aluminium frame Assembly: Brisbane Transport's Toowong Workshop Capacity: 62 with seating for 44 Features: low floor, kneeling front and air-conditioned</p>
	<p>Manufacturer: MAN (Man Automotive Imports Pty Ltd) Chassis: MAN 18.310 HOUC-L-R-NL Engine: EEV standard 12 Litre 6 cylinder gas engine CNG tanks: 7 tanks with 1295 litres of CNG at 200bar Performance: 228kW, 1250Nm with a 450km range Body: Volgren, using extruded aluminium frame Assembly: Brisbane Transport's Toowong Workshop Capacity: 62 with seating for 44 Features: low floor, kneeling front and air-conditioned</p>
	<p>Manufacturer: MAN (Man Automotive Imports Pty Ltd) Chassis: MAN NG 313F CNG Engine: EEV standard 12 Litre 6 cylinder gas engine CNG tanks: 9 tanks with 1665 litres of CNG at 200bar Performance: 228kW, 1250Nm with a 450km range Body: Custom Coaches CB60 stainless steel frame Assembly: Custom Coaches at their Gold Coast facility Capacity: 87 with seating for 61 Features: low floor, kneeling front and air-conditioned</p>



• **Ultra low sulphur diesel (ULSD)**

In Queensland, sulphur levels in diesel and petrol have been reduced from 1200 to 500 parts per million (ppm), and fuel, which is referred to as ultra-low sulphur diesel (ULSD), is now available with sulphur content as low as 50ppm. While the Brisbane City Council still has two-third of diesel buses, these buses use ULSD, one of the environmentally friendly fuel available. Brisbane City Council is the first major fleet operator in Australia to use ULSD on buses.

Implementation of Green Buses

Since 2000, the Council has invested over \$180 million on new buses and now it owns 352 CNG buses. With the total bus fleet of over 847 buses, one-third of the buses are powered by natural gas. The air-conditioned and fully accessible CNG buses are dispatched in preference to older buses whenever possible. The Council is also working with the State Government’s TransLink agency and other providers on a range of initiatives including planning for more busways, improved bus and ferry services, better infrastructure and the introduction of “contactless” smartcards.

C3.2.4 Power Supply and Gas Industries in Hong Kong

Power Supply in Hong Kong

Hong Kong’s electricity are generated from 2 private companies, CLP Power Hong Kong Limited (CLP) and Hong Kong Electric Company (HEC). CLP supplies electricity to Kowloon and the New Territories, including, Lantau, Cheung Chau and several outlying islands. It employs a fuel mix strategy of coal, gas, nuclear and oil. In contrast, HEC supplies electricity to Hong Kong Island and the neighbouring islands of Ap Lei Chau and Lamma. It uses a combination of coal and natural gas energy.

In 2006, the total installed electricity generating capacity of Hong Kong was 12,644MW. Contribution from different energy sources are given in Fig C3.9. This included 70% of the capacity of units 1 and 2 of the Guangdong Nuclear Power Station at Daya Bay and 50% of Phase 1 of the Guangzhou Pumped Storage Power Station. For CLP Power, it operates Black Point Power Station (2,500MW), Castle Peak Power Station (4,108MW) and Penny’s Bay Power Station (300MW) in Hong Kong. For HEC, it operates Lamma Power Station (3,756MW).

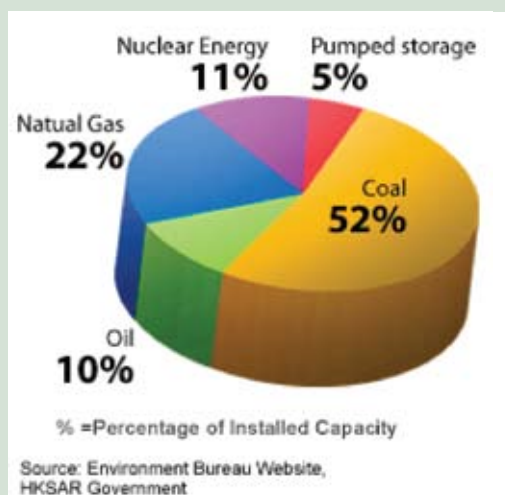


Fig C3.9 Percentage of different Installed Capacity

Note: The percentages of installed capacity of different fuels are dynamic figures that reflect the make-up of the total capacity. They should not be taken solely at their face values

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New Scheme of Control

The two power companies are regulated by Hong Kong Government under the Scheme of Control (SoC) Agreements. The new SoC will be effective from 1 October 2008. One of the highlights of the new SoC is the linking of the permitted return to the achievement of prescribed levels of emissions of SO₂, NO_x and RSP. Additionally, there will be financial incentives and penalties relating to their supply reliability, operational efficiency and the quality of customer service.

Gas Industry in Hong Kong

Unlike Australia, Hong Kong has neither natural gas resources nor any other energy resources. Hong Kong uses town gas, manufactured by The Hong Kong and China Gas Co. Ltd. (HKCG) using natural gas and naphtha as feedstock, for most of the daily gas appliances. The gas supply network of HKCG is now covering over 85% of Hong Kong representing over 1.6 millions households and 15,000 commercial and industrial customers. The natural gas feedstock has been supplied by the Guangdong LNG (Liquefied Natural Gas) terminal situated in Shenzhen of China with a pair of high pressure submarine pipelines since October 2006.

In contrast to Australia, the public transportation in Hong Kong is not fuelled by natural gas. However, to manage better air quality and arrest the deterioration of roadside air quality, the government took the initiative in late 90s to implement the use of LPG taxis and minibuses, which are two popular modes of transport in Hong Kong.

C3.3 Biodiesel

C3.3.1 Overview of Biodiesel Fuel

Biodiesel is a renewable fuel derived from vegetable oils or animal fats through the esterification process. They can be used in conventional diesel engines as a direct replacement of petroleum or blend stock component with petroleum. The feedstocks for the production of biodiesel are lipids, such as vegetable oil, animal fats, and used cooking oils. They are converted into biodiesel, mono-alkyl esters of long chain fatty acids, through the esterification with an alcohol in the presence of a catalyst. The alcohol commonly used is methanol.

There are a number of benefits of using biodiesel when compared with petroleum and they are listed below:

- As a renewable energy source since they are produced from feedstocks;
- Generate less greenhouse emission as it emits less greenhouse gases than petroleum derived diesel;
- Generate less air pollutants, such as carbon dioxide, carbon monoxide, particulates and sulphur;
- Biodegradable and will not cause lasting damage to the environment if spilled;

C3.3.2 Biodiesel Development in Australia

The Australian Federal Government has made commitment to reduce reliance on fossil fuels, and a target of producing 350 million litres (ML) of biofuels by 2010 is set. Though the target is not mandatory, it has encouraged the biofuel industry to expand their production. In 2007, there are a total of 17 biodiesel production plants in Australia located at different states. Three of them are located in Queensland, while seven in NSW. The biodiesel plants have a current production capacity of 323ML and a planned capacity of 1,122ML.

To obtain an exposure to the production of biodiesel in Australia, a technical visit was organised to Eco Tech Biodiesel plant in Narangba in Queensland on 7 March 2008.



Fig C3.10 Group photo of Mr Paul Hetherington (L5) plant manager of Eco Tech Biodiesel and the delegates



C.3.3.3 Example of Australia Biodiesel Production Plant: Eco Tech Biodiesel Plant

General Information

Eco Tech Biodiesel Plant is situated in Narangba, 35km north of Brisbane. It is a joint venture between Australia's largest independent petroleum producer, Gull Petroleum, and a group of independent businessmen. The plant commenced operation in May 2006 and has a production capacity of 30ML of biodiesel per year. At its full production, it can produce an additional of 75ML.

Feedstocks

The feedstocks used for the production of biodiesel are cooking oil and tallow (animal fat). One of the main feedstocks is beef tallow generated from the slaughter of cow. The plant requires 28,000 tonnes of tallow to meet its initial production demands. The feedstocks are collected by waste collectors and delivered to the site for storage in the feed tanks.

Production Process

The technology employed in the production of biodiesel is imported from Germany. It has been used in Europe since 2000 in five commercial plants in Germany and Austria. The technology is based on the process of transesterification of fatty acids glycerides in an alkaline environment. The process consists of five main stages, namely 1.) Pre-cleaning of feedstock, 2.) Transesterification in two stages, 3.) Solubilisation (product washing), 4.) Distillation of methanol and water and 5.) Addition of special ingredients.

The feedstocks are first pre-cleaned to remove impurities, such as food residues and water, before entering the main process. The pre-cleaning process includes filtration, drying and reduction of free fatty acid.

The pre-treated feed then enters the reactor for transesterification in two stages. Methanol is added to provide the alkaline environment, while liquid potassium methylate is added as catalyst. The mixture is heated to about 54°C for several hours for the reaction to take place, in which biodiesel (methyl-esters) and glycerol (by-product) are produced. Glycerol is allowed to separate out by gravity in another tank. A portion of the glycerol is recycled back into the stream.



Fig C3.12 The process units



Fig C3.11 Feedstocks and final product storage tanks

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In the solubilisation stage, the product is washed by adding a small amount of water to remove the remaining feedstocks. The desired product is separated out by centrifugation and is further treated by distillation. During the distillation process, methanol and water are separated from the biodiesel. Methanol is returned to the process for reuse, while the biodiesel is added with special ingredients and stored in the final product tank. The biodiesel produced are sampled for laboratory testing to ensure that its quality meets the requirements.



Fig C3.13 Biodiesel – the final product

Advantages

The technology employed in Eco Tech Biodiesel has the following advantages:

- The system is suitable to process a wide range of feedstocks, such as used cooking oil and animal fat;
- The process runs fully automatic and is computer-controlled;
- The plant has low energy consumption;
- The plant occupies a small footprint.

C3.3.3 Biodiesel Development in Hong Kong

The development and application of biodiesel in Hong Kong is rather limited. There are no biodiesel production plants in operation and biodiesel are not readily available to consumers at retail level. As a result, biodiesel has not been widely used by consumers. However, its development might gain momentum in the future as the government is promoting the use of biodiesel and biodiesel production plants are coming into operation.

In the 2007-08 Policy address, the government stated that they would promote the use of biodiesel by committing to a duty-free policy. In order to strengthen confidence of consumers and control the environmental impact of biodiesel, the government is also drawing up specifications for auto-biodiesel to ensure its quality. Consultation with stakeholders was conducted during January 2007 and new regulations are expected to become effective in early 2009.

Two biodiesel plants are proposed to be built at EcoPark and Tseung Kwan O Industrial Estate. In the tenancies for lots in EcoPark, one of them was awarded to manufacturing of biodiesel from waste cooking oil. The development of a biodiesel production with an annual capacity of 100,000 tonnes was also proposed at Tsung Kwan O Industrial Estate. The plant will use a multi-feedstock which consists of waste cooking oil, oil and grease recovered from grease trap waste, palm fatty acid distillate and animal fats. The plant is scheduled to commence operation in October 2009.

C3.3.4 Our Views

The use of biodiesel as an alternative fuel for petroleum would be beneficial to our environment. Biodiesel generates less air pollutants and could improve our air quality. It also has lower greenhouse gas emissions and could contribute to global efforts in combating climate change. Furthermore, waste cooking oil and the oil and grease from grease trap waste could also be reused for the generation of biodiesel and thus reducing impact to the environment and our limited landfill space. These are essential in ensuring the sustainable development of our city.

With the operation of biodiesel production plants in the coming future, biodiesel would be more readily available in Hong Kong. We suggest the government could step up the promotion of the use of biodiesel, and establish confidence in the consumers on its usage. Consumers currently have doubts on whether the use of biodiesel would damage their vehicles. The government could carry out studies to further investigate on this aspect. They could also take the initiative of using biodiesel in their vehicle fleets.



References

- [1] Biofuels in Australia – Issues and Prospects, Rural Industries Research and Development Corporation (June 2007) [available at <http://www.rirdc.gov.au/reports/EFM/07-071sum.html>]
- [2] Clean Air and Blue Skies – The Choice is Ours, The Council for Sustainable Development, HKSAR Government
- [3] Council's Fleet of Gas Buses – a Breath of Fresh Air, Brisbane City Council, Australia (30 July 2007)
- [4] Development of a Biodiesel Plant at Tseung Kwan O Industrial Estate – Project Profile of ASB Biodiesel (Hong Kong) Limited, Environmental Resources Management (December 2007) [available at <http://www.epd.gov.hk/eia/register/profile/latest/esb178/esb178.pdf>]
- [5] EcoPark – Latest Development, Environmental Protection Department, HKSAR Government (19 March 2008) [available at http://www.epd.gov.hk/epd/english/environmentinhk/waste/prob_solutions/eco_news.html]
- [6] EIA - International Energy Outlook 2007 [available at http://www.eia.doe.gov/oiaf/ieo/nat_gas.html]
- [7] Energy Resources, PowerU (Jan 2008), CLP Group, HK [available at https://www.clpgroup.com/poweru/eng/energy_resources/fuel_used_in.aspx]
- [8] NaturalGas.org [available at <http://www.naturalgas.org/overview/resources.asp>]
- [9] Policy Address of HKSAR (2007-2008) [available at <http://www.policyaddress.gov.hk>]
- [10] Presentation PowerPoint of GridX Power, Australia
- [11] The Brisbane Air Quality Strategy, Brisbane City Council (January 2004)
- [12] The Scheme of Control Agreement (9 March 1992), Environment Bureau, HKSAR Government [available at http://www.enb.gov.hk/en/resources_publications/agreement/index.html]
- [13] The Scheme of Control Agreement (7 January 2008), Environment Bureau, HKSAR Government [available at http://www.enb.gov.hk/en/resources_publications/agreement/index.html]
- [14] The Vision Estate Glenfield GridX Perspective, Brochure of Integral Energy, GridX Power, Australia [available at http://www.gridxpower.com/page_sections/power/index.aspx?id=download_brochure]



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C4 Water Resources

C4.1 Background of water resources in Australia

Australia has two natural water sources: surface water collected in lakes or dams/weirs and groundwater. There are state/territory regulatory authorities to undertake different roles of water allocation, quality management, public health and pricing oversight. The state/territory governments are responsible for the water supply under the Australian Constitution. Water utilities either as public companies or regional water authorities supply raw water in bulk to local governments. The Sydney Catchment Authority and the South East Queensland Water Corporation Limited are two of these utilities. In local government levels, state-owned companies like the Sydney Water Corporation, or commercialized business of government councils like Gold Coast Water and Brisbane Water are responsible for the treatment and supply of water for use, as well as the planning and management of local water infrastructures. These local water utilities usually provide wastewater and stormwater services to their respective servicing areas in addition to the water supply service.

In general, local water supply activities in Australia adopt the mode of operation as commercial business. The water business composes of portable water, wastewater and stormwater. All Australian states/territories have separated the regulatory functions from the water business.

The delegation is pleased to have the reception by both Sydney Water and Gold Coast Water on 4 March & 5 March 2008 respectively. During the meeting with their officials, latest water sustainability issues as well as their projects ahead have been introduced (see Fig.C4.1, C4.2 and C4.3 for the visit to Sydney Water, and Fig C4.4, C4.5 and C4.6 for the visit to Gold Coast Water). The delegates also visited two of the latest projects undertaken by Gold Coast Water on 5 March 2008. Details of the findings and site visit will be presented in the following sections.

C4.2 Water supply situation in Sydney and Gold Coast

C4.2.1 Sydney

Sydney Water is a statutory, state owned corporation. It is fully owned by the people of New South Wales. It provides drinking water, recycled water, wastewater services and some stormwater services to almost 4.2 million customers in Sydney, Illawarra and the Blue Mountains. Sydney Water supplies more than 1.4 million litres of water to more than 1.6 million homes and business each day. About 80% of water is supply from Warragamba Dam. It has 10 water filtration plants and over 20,000 kilometres of water mains. It has 31 sewage treatment plants and 28 separate sewerage systems. The total distance of sewer pipes is over 23,000 km. Sydney Water provides storm water facilities to more than 465, 000 homes and business with about 463 km large trunk stormwater channels.

C4.2.2 Gold Coast

Gold Coast Water supplies the water to the city with population of about 507,000, predicted to grow to 1.2 million by 2056. 100% of water supply of Gold Coast is drawn from one surface water storage. Gold Coast Water has been established as a Directorate of the Gold Coast City Council since June 1995. It provides fresh water and wastewater treatment services to the customers through the management of the city's water and wastewater assets.

Gold Coast Water also manages the water sources, the Hinze Dam and Little Nerang Dam. Its services are provided through over 3,000 kilometres of water mains, over 3,000 kilometres of wastewater infrastructure, two water treatment plants and four wastewater treatment facilities.



Statistics of water consumption by some Australian cities are summarized in Fig C4.1 below.

Fig C4.1 Water Consumption by some Australian Cities (Compilation from WSAAfacts 2005)

City	Population receiving water supply services (000's)	Usage (L/cap/day)		Usage (kL/perperty/yr)		Water supply mains length (km)
		Total	Residential	Total	Residential	
Brisbane	1975	497	285	421	264	6273
Gold Coast	495	401	261	399	244	2,995
Sydney	4228	341	213	312	211	20,669

1 Excludes water supply to neighbouring councils

C 4.2.3 The Drought Problem

Australia is prone to drought because of its geography. The continent sits more or less astride the latitudes of the subtropical high pressure belt, an area of sinking, dry, stable air and usually clear skies. The far north and south of the country come under the influence of reasonably regular rain-bearing disturbances for at least part of the year, and the east coast is watered reasonably well by moisture from the Tasman and Coral Seas. However over most of the country rainfall is not only low, but also highly erratic. The average annual precipitation is about 460mm with large variations.

The current decade-long rainfall deficits and record high temperatures have severely stressed water supplies in the east and southwest of Australia. Several years of above average rainfall are required to remove the very long-term deficits. Furthermore, the combination of heat and drought for the past five to ten years over the Murray Darling Basin and southeastern Australia is outside the typical range of variability experienced during the previous 100 years. The drought that has plagued much of Australia continues, with water restrictions being implemented in most Australian cities.



Fig C4.1 The Delegates receiving briefing by Sydney Water representatives



Fig C4.2 Delegation Advisors Ir Dr W K Lo (left 3rd), Ir Edmund Leung (left 2nd) and Delegation Manager Ir Johnson Lee (left 1st) present souvenirs to Sydney Water representatives

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Fig C4.3 Group photo of the Delegates with Sydney Water representatives



Fig C4.4 The Delegates receiving briefing by the Gold Coast Water official



Fig C4.5 Delegation Advisor Ir Edmund Leung (middle) and Delegation Manager Ir Johnson Lee (right) presenting souvenir to the Director of Gold Coast Water, Mr. Shaun Cox



Fig C4.6 Group photo of the Delegates with Gold Coast Water officials



C4.3 Water Supplies in Sydney and Gold Coast

C4.3.1 Water Conservation

Facing the prolonged drought and increase in water demand, water restrictions have been put in place in different states and cities in Australia. Many states describe the different levels of water restrictions in terms of "Stages/ Levels". There are different definitions given to each Stage/ Level in different states. State governments deploy "water inspectors" who can issue penalties to people violating the water restriction requirements.

Currently Level 3 restrictions are applied to restrict the water use and the storage levels of dam have been raised to 66.4% in Sydney. The following Levels (Table 4.1) have been used by Sydney Water to describe the different stages of water restrictions in Sydney for the residential sector.

In Southeast Queensland, the water restrictions are set out by the Queensland Water Commission. To save the water, South East Queensland Councils including Brisbane and the Gold Coast have collectively implemented Level 6 Water Restrictions since 23 November 2007. Table C4.2 shows some of the details of different levels of water restrictions which apply in Queensland for the residential sector.

Table C4.1 Different levels of water restrictions applied in Sydney

	Level 1	Level 2	Level 3
Sprinklers and irrigation	No sprinklers at any time; drippers only		
Hand-watering gardens and lawns	No restrictions	3 times weekly, before 9am or after 5pm	2 times weekly, before 10am or after 4pm
Swimming pools	No restrictions	No filling pools over 10,000L without permit	
Hard surfaces	No hosing hard surfaces (paths, driveways, cars, floors and buildings)		

Table C4.2 Different levels of water restrictions applied in Queensland

	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
Hose watering of gardens	3 days/week		No hosing				No external water use without permit
Hose watering times	4-8am & 4-8pm	Before 7am & after 7pm					
Bucket/ watering can watering times	Any time		3 days/ week; 4-8am & 4-8pm	No watering lawns; Otherwise 3 days/ week, 4-7pm			
Hosing hard surfaces	Prohibited at all times						
Car/window washing	Hose or bucket		Bucket only		Bucket only, to wash mirrors, lights & windows		

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C4.3.2 Sustainable water management plan

Facing the prolonged severe drought in most places of Australia, intergovernmental agreement and water planning at national level such as the National Water Initiative and the National Plan for Water Security have been announced and put into implementation. The directions of work of the Australian Government include:-

- Identifying over-allocated water systems and restoring them to sustainable levels,
- Promoting more profitable use of water and more cost-effective and flexible recovery of water to achieve environmental outcomes,
- Better and more efficient management of water in urban environments, for example through the increased use of recycled water and stormwater,
- Improving water management across the nation, in particular in the use of agricultural water,
- Modernizing irrigation, addressing over-allocation, reforming management, and upgrading water information.

Many new initiatives identified in the Strategy are already being rolled out on a local and regional level. These include a pressure and leakage management program, water conservation programs and desalination. Other initiatives, such as increasing the use of recycled water around the city, continue to create interest both nationally and internally with flagship projects such as the fully integrated urban water managed community of Pimpama Coomera.

C4.4 New Water Resources in Sydney and Gold Coast

In the following sections, the discussion will focus on three new water resources vital to the sustainable water use of Australia, they include the use of recycled water and desalted water from the ocean as well as installation of rain water tanks in each household.

C4.5 Use of Recycled Water

Harvested rainwater in Australia through the existing sources can not satisfy future demands if it is used only once. The existing resources are barely able to meet current demands as demonstrated by the current drought. Water supply needs could alternatively be provided by recycled water. Recycled water is wastewater that has been treated according to stringent environmental and health guidelines. Rather than discharging it into the ocean, it is put to good use. The use of recycled water in Australia has been increasing in recent years. The delegation was pleased to be arranged by Gold Coast Water to visit a flagship project with fully integrated urban water managed community of Pimpama Coomera and the associated wastewater treatment plant on 5 March 2008.

C4.5.1 Classification of Recycled Water and Uses

State governments set up their own guidelines for the specifications or required level of treatment for recycled water. For instance, in Queensland, the Queensland Water Recycling Guidelines (December 2005) define the classes of recycled water by their respective quality characteristics. The guidelines also recommend the class of recycled water to be used for particular purposes. Recycled water can be treated to several qualities or classes depending on its intended use as defined by the Queensland Government's Water Recycling Guidelines, ranging from classes A to D and the Class A+ of recycled water. Class A+ is the highest class of recycled water for non-drinking purposes in Queensland. It is highly treated through two different treatment plants with multiple process steps to meet stringent environmental and health guidelines.

Table C4.3 outlines the various recycled water classes and their respective uses.

Types of Recycled Water	Availability	Appropriate Uses
Purified Recycled Water	Treatment plants are currently being constructed in Brisbane	Replenishment of Wivenhoe Dam water supplies
Class A+	Available in the Pimpama Coomera region from the end of 2008*	Household toilet flushing and garden use
Class A	Currently available to recycled water tankers	Irrigation of parks & gardens
Classes B & C	Currently available via direct pipes to industry* and recycled water tankers	Irrigation of parks, golf courses, sporting fields & cane farms after-hours and with restricted public access Dust suppression on construction sites and road works (with Council approval)

Table C4.3

* In particular areas only



C4.5.2 Visit to Coommera Estate Construction Site in Gold Coast

The suburbs of Pimpama Coommera are located about 40 km south of Brisbane, at the northern end of Gold Coast. The Pimpama Coommera region is one of Australia's fastest growing low-rise residential communities and is expected to grow from approximately 15,000 people to around 120,000 people by 2056.

The Coommera Estate is where the dual reticulated system installed at the same time with the new houses. A typical house in the estate is shown in Fig. C4.7. Dual reticulation refers to properties that are plumbed with separate potable (drinking) and Class A+ recycled water pipes and taps. And they have separate water meters for potable water and Class A+ recycled water (Fig. C4.8).



Fig C4.8 Separate meters for potable water and Class A+ recycled water (Purple)

The dual reticulation system is constructed under the Pimpama Coommera Waterfuture Master Plan developed by Gold Coast City Council and will deliver sustainable water and wastewater services to the region. It is the largest integrated urban water cycle water management program undertaken in Australia. Under the Master Plan, all new homes and business are dual-reticulated to receive Class A+ recycled water for non-drinking purposes and have mandatory rainwater tanks. The Class A+ recycled water for toilet flushing



Fig C4.7 A new house in Coommera Estate under construction

All Class A+ recycled water supply components such as the water meters, pipes and fittings are coloured purple for easy identification, as shown in Fig. C4.9 and C4.10. It is mandatory for all recycled water taps to be coloured purple and have warning signs that read "recycled water – do not drink" next to the taps.

Class A+ recycled water is suitable for toilet flushing, garden watering and irrigation, filling ornamental ponds, car washing, fire fighting, construction and building purposes, dust suppression, irrigation of food crops, external household cleaning. But it is not intended for drinking, cooking, bathing, washing clothes or evaporative coolers.



Fig C4.9 Purple pipe for Class A+ recycled water leading into the house

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Fig C4.10 Purple pipe for Class A+ recycled water running across the beams of the house



Fig C4.11 General View of the construction site of the wastewater treatment plant



Fig C4.12 Introduction of the wastewater treatment plant

and external use is programmed to be available starting from late 2008. The Master Plan aims to reduce the region's reliance on drinking water supplies by up to 84%.

C4.5.3 Visit to Pimpama Wastewater Treatment Plant Construction Site

In Pimpama Coomera, wastewater from the community will first be treated at the Pimpama Wastewater Treatment Plant through a series of processes including preliminary treatment, biological nutrient removal, anthracite and sand filtration and disinfection. The water is classified as Class B recycled water at this stage. The water then undergoes further treatment at the Pimpama Recycled Treatment Plant, which includes ultra-filtration, ultra-violet disinfection and chlorination. This is Class A+ recycled water. The water will be delivered to all dual-reticulated homes and business in Pimpama Coomera. Rigorous monitoring and testing regimes will be put into place to ensure the treatment plant provide Class A+ recycled water of consistently high quality to meet stringent environmental and health guidelines.



Fig C4.13 Sedimentation tank of the wastewater treatment plant



Fig C4.14 Ultra-filtration units of the wastewater treatment plant

C4.6 Desalination

Desalination is the process of producing drinking water by removing dissolved solids, primary salts, from a water source such as seawater, treated wastewater or brackish groundwater. The advantage of desalination over most other water supply sources is that it is not dependent on rainfall. It can insure against the impacts of drought climate.

The two most widely used and commercially proven desalination technologies are reverse osmosis (membrane based method) and thermal distillation (evaporative method). For the method of reverse osmosis, the seawater is pressurized to force water molecules through a fine-pore membrane that blocks the salt ions, viruses, micro-organisms and other impurities which are retained by the membrane in a concentrated solution for subsequent disposal (Fig C4.15). For the thermal method, it removes salts by evaporating seawater and then condensing the vapour back to drinking water. At present, this technology has dominated the seawater desalination market, particularly the Middle East. However, the energy intensity of the thermal method and the advance in the energy efficiency of reverse osmosis technology have contributed to a significant increase in the market share of reverse osmosis, which has become the most commonly used technology in Australia.

C4.6.1 Use of Desalination in Australia

Desalination is widely used in the Middle East, the USA, Singapore and Japan. It is also used around Australia in the isolated communities (e.g. Kangaroo and Rottnest Islands), for industrial process, and in mining and power generation.

A desalination plant currently operates in Perth of Western Australia. It is the first State of Australia to use desalination as a major public water source. The Perth Seawater Reverse Osmosis Plant was opened in November 2006. When the plant is fully operational, it will produce 130 million litres of water a day, which is about 17 per cent of Perth's needs. Therefore, about 17% of Perth's drinking water will be sourced from the Indian Ocean.

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C4.6.2 Desalination industry in Sydney

For Sydney, owing to the uncertainty rainfall, it is vital to secure non-rainfall dependent source of water. Sydney's population is growing by 50,000 people each year. According to the Metropolitan Water Plan, a desalination plant will be constructed in Sydney if the drought problem continues beyond 2006. Sydney Water is building a desalination plant with production capacity of 250ML per day and associated pipeworks at an estimated cost of AUD\$1.833 billion. The contract was awarded and the plant construction was started in 2007. The pipeline construction has also started in 2008. The water will be delivered to Sydney's water supply by summer of 2009 to 2010. The Sydney's desalination plant will employ reverse osmosis technologies. (Fig C4.15)

Desalination could be an energy-intensive way to produce drinking water, and it is important to manage the greenhouse impacts associated with the use of desalination technology. A broad range of energy sources were considered for the plant. In order not to have significant increase in green house gases production, the plant will be supplied with power from 75 wind turbines from as many as six wind farms to be built across the state. The proposed plant will demand one-fifth of the Australia's wind-generated energy which can boost the state's green energy industry.

C4.6.3 Desalination in Gold Coast

In Gold Coast, a joint desalination project is initiated by the Gold Coast City Council and the Queensland Government to construct the first large-scale water desalination plant on Australia's eastern seaboard by November 2008. The plant will provide 125ML/day of fresh drinking water by the end of 2008. The strategy is similar to Sydney that the future water source is not dependent on climate. The plant was planned for commissioning around 2030 but it has been implemented earlier, and increased in size, to provide an emergency water supply to South East Queensland due to severe drought condition. South East Queensland will obtain approximately 15% of its current water needs from the desalination facility.

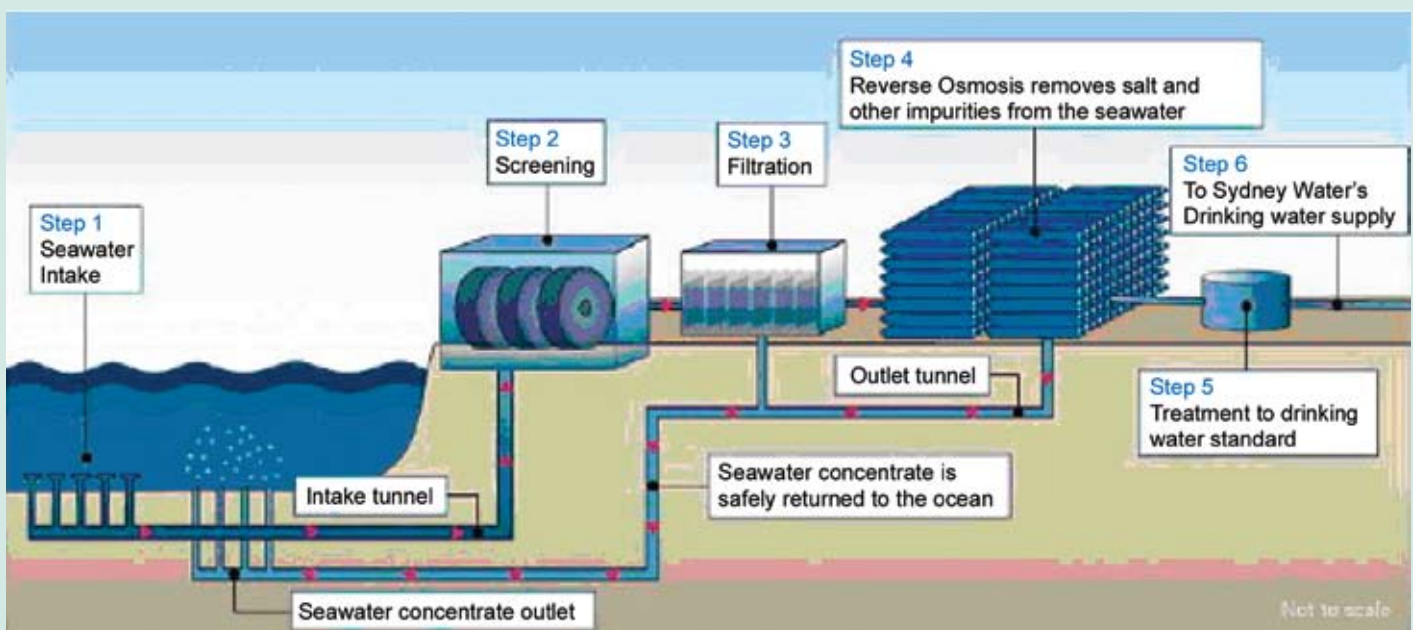


Fig C4.15 Detailed process of Desalination by Reverse Osmosis (Metropolitan Water Plan Sydney Water-2007 progress report)



C4.7 Installation of Rainwater Tanks

The installation of rainwater tanks is another initiative in Australia to reduce the consumption of potable water. Under the water restrictions being implemented by state governments as well as the water saving targets, the installation of rainwater tanks has become a building solution. The rainwater is generally used for gardening, toilet flushing, washing machines, and washing cars. Rebate scheme has been launched by some state or local governments to encourage the installation of rainwater tanks in homes or business.

Both the New South Wales and Queensland Governments provide rebate to households with rainwater storage system and connect this system to service toilets and washing machines.

A rainwater tank is a covered tank or a combination of covered tanks used to collect rainwater from a building roof or multiple roofs. The rainwater tank comes in many shapes and sizes and can be made of a variety of materials such as polyethylene, galvanized steel, stainless steel or concrete depending on its intended use. It must have suitable measures like a screened downpipe rainhead to prevent contaminants from entering the tank, and mosquito-proof screens to prevent mosquitos breeding in the tank and other vermin entering the tank. Fig C4.16 and C4.17 are some of the rainwater tanks being used in Australia.



Fig C4.16 A slimline rainwater tank



Fig C4.17 A traditional rainwater tank



Study on Sustainable Development

C4.8 Water Demand and Supply Situation in Hong Kong

C4.8.1 Fresh Water Supply and Total Water Management (TWM) Strategy

In 2007, the total fresh water demand in Hong Kong was 951 million cubic metres (mcm). Domestic (35%) and non-domestic (25%) consumption accounts for most of the water demand. Water mains leakage (23%) aside, the other important consumption of fresh water includes flushing and fire-fighting. Under the scenario of reference population of 8.4 million by 2030, the fresh water demand will grow to 1,315 mcm.

The fresh water supply is composed of two components. Firstly, surface water collected locally from water gathering grounds ("local yield") provides 20 to 30 percent of water supply at present. The average annual local yield is 295 mcm per year. The local yield can provide a reliable supply of 210 mcm per year in a one-in-one hundred year drought (99 percent reliability). Secondly, about 70 to 80 percent of water is imported from Dongjiang under HKSAR's agreement with Guangdong authorities. So far, the largest quantity of Dongjiang water imported was 808 mcm in 2004. The agreed ultimate Dongjiang water supply quantity is 1,100 mcm per year. The maximum capacity available through the Dongjiang water supply system will be sufficient to cope with the projected demand in the coming two decades even under a rapid demand growth scenario.

As compared with Australia, Hong Kong has also commissioned study on the implementation of Total Water Management (TWM) strategy, to ensure rational utilization, protection and management of water resources in the water cycle in a holistic manner and to explore new water resources. It comprises four key elements, namely, new water resources, water conservation, water reclamation, and water resources protection and management. The strategy is required to better prepare Hong Kong for uncertainties such as acute climate changes. It also helps enhance Hong Kong's role as a good partner of other municipalities in the Pearl River Delta in promoting sustainable development in the light of the rapid growth in water demand in the region.

As mentioned above, Australia cities have taken a proactive role in exploring new water resources, including recycled water and desalination. In Hong Kong, the development of recycled water and desalted water has also been studied under the Total Water Management. Much of the discussion below has made reference to the ACE Paper 13/2008 recently published by Advisory Council on the Environment (ACE) in Hong Kong.

C4.8.2 Water Reclamation

Compared to the "Recycled Water" discussed above, the terminology more commonly found in Hong Kong is the "Reclaimed Water".

Water reclamation is to use lower quality water to replace high quality water currently used for non-potable purposes such as toilet flushing, irrigation and street cleaning. The most important of this is the use of reclaimed water from sewage treatment works for non-potable use such as toilet flushing. The Government has conducted pilot schemes in Ngong Ping and Shek Wu Hui. In the Ngong Ping scheme, commissioned in early 2006, tertiary-treated effluent in Ngong Ping Sewage Treatment Works is reused for toilet flushing and gardening in the Treatment Works and used in the toilets in the Cable Car Terminal for flushing.

The Shek Wu Hui scheme was commissioned in late 2006 and supplies reclaimed water for flushing, gardening and water features. Both pilot schemes will be concluded in the end of 2008. They are being monitored in respect of operating conditions, reclaimed water quality and public acceptance of using reclaimed water. The interim results of surveys on public acceptance to the use of reclaimed water under the two pilot schemes were favourable. Subject to the final results of the two pilot schemes, reclaimed water from Shek Wu Hui Sewage Treatment Works could be planned for provision to consumers in Sheung Shui / Fanling for toilet flushing and other non-potable uses. This will also bring forth positive impact on water quality at Deep Bay, which currently receives the discharge from the Treatment Works.



C4.8.3 Use of Grey Water and Rainwater Harvesting

Other types of water reclamation are reuse of grey water and rainwater harvesting. Grey water is collected from baths, wash-basins and kitchen sinks mainly for toilet flushing. Rainwater can be harvested for purposes such as irrigation and toilet flushing. Comparing with the wide-spread usage of rainwater tanks in Australia, in the Hong Kong environment, such systems would be very costly to set up and the potential quantity of water saved is small (of the order of a few mcm per year in total). As noted in the ACE paper, they will not generally be a priority measure in the TWM programme. However, the Government will conduct trials in projects of appropriate scale and nature, to gather experience and encourage private developers to consider them. Both grey water and rainwater recycling systems are being planned for some new public projects such as schools.

C4.8.4 Use of Seawater for Toilet Flushing

As discussed above, Australia is now undergoing rapid development of using recycled water for toilet flushing purpose. In Hong Kong, the Water Supplies Department (WSD) has used seawater for toilet flushing in metropolitan areas and most of the new towns to conserve fresh water. According to the officially published statistics from the Department, the percentage population supplied with seawater for flushing is about 80% while the quantity of seawater used for flushing is equivalent to some 28 per cent of the daily fresh water consumption. WSD has been planning for expansion of the seawater flushing supply system whenever it is economically justified. In this regard, preparatory works are in progress for the supply to Pok Fu Lam, Yuen Long and Tin Shui Wai.

C4.8.5 Use of Desalination Technology

Other than reclaimed water two alternatives of new water resources were evaluated in the latest review on TWM, they are expansion of water gathering grounds and reservoir storage and desalination. As addressed in the ACE paper, whilst desirable from the viewpoint of enhancing local water resources, expansion of water gathering ground will entail high costs and undermine the development potential of the areas concerned for protection of the water quality. Besides, it will give rise to negative impacts on the environment, in particular the ecology of some sensitive downstream resources.

The review thus concludes that the option of expanding water gathering grounds and reservoir storage is of very low priority for Hong Kong.

On the other hand, WSD has commissioned study on seawater desalination by reverse osmosis (RO), which could yield the largest quantity of new water supply in Hong Kong. In 2003, WSD began a pilot desalination plant study using RO technology in Tuen Mun and Ap Lei Chau. The pilot tests were completed in 2007 and confirmed that RO desalination technology is viable for Hong Kong. According to this study, on the positive side, it is the option yielding the largest quantity of new water in the order of hundreds of mcm per year and theoretically as much as needed. It is a proven technology internationally and suitably tested in Hong Kong. The disadvantages are the high capital costs, long implementation time, high level of electricity consumption, and possible negative impact on the marine ecology. In light of this, WSD will keep the option closely in view for future preparedness, including searching for means of alleviating environmental issues and improving financial viability, taking account of advancement of technology and overseas experience.

C4.9 Our Views

Sydney, Gold Coast (in fact the whole Australia) and Hong Kong are proactive in exploring new water resources, in particular recycled/reclaimed water and desalted water, which are not dependent on natural rainfall, despite the difference in the pace of implementation. We believe that these new water resources are vital in promoting sustainable development of the cities in view of the growth in water demand as well as the highly uncertain acute climate changes.

References

- [1] Australian Water Information: Statistics 2006
- [2] WSAAFacts 2005
- [3] Queensland Water Recycling Guidelines (December 2005)
- [4] Metropolitan Water Plan-2007 Progress report, Sydney Water
- [5] ACE Paper 13/2008, Advisory Council on the Environment (ACE), Hong Kong



Meetings with Australian Engineers

D Meetings with Australian Engineers

To enhance the communication between the Institution and its Australian Chapter, the delegation has taken the opportunity to meet the Chapter's representatives in Sydney and Brisbane at two social functions. Besides, to promote the image of the Institution and Hong Kong's engineering profession, meetings with Australia's professional organizations were arranged. We are pleased to have the opportunities to meet the key officials of Engineers Australia (Sydney and Queensland Divisions). The delegation has also organized gatherings to meet the young engineers of Sydney and Queensland so as to enhance our understanding of the working life as young engineers in Australia. Finally we learnt how engineers in Australia contribute to the disadvantaged communities by holding fruitful meetings with Engineers Without Borders - Australia.



Fig D1.1 Meeting with HKIE Australian Chapter in Sydney

D1 HKIE - Australian Chapter

The Hong Kong Institution of Engineers (HKIE) has three overseas chapters which are Canada, the UK and Australia. The Australian Chapter is set up by the Institution in the 2002/03 Session. To enhance the communication between the Institution and the Australian Chapter, the delegation has taken the opportunity to meet the representatives of the Chapter's of Sydney Branch and Queensland Branch on 3 and 5 March 2008 respectively. HKIE Members residing in Sydney and Brisbane were invited to attend the gatherings held in both cities. The gatherings, attended by our Advisors, were particularly useful in exchanging the information on the latest development of the engineering industry in Australia and Hong Kong.



Fig D1.2 Meeting with HKIE Australian Chapter in Brisbane, Queensland



Fig D1.3 Meeting with HKIE Australian Chapter in Brisbane, Queensland



D2 Engineers Australia

D2.1 Engineers Australia Sydney Division

A meeting with Engineers Australia Sydney Division (EAS) was successfully held on 3 March 2008 in the Division's Headquarters, facilitated by EA's representative Mr Jon Lee. The meeting was started by the introduction of EAS by its President, Dr Richard Barnes. According to Dr Barnes over 50% of their members are under the age of 35. The Division is active in organising learned society activities to their members. During the meeting, HKIE's President - Ir Dr W K Lo and the delegation manager - Ir Johnson LEE gave an overview of HKIE and the Delegation. Ir Edmund LEUNG also introduced Hong Kong's sustainable achievements towards the end of the meeting. EA has also invited Mr Henry PAN to share his experience on how engineers can contribute to the disadvantaged community. Besides, the Director of the division, Richard Phillips introduced the latest division's development.



Fig D2.1 Meeting with Engineers Australia Sydney Division



Fig D2.2 Group photo in Engineers Australia Sydney Division

D2.2 Engineers Australia Queensland Division

The meeting with Engineers Australia Queensland Division (EAQ) was held on 6 March 2008. The delegates were pleased to meet several key officials of the division including Mr Geoff Haign, Immediate Past President, Mr Paul Hummel, Executive Director and Ms Katrina Shears, Deputy Director. During the meeting they introduced the latest issues related to sustainable development in Queensland. Besides the division's development was introduced.



Fig D2.3 Discussion with officials of Engineers Australia Queensland Division



Fig D2.4 Meeting with Engineers Australia Queensland Division



Meetings with Australian Engineers

D3 Young Engineers Australia

Young Engineers Australia (YEA) is currently the single largest subgroup within Engineers Australia, with a membership base comprising of over 40,000 young engineers. The group has now been established for over 20 years, with a local committee in each of Engineers Australia's nine divisions.

The delegation has organised two social gatherings on 4 March 2008 and 7 March 2008, during which committee members of YEA's Sydney and Queensland Divisions were met. We exchanged the ideas and knew more about the working life of young engineers in Australia. To show our friendship from Hong Kong, interesting souvenirs with Chinese tradition were presented to the Australian counterparts.



Fig D3.1 Meeting with Young Engineers Australia Sydney



Fig D3.2 Meeting with Young Engineers Australia Queensland

D4 Engineers Without Borders Australia

The delegation is pleased to have the chance to meet the key officials as well as members of organisations which have contributed to the world's sustainable development in Australia. One of those is Engineers Without Borders (EWB) Australia.

EWB Australia is a non-profit making organisation which aims to improve the quality of life of disadvantaged communities, both within Australia and overseas, through sustainable, appropriate engineering projects. Its vision is of a world where every individual and community has adequate access to the resources, knowledge and technology necessary to meet their self identified human needs. EWB is working towards achieving its vision by engaging with engineering students, professionals and industry as well as the broader community.

The delegation was pleased to attend a presentation on 7 March 2008 in Brisbane by Miss Lizzie Webb, the EWB Australia's Education, Training & Research Director. During the presentation the development programmes of EWB were introduced. The programmes include local initiative projects, volunteer international placements and the technical assistance networks. YMC chairman, Ms Sally Leung, finally shared with Lizzie regarding the community services organised by YMC.



Fig D4.1 Present souvenirs to the speaker (Ms Lizzie Webb)

On the other hand, EWB Australia has also spent efforts in ensuring the sustainable development of the developing countries and disadvantaged communities. We were delighted to have a meeting with their Climate Group of EWB Australia – NSW on 4 March 2008. During the meeting the climate change



situations happening around both Australia and Hong Kong were discussed. We have also shared with them regarding the efforts that HKIE has contributed to combat the climate change effects. The climate group was established to guide and to support EWB Australia on matters relating to climate change within the scope of EWB's Charter. They provide recommendations on the strategy, policy and operation of EWB Australia's climate control campaigns, and produce resources for the campaigns.

Climate change is evident and has impacts on various aspects of our life, such as water resources, ecosystems, food supply, and health. However the severity of impact varies among different communities. Developing communities would be more vulnerable to climate change as their adaptive capacities to these changes are low when compared to developed countries. As shared by EWB, in Africa, it was predicted that the yields from rain-fed agriculture in some countries could be reduced by up to 50%. Agricultural production, including access to food, in many African countries is projected to be severely compromised. This would further adversely affect food security and exacerbate malnutrition. Health concerns are expected to be particularly pronounced in developing countries due to the lack of adaptation capacity and high reliance upon local resources.

EWB has implemented projects that have sustainable social outcomes and can reduce net greenhouse gas. The installation of solar cookers for families in developing countries is one of them. The use of solar cookers can protect the forest from unsustainable harvesting for cooking. Each cooker can reduce greenhouse gas emissions when used to replace non-sustainable firewood. It also has other social benefits for the community such as improving health, labour saving and improving living standards.

EWB Australia also concerned with the sustainability of clean water supply to the developing countries and region of poverty. We have attended a seminar jointly organised by EWB Australia – Queensland and Young Water Professional Group of Australian Water Association(AWA) on 5 March 2008. Details are described below.

D5 Australian Water Association

Australian Water Association (AWA) is a national body representing the water professionals in Australia. It promotes sustainable water management through collaboration, advocacy and professional development. It was our pleasure to attend a seminar entitled "Water Sustainability", jointly organised by EWB Australia – Queensland and Young Water Professional Group of AWA. And our delegation was invited to share HK practice in it. Issues included seawater flushing and import of water from Mainland China were discussed during the event. Ms Claire Moore also introduced a non-profit making organization called Water Aid to us and she shared her experience in ensuring water sustainability in developing countries.



Fig D5.1 Ms Sally Leung introducing the delegation to the audience



Fig D5.2 Presentation of souvenirs to the speaker of AWA, Ms Claire Moore

Local Seminars and Visits

E Local Seminars and Visits

Seven local seminars and visits were organised to provide HKIE members and delegates an in-depth understanding on sustainable development and the current practices in Hong Kong. Distinguished speakers from various fields shared with us their experience and views on achieving sustainable development in Hong Kong. Highlights from the local events are presented below.

1. Technical Visit to Dunwell's Group Used Oil Re-refinery Plant

A technical visit to Dunwell's Group used oil re-refinery plant was organised to appreciate the contribution of their Vibrating Membrane Advanced Treatment (VMAT) recycling technology to sustainable development and environment. Dunwell's used oil re-refinery plant collects and treats 80% of used oil in Hong Kong by VMAT. It is an innovative recycling technology that

Date	Title	Speakers
5 Jan 2008	Technical Visit to Dunwell's Group Used Oil Re-refinery Plant	Ir Anthony K M TAM <i>Director of Industrial Operations, Dunwell Petrol-Chemical Co. Ltd</i>
15 Jan 2008	Seminar on the Role of Wind-Structure-Human Interactions in Sustainable Development	Prof Kenny KWOK <i>Director, CLP Power Wind/Wave Tunnel Facility, Hong Kong University of Science and Technology</i>
19 Jan 2008	Ten Major Infrastructure Projects and Sustainable Development Forum	Ir C K MAK <i>Permanent Secretary for Development (Works), Development Bureau, HKSAR Government</i>
28 Jan 2008	Seminar on Sustainable Development in the Twentieth Century from an Engineering Perspective	Ir Otto POON <i>Member of the Council for Sustainable Development</i>
29 Jan 2008	Seminar on Findings of a Sustainable Development Project: Sustainable Development and SMEs in Hong Kong - Awareness and Relevance	Dr Francis K K LUNG <i>China & International Business Director, MTR Corporation Limited</i>
26 Feb 2008	Seminar on Towards Better Urban Air Ventilation for Hong Kong	Prof. Edward NG <i>Professor, Chinese University of Hong Kong</i>
19 Mar 2008	Seminar on BEAM - The Green Building Labelling System	Mr C F LEUNG <i>Specialist - Built Environment, Business Environment Council</i>

allows the sustainable use of used oil. Ir Anthony K M Tam, Director of Industrial Operations of Dunwell Petrol-Chemical Co. Ltd, and his team introduced the innovative process to us.

VMAT is a physical separation method with the use of a vibrating membrane. The technology enables the separation of contaminants in used oil in an energy efficient way. Unlike traditional separation systems, it



operates under low temperature (below 90°C), low pressure (3-4 bar), and occupies a small footprint. Used oil fed into the VMAT system is separated into permeate and concentrate. The clear brown permeate it produces is suitable for low grade lubricant or further processing. The concentrate is also recycled back to the feed after separating out the tar to achieve higher recovery rate.

VMAT is an environmentally friendly technology that minimizes secondary pollution and preserves our limited fuel oil. Besides its application in Hong Kong, it has been used in China, Indonesia and Malaysia for used oil refinery. It has also been adopted by Beijing as the preferred recycling technology in preparation for the 2008 Olympic Games.



Fig E1.1 Dunwell's VMAT Technology

2. Seminar on the Role of Wind-Structure-Human Interactions in Sustainable Development

Wind engineering has been applied to tackle the technical challenges on infrastructure and building development. It has also been used to assess how new buildings could affect our air quality and what could be done to improve the environment. We were delighted to have Prof. Kenny Kwok from the Department of Civil Engineering of HKUST and the Director of CLP Power Wind/Wave Tunnel Facility to share his research and findings in this area.

The use of wind tunnel laboratories has been applied in many areas, such as the design of buildings, curtain walls, and bridges. It has also been used to study urban air quality and assessment of air pollutants dispersion.

In year 2003, SARS dispersed in a very rapid speed. From the wind tunnel tests, it was found that the building pattern and the crowded urban planning might have trapped the source of virus within the building so that the spreading of virus was so serious. The simulation on the air pollutant dispersion pattern in the most crowded region – Causeway Bay was also conducted. It was found that most of the pollutants were trapped between the high and crowded buildings near the ground thus the air quality was hard to be improved in this district.

The application of wind tunnel laboratories to study the different aspects of the environment has helped us to better understand our environment and develop solutions for them.



Fig E1.2 Presentation of souvenir to Ir Anthony K M Tam (R)



Fig E1.3 Presentation of souvenir to Prof Kenny Kwok (R)

Local Seminars and Visits

3. Ten Major Infrastructure Projects and Sustainable Development Forum

The policies of the Government in the development of infrastructure projects have a major impact on sustainable development of Hong Kong. We were honored to have, Ir C K Mak, Permanent Secretary for Development (Works), to give us a prestigious presentation of the ten major infrastructure projects and share his views on the development strategies.

The 2007-2008 Policy Address entitled "A New Direction for Hong Kong" outlines the ten infrastructure projects to boost our economy; four of them are railway infrastructures. They are the South Island Line, the Sha Tin to Central Link, the Guangzhou-Shenzhen-Hong Kong Express Rail Link and the link between Hong Kong International Airport and Shenzhen Airport. The railway infrastructures can improve the cross-boundary transportation system and enhance the existing territory railway system. Railway system facilitates fast and mass movement of people in an environmentally friendly mode of transport, and thus provides a sustainable solution to cope with Hong Kong's transportation need.



Fig E1.4 Presentation of souvenir to Ir C K Mak (R2)

4. Seminar on Sustainable Development in the Twentieth Century from an Engineering Perspective

If we would like to achieve a sustainable future, every one of us has a role to play in the society. In the seminar, Ir Otto Poon, one of our delegation advisors, shared his experience on sustainable development and what engineers could contribute.

The population on earth has grown from one billion to over six billion nowadays, while the total per capita energy consumption has increased dramatically as we advanced from agricultural society to industrial one. Pro-active life style is necessary to change human behaviour and to relief the burden on earth. For instance, using vehicles with smaller horsepower can finish the same journey with less gasoline consumption.

Climate change will seriously impact on our living environment, such as the water supply, ecosystems, and drainage system. From the engineering perspective, there is a two prong approach, "Adaptation" and "Mitigation" to deal with climate change. Adaptation is to combat climate change with regards to the impact on environmental, economic and social. Mitigation means prevention of future damages to the environment. It could be achieved by conservation, energy efficiency, use of renewable or carbon neutral energy, Carbon sequestration (Capturing carbon dioxide from large point sources and storing it instead of releasing it into the atmosphere) and new technology, in which conservation and energy efficiency should be considered in the highest priority.



Fig E1.5 Presentation of souvenir to Ir Otto Poon (L)



5. Seminar on Findings of a Sustainable Development Project: Sustainable Development and SMEs in Hong Kong – Awareness and Relevance

The Hong Kong University Engineering Alumni Association (HKUEAA) had undertaken a survey during 2006/07 to determine whether Small and Medium Enterprises (SMEs) in Hong Kong are aware of what sustainable development means to their business. We were delighted to have Dr Francis Lung, China & International Business Director of MTR Corporation Limited, who is also the president of HKUEAA, to share the findings of the study.

In the study, interviews and telephone surveys were conducted with 120 Hong Kong SMEs in the import/export and restaurant sectors. In addition, a best practice study in Asia was conducted to collect ideas on how Hong Kong SMEs can improve their competitiveness through sustainable development practices. The study results indicated that there is a general lack of understanding on sustainable development in SMEs of Hong Kong. The lack of sustainable development initiative among SMEs is due to limited resources and lack of Government support.

Recommendations were made for promoting sustainable development practices. At the government level, elements for promotion can be incorporated into the procurement of government services by SMEs and tax relief should be considered to specific sustainable development measures. Training for SMEs to learn about basic business management skills should also be considered. At the Enterprise level, the SMEs could implement “3R” (Reduce, Reuse and Recycle) and share resource and innovation with other SMEs in the same sector in order to reduce costs. SMEs could also make their business better known to their local community and develop a system to monitor the effectiveness of sustainable development measures.



Fig E1.6 Our distinguished speaker, Dr Francis Lung (L3)

6. Seminar on Towards Better Air Ventilation

The call for better air quality has been a hot topic in the recent years. In this seminar, Prof. Edward Ng, Professor of Chinese University of Hong Kong and an architect, discussed with us the means in achieving this goal.

A number of problems in the design of our buildings have led to air ventilation problems that Hong Kong is encountering nowadays. These problems including the small street width to building height ratio, uniform building heights, and large podium formed a deep street canyon that trap heat and pollutants, also minimize the wind availability at pedestrian level.

A study on air ventilation assessment was conducted by Prof. Ng that focused on the fundamental mission of “How to design and plan our city fabric for better natural air ventilation.” It explored the feasibility of establishing some protocols to assess the effects of major planning and development proposals on external air movement for achieving an acceptable macro wind environment.

With the aim of providing scientific based urban interventions, the Planning Department issued an Urban Design Guidelines, which contained qualitative guidelines on air ventilation. These guidelines are useful for project proponents to have an idea “qualitatively” on how to optimize their design for air ventilation in the early design stages. Guidelines on the design of breezeway, orientation of street grids, and linkage of open space etc are also included.



Fig E1.7 Our distinguished speaker, Prof. Edward Ng (L4)

Local Seminars and Visits

7. BEAM – The Green Building Labelling System

About 56% of the energy generated in Hong Kong is consumed in commercial and residential buildings. Through the adoption of green building concepts in the planning, design, operation and management of buildings, energy consumption could be reduced. The Building Environmental Assessment Method (BEAM) provides a common set of performance standards that can be pursued by developers, designers, architects, engineers, contractors and operators in achieving a sustainable building. In the seminar, Mr C F Leung (Specialist -Built Environment) from the Business Environment Council gave us a talk on the details of BEAM.

The BEAM defines a set of benchmarks for a range of sustainability issues for a green building. It adopts a whole-life cycle approach and covers issues relating to the planning, design, construction, commissioning, management, operation and maintenance of buildings. There are currently two sets of standards, one for new building and the other for existing buildings. The intention of BEAM is to provide guidance to stakeholders on practices which reduce the adverse effects of buildings on the environment.

The major scopes of BEAM include the following 6 categories: site emission, material consumption, use of energy, use of water, indoor environment quality, and creativity in environmental management. Each category consists of different sections, and credits would be given when the building achieved a certain standard. The standards listed in the assessment incorporate

a range of good practices in achieving a sustainable building and is aligned with local regulations, standards and codes of practice.

Buildings are independently assessed and receive a BEAM certificate with ratings ranging from Bronze, Silver, Gold or Platinum, according to their performance. Advice and guidance to improve performance is provided to owners, designers, builders and operators throughout the assessment process.



Fig E1.8 Presentation of souvenir to Mr C F Leung (L)

Conclusions



F Conclusions

Young engineers in Hong Kong have long recognized the importance of achieving sustainable development of our city. In this regard, a delegation to Sydney, Brisbane and Gold Coast cities in Australia with a view to studying Australia's achievements of sustainable development was successfully organized in March 2008. Fourteen delegates specializing in a variety of engineering disciplines, who work in different sectors of the engineering profession, have been selected. The composition is a representative one from Hong Kong young engineers. The delegation was pleased that Ir Dr W K LO, the President of HKIE and Ir Edmund LEUNG, the Past President of HKIE who was also the advisor leading YMC's first delegation to Australia have joined the trip and participated in the core part of the delegation.

The delegation has studied Australia's achievements in sustainable development towards their infrastructure development, green building design and water and energy resources management. This was achieved by meeting with engineering professional bodies and policy organizations, visiting major engineering infrastructures and production plants and attending several technical meetings presented by prominent speakers. Besides, the delegates were able to draw analogy with the Hong Kong practices with respect to the study topics in Australia.

To further enrich HKIE members' knowledge on key sustainable development issues in Hong Kong, a series of local seminars and visits related to the theme of the delegation was organised. This publication comprises report on overseas and local events. All these activities increase the number of members benefiting from the study of the delegation.

Australians have employed some of the latest technologies in tackling the challenges towards the sustainable development of their cities. Through the delegation, the delegates realized that there are a lot of technologies, engineering policies and practices that Hong Kong can make reference to. On the other hand, there is a contrast in applications between Hong Kong and Australia in some of the study topics although Australia and Hong Kong may face similar natural constraints. In these cases, application of such

technologies requires rather different engineering solutions. The application of chilled beam technology as detailed in section C2 is among one of those. All these findings proved most educational for Hong Kong engineers.

The delegation has also taken the opportunity to promote the image of HKIE and Hong Kong engineers. Social gatherings to build up the connection with the young engineers in Australia and the members of the Australian Chapter of the Institution were organised.

With the dedicated efforts and hard work from the team, the delegation was held successfully. However, it is not the end; young engineers would endeavour to equip their knowledge on sustainable development and there are a lot more that young engineers need to do to sustain our future and our engineering profession.



Annex

Profile of Advisors



Ir Dr W K LO MH JP
HKIE President
Delegation Advisor

Ir Dr Lo, holds a Doctorate in Engineering, Bachelor's degree in Mechanical Engineering and Master's degrees in Business Administration and Industrial Engineering. He is also a Registered Professional Engineer, guest professor of the University of Electronic Science & Technology Zhongshan College, adjunct professor of the City University of Hong Kong, Industrial Fellow of the University of Warwick and Honorary Fellow of the Vocational Training Council. Currently, Ir Dr Lo is the Managing Director of Surface Mount Technology (Holdings) Ltd.

Ir Dr Lo is very active in the community and has served numerous government bodies and professional organisations, which include being member of the Sha Tin District Council, Vice Chairman of the Hong Kong Quality Assurance Agency, and member of Research Grants Council, etc. He is Committee Member of the China Association for Science and Technology. Ir Dr Lo was a Council Member of City University of Hong Kong (1991-98) and the Hong Kong Productivity Council (1993-97) and President of the Hong Kong Association for the Advancement of Science and Technology (97).

With his remarkable engineering achievements and service to the community, Ir Dr Lo was awarded the "Young Industrialist Awards of Hong Kong" and the "Ten Outstanding Young Persons" in 1992. Ir Dr Lo was also awarded Medal of Honour by the Chief Executive of the HKSAR Government in 2001, and has been appointed as a Justice of the Peace since July 2004.



Ir Edmund K H LEUNG OBE JP
HKIE Past President
Delegation Advisor

Ir Leung was a graduate of Hong Kong University in Mechanical Engineering in 1967.

He has pursued an engineering career for 40 years, starting with the power utilities, and then manufacturing industry before his focus on the construction industry. He had been closely involved with construction projects of most railways and highway tunnels projects in Hong Kong.

He retired from position of Chairman of the Greater China Region of Hyder Consulting Limited in 2003 and presently serving as an Advisor to Parsons Brinckerhoff (Asia) Limited.

He is very active in public services, and served as the President of The Hong Kong Institution of Engineers for 1995/1996, the Chairman of the Hong Kong Branch of the Institution of Mechanical Engineers for 1997-2000 and Council Member for 2005-2007.

He is presently serving as a Board Member of the Hong Kong Airport Authority, a Member of the Town Planning Board, and the Chairman of the Energy Advisory Committee, among other public services.

He was honoured in 1996 as an OBE and appointed a Justice of Peace in 1997.



Ir Otto POON BBS OBE
*HKIE Past President
 Delegation Advisor*

Otto was educated in Hong Kong and England.

He is a Chartered Engineer with over 40 years' experience in E&M engineering. He established Analogue Group of Companies in 1977 which has developed into diversified international engineering operations with over 1,500 staff in Hong Kong, Macau, China and Canada specialise in IT, security, environmental, process control, elevator, escalator, electrical and mechanical equipment and plant.

Otto was a Member of the Advisory Council on the Environment from 1996 to 2004, Chairman of Environmental Impact Assessment Subcommittee from 2003 to 2004, a Member of Energy Advisory Committee from 1996 to 2000, Chairman of Energy Advisory Committee from 2000 to 2006, a Member of Solicitors Disciplinary Tribunal Panel from 1996 to 2007 and a Member of Trustee Board, Institution of Mechanical Engineers, UK from 2005 to 2007. He was also the President of the Hong Kong Institution of Engineers (1998/1999) and the Chairman of Institution of Mechanical Engineers, Hong Kong Branch (2002/2004).

He now serves as Chairman of Strategy Subcommittee and Member of the Council for Sustainable Development, Member of Bauhinia Foundation Research Centre, President of Hong Kong Association of Energy Engineers, President of Association of Energy Engineers (Hong Kong Chapter), Council Member of Chinese Mechanical Engineering Society, China, and Member of Advisory Committee of the Department of Electrical & Electronic Engineering, the University of Hong Kong.

Otto was awarded OBE in 1996 and BBS in 2003. He was elected as an Outstanding Hong Kong Polytechnic University Alumni in 1999 and an Outstanding Branch Member of the Year (2003-04) by the Institution of Mechanical Engineers, UK. He was also awarded as a University Fellow by the Hong Kong Polytechnic University in 2007.



Ir Victor K Y LO
*CPDC Deputy Chairman
 Delegation Advisor*

Ir Lo is the Deputy Chairman of CPD Committee of the HKIE and serving the Civil Division Committee as well as the Public Relation Committee. He has organized hundreds of site visits, technical meetings, seminar and conference for the members of the HKIE in his past ten years service with the Institution. Victor has involved in candidate selection interview in this delegation. He is now a senior engineer working in the Water Supplies department of the HKSAR Government.



Ir W K LEUNG
*CPDC Member
 Delegation Advisor*

Ir. W K Leung is the Past Vice President of HKIE and Past Chairman of CIE Hong Kong. Ir. Leung graduated from Hong Kong Technical College and received his M.Ed. (Higher Education) from the University of Hong Kong. He had worked in Swire Group and Hong Kong Polytechnic. He is now the Senior Lecturer in the Department of Engineering, Hong Kong Institute of Vocational Education, (Tsing Yi). His current interests include mobile communications, electromagnetic compatibility and low power radio systems.



Profile of Advisors and Delegates



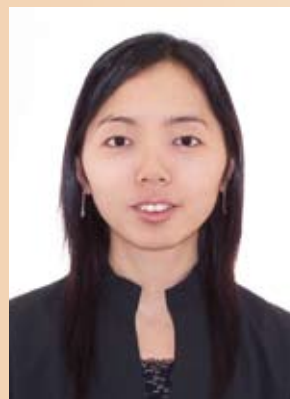
Ir C S LAM
CPDC Member
Delegation Advisor

Ir Lam, advisor of the Australia Delegation 2008 for Young Members Committee, has been serving as an executive committee member in the Continuing Professional Development Committee, Civil Division and Materials Division. Ir Lam has organized many technical seminars, talks and visits, and given safety & health talks for the benefits of the members. Ir Lam has worked in CLP Power Hong Kong Ltd as an Engineer. He would like to help young engineers becoming a corporate member.



Ir Johnson K C LEE
(Civil Engineering, email:
johnsonkclee@yahoo.com.hk)
Delegation Manager and
YMC Immediate Past
Chairman

Ir Johnson Lee graduated from the University of Hong Kong in civil engineering in 2001 and obtained his second degree in Law in 2006. He acquired chartership recognised by professional institutes of Australia, UK and Hong Kong. He has six years of experience in the planning, design and contract administration of highways, sewage treatment plant and wastewater collection system projects. He is currently an Engineer responsible for surveillance and monitoring of impounding and service reservoirs of the Water Supplies Department of HK Government. Besides, Ir Lee has actively participated in serving the Institution and was elected as YMC Chairman for session 2006-2007, overseeing the interest of 8000 members below 35. He was previously involved in organising delegations to Mainland China and southeast Asia.



Ms Sally S Y LEUNG
(Building Services Engineering,
email: sallyleungymc@gmail.com)
Deputy Delegation Manager
and YMC Chairman

Sally obtained her Master and Bachelor degrees in Building Services Engineering from the Hong Kong Polytechnic University. Upon her graduation, she joined Meinhardt (M & E) Limited and was trained to become a Building Services Engineer. Sally is currently responsible for hydraulic design. Sally joined HKIE-YMC in 2004 and became a committee member in Session 2005-2006. She was then elected as the Honorary Treasurer in Session 2006-2007 and become the Chairman for the current Session 2007-2008. During leisure time, Sally enjoys participating in the volunteer teaching works and acting as eco-tour guide for the community.



Ir Trevor C W TANG
(Gas Engineering,
email: trevor.tang@towngas.com)

*Deputy Delegation Manager and
YMC Committee Member*

Trevor obtained his BAsC and MEng degrees in Mechanical Engineering from the University of British Columbia, Canada in 2000 and 2001 respectively. In 2004, he acquired the Trainee of the Year Award from the HKIE. Since 2002, he has been actively contributing himself to the HKIE as well as YMC. He is now a committee member of HKIE YMC leading the Public Relations Group. Trevor joined The Hong Kong and China Gas Co. Ltd as a Graduate Trainee in 2002 and is currently an Engineer responsible for operating and maintaining underground gas pipelines.



Mr Ken C N CHEUNG
(Electrical Engineering,
email: ken_cn_cheung@yahoo.com.hk)

*Overseas Liaison Officer and
YMC Committee Member*

Ken received his BEng(Hons) and MEng degrees in Electrical Engineering from the Hong Kong Polytechnic University in 2006. In 2005, he obtained the 3rd prize award in the '9th National Challenge Cup Contest' (China) and a trainee award to work in Czech Republic. Besides, Ken has been actively involved in the activities of learned societies. He now serves as a committee member of HKIE -YMC responsible for student promotion matters and an ex-officio member in the HKIE Nuclear Division. He is now working in CLP Power Hong Kong Limited as a Graduate Trainee, in which CLP is the largest power utility in Hong Kong serving 2.2 million customers.



Ir Victor K S LEE
(Geotechnical Engineering,
email: victorkslee@yahoo.com.hk)

*Secretary and
YMC Committee Member*

Victor works as an Assistant Resident Engineer in Maunsell Geotechnical Services Ltd. He has joined YMC as a helper since 2003 and became the committee member of YMC in 2005. Victor has led the working groups of webmaster and seminar for the last 2 years. He is also the community service group leader in the current YMC session. He has actively participated in different visits/delegations and was one of the delegates of YMC Mainland Delegation 2003 to Beijing and Hubei of Mainland China.



Ms Christina N Y LEE
(Civil Engineering,
email: christina.lee@atkinsglobal.com)

Overseas Liaison Officer

Christina works in Atkins China Limited as an Assistant Engineer and is currently involved in detailed design of underground stations for the Dubai Metro Project. She was an Assistant Resident Engineer in the project of Central Reclamation Phase III in Hong Kong, responsible for supervising the site works and monitoring the works programme. She is an active helper in the YMC, organizing and participating in different kinds of community services. Her interests are sports and music.



Mr Ernest K W TSANG
(Building Services Engineering,
email: ekwtsang@yahoo.com.hk)

Treasurer

Ernest is currently a Research Assistant at City University of Hong Kong. Before he furthers his post-graduate study, he has been working in the private sector for several years. His research interest includes building and environment issues, particularly solar and daylighting design, building energy and daylighting modeling.



Mr Marcus H K TANG
(Environmental Engineering,
email: marcus_thk@yahoo.com.hk)

Local Liaison Officer

Marcus joined the Environmental Protection Department as an Environmental Engineering Graduate upon graduation in 2001. He was involved in the development and management of waste facilities, and noise assessment of planning projects. In 2005, he joined the railway industry. He is currently an Environmental Engineer at MTR Corporation Limited and is responsible for managing the environmental aspects of railway projects.



Profile of Delegates

**Mr Ken K K CHAN**

(Civil Engineering,
email: kenchan72002@yahoo.com.hk)

Local Liaison Officer

Ken is currently working in the Drainage Services Department of HK Government as a Graduate Engineer. He has working experience in the planning and design of the sewage collection system and the salt water supply system in Hong Kong. He looks forward to share his experience with engineers in Australia.

**Mr Ryan H L CHAK**

(Civil Engineering,
email: ryan.chak@cr3.com.hk)

Public Relations Officer

Ryan obtained his Bachelor of Engineering (Hons) in Civil and Structural Engineering in the Hong Kong Polytechnic University in 2005. He works in the Atkins China Limited as a Graduate Engineer after his graduation and is now working for the Central Reclamation Phase III project as an Assistant Resident Engineer.

**Ms Meg H Y CHOW**

(Civil Engineering,
email: meg.chow@atkinsglobal.com)

Publicity Officer

Meg obtained her Master and Bachelor degrees in Civil and Environmental Engineering from the Hong Kong Polytechnic University. She is working as an Assistant Engineer for the Tunnel and Ground Engineering Department of Atkins China Limited. Over the years, she has been involved in a number of large infrastructure projects, including Dubai Metro in the Middle East as well as the Central Reclamation Phase III in Hong Kong. Her particular interests are geological modeling, ground settlement analysis and impact assessment.

**Mr Jacky K K LEE**

(Building Services Engineering,
email: kakihk1@yahoo.com.hk)

Publication Officer

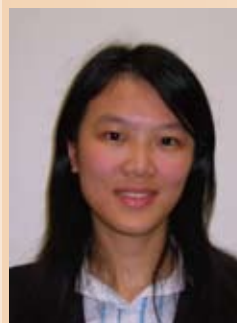
Jacky holds a Bachelor degree in Building Services Engineering from the Hong Kong Polytechnic University in 2006. In 2005, he acquired "Fire Engineer Scholarship" from Hong Kong Polytechnic University and was in the Dean's List in 2006. Jacky is in the building services discipline and is currently working in Meinhardt (M & E) Limited as a Graduate Engineer. He has involved in the design of heating, ventilation, air conditioning and fire service systems. At present, he works for a large-scale development project in Macau of Mainland China.

**Ms Jenny C L LAU**

(Structural Engineering,
email: chinglingb@yahoo.com.hk)

Publication Officer

Jenny was graduated in the University of Hong Kong in Civil Engineering last year. She is currently a Graduate Engineer in the Department of Structural Engineering of the Ove Arup and Partners Limited in Hong Kong. Having interest in traveling, she hopes to involve in different projects around the world. She shows particular interest in Astronomy and Stargazing.

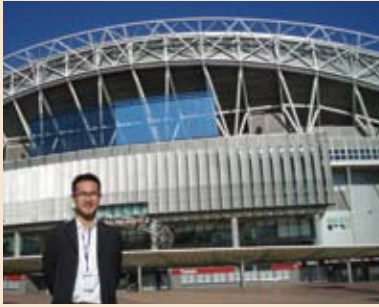
**Ms Gloria Y L SUEN**

(Building Services Engineering,
email: julieluby008@yahoo.com.hk)

Logistics Officer

Gloria was graduated in City University of Hong Kong in Building Services Engineering in 2006. She is currently working as an Assistant Engineer in the Far East Consulting Engineers Limited, a building services engineering consultancy firm. In the past years, she has worked on the design of electrical installation for building development, including hotel, institutional and residential buildings.

Messages from Delegates



Ir Johnson K C LEE

Not only the knowledge of sustainable development, the delegation also trained me to lead a team of young engineers to conduct a meaningful research. Although this delegation has come to an end, our enthusiasm to contribute to build a sustainable world will continue.

Ms Sally S Y LEUNG

Organizing the delegation is a challenging task as it involves many overseas and local liaison works but I enjoy working with all of them. It is really a great opportunity for me to meet different organizations and extend my horizon. Special thanks should be given to all of our honourable advisors for their continuous support to YMC.



Ir Trevor C W TANG

The delegation has not only extended my engineering experience to a new horizon, but also expanded my social network to another continent for cultural and experience exchange. I would highly recommend this kind of delegation to other young engineers.

Ir Victor K S LEE

It was a successful delegation that I have learnt many new things of sustainable development from Australia. I would also like to thank all the delegates for their efforts and the advisors for their valuable advices.



Mr Ernest K W TSANG

This trip is the busiest trip. However, it is also the most valuable trip to me. Not only engineering knowledge, it also improved myself in all round. Many thanks to Johnson, Trevor and Sally for organising this trip, thanks are also expressed to other teammates who have made a memorable journey to me.

Mr Ken C N CHEUNG

Having this opportunity to get familiar with Australia's up-to-date engineering wonders, building friendship with Australian young professionals is another precious souvenir for this delegation. I would like to express my heartfelt thanks to all Australian hosting organizations for providing us those eye-opening experiences.

Ken Cheung (right) and Edmund Leung (left) in front of Sydney Opera House





Messages from Delegates



Ms Christina N Y LEE

The delegation is fruitful, cheerful and unforgettable. From putting effort to organize and prepare for the trip, to the busy days in Australia and then to the sharing of experience to engineers in Hong Kong, I learnt a lot and felt myself becoming more mature. It is my great pleasure to involve in this Delegation.

Mr Marcus H K TANG

I treasure this valuable opportunity to get together with professionals from different fields both locally and in Australia. It is nice to share and learn from each other on dealing with challenges we faced in different cities.



Mr Ken K K CHAN

I am benefited so much from this Australia Delegation. I felt very honoured and fortunate to be able to travel with a group of outstanding young engineers from various disciplines and two accompanying advisors. The seven days of sharing, gatherings, sunshine and fresh air in Australia would always be a part of my unforgettable memories.

Mr Ryan H L CHAK

I am so glad to join the Australia Delegation and I could visit the sites, companies and organizations which are related to sustainable development. Besides, we met a lot of new friends in Australia who work in engineering field. Moreover we have an enjoyable day trip to Gold Coast last day!



Ms Meg H Y CHOW

I am pleased to have such an opportunity to Australia, exchanging information on sustainable development and making friends with the Australian engineers. Their hospitality is so impressive to me and the journey is marvellous!

Mr Jacky K K LEE

It is wonderful time during the delegation. I can see and learn many new things and technology. I can acquire my knowledge and make many new friends. Australia is a very nice country.



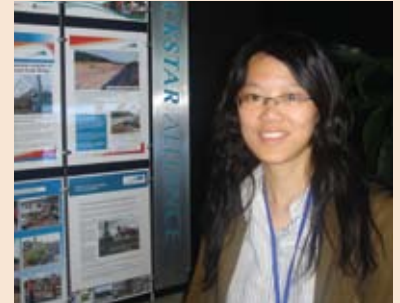


Ms Jenny C L LAU

It is a fruitful experience for me to broaden my horizon in the field of engineering. It is also grateful to meet engineers from different background and different countries. I would share what I learn on sustainability in this trip to others.

I am glad that I can participate in this overseas delegation. It is so worth for me to enjoy the trip and communicate with other engineers. I would like to thank all my teammates as we can support each other during the preparation work and the journey.

Ms Gloria Y L SUEN





Financial Statement

Financial Statement

Income & Expenditure Statement

Income

	Financial Status (HKD)
1. YMC Reserve	30,000.00
2. Delegates' Contribution	98,000.00
3. CPDC Contribution	40,000.00
4. Sponsors	55,000.00

Expenditure

	Budget (HKD)	Financial Status (HKD)
1. Meeting Expense	1,500.00	1,053.40
2. Overseas Events Expenditure		
a. Travel & Accommodation	150,000.00	142,800.32
b. Catering	24,000.00	29,351.23
c. Souvenirs	1,600.00	1,725.72
d. Photographs	100.00	98.60
e. Communication	2,000.00	2,000.00 *
f. Postage	500.00	500.00 *
g. Miscellaneous on Trip	2,000.00	157.30
3. Local Event Expenditure		
a. Travel	500.00	400.00
b. Catering	200.00	251.00
c. Delegation Presentation	3,500.00	3,500.00 *
4. Publicity	1,000.00	1,351.00
5. Report Production		
a. Report	35,000.00	32,000.00 *
b. Postage & Stationery	1,000.00	1,000.00 *
Sub-total	223,000.00	216,188.57

Net=
Surplus 6,811.43

Remark:

* Estimate as of May 2008

Acknowledgements



Acknowledgements

We would like to express our deepest gratitude to the following organizations for their helpful guidance and enduring supports leading to the success of this delegation:

- Australian Water Association, Young Water Professionals
- Brisbane City Council, Transport & Traffic of City Policy and Strategy Division
- Eco Tech Bio Diesel
- Engineers Australia, Queensland Division
- Engineers Australia, The Innovation Sub-committee
- Engineers Australia, The Society for Sustainability and Environmental Engineering
- Engineers Australia, Sydney Division
- Engineers Australia, Young Engineers Australia (YEA)
- Engineers Without Borders, Australia
- Gold Coast Water
- GridX Power Pty Ltd
- The Hong Kong Institution of Engineers, Australian Chapter
- Maunsell Australia Pty Ltd
- Queensland Government Trade & Investment Office Hong Kong & Guangzhou
- Sydney Water
- Trackstar Alliance

We appreciate very much the financial support from the following sponsors:

- ATAL Engineering Ltd
- Hong Yip Service Company Ltd
- Leighton Asia Limited
- Meinhardt (Hong Kong) Limited
- The Hong Kong and China Gas Company Limited
- The Hongkong Electric Co. Ltd
- Zurich Life Insurance Co. Ltd

In addition, we would like to express our special thanks to following people who generously assist us throughout our delegation:

- Mr Jon Lee
- Ms Anny Joseph
- Prof David Hood

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- Public address system
- Security system
- Computer room fitting out installation
- Data and communication system
- Lift and escalator
- Industrial electrical and mechanical plant
- Transport systems (rail, underground and ITS)
- M&E service and maintenance

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Editors

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June 2008

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