

**Valuing Natural Capital in Real Estate Development**  
**Challenges and Opportunities in the Pearl River Delta, P.R. China**

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by

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B. Architecture & B. Science, Environmental Design, 1994  
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Submitted to the Department of Architecture in Partial Fulfillment of the Requirements  
for the Degree of

**Master of Science in Real Estate Development**

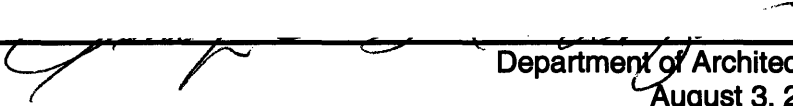
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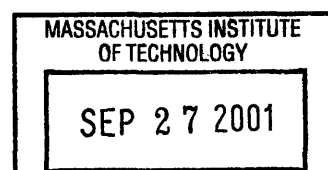
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### **Abstract**

The challenging economic, social, and political issues that face the Pearl River Delta region of south China make it different from any other area of the world. With the clash of such dynamic elements and a desire for rapid expansion, the environment there has suffered greatly. The forces of change within the delta, unleashed by the open economic policies of the late 1970s, have caused a staggering amount of development and industrialization, while the methods to control its impact are still evolving. The recent reunification of Hong Kong and Macao into China and the impending entrance of the country into the WTO bring new challenges. As the center of economic transformation, the region has become the nation's gateway to the outside world and is seeking to keep its competitive edge as other coastal regions open up. A cleaner environment is beginning to be seen as part of this competitive edge.

The region has tremendous potential for giving its economy and society ecological orientation. Only a more systematic, integrated view will enable this region to innovate for long-term profitability and sustainability. A strategy that values natural capital can bring competitive advantage. Natural capitalism is a powerful new business model that integrates business and environmental motives. Through this model, businesses can better satisfy their customers' needs, increase profits, gain competitive advantage, and help solve environmental problems, all at the same time. As currently practiced, the real estate business does not place value on natural capital. Green development is the vehicle through which natural capitalism can be practiced in real estate development.

In the context of the natural capitalism model, this thesis explores the emerging financial, social, and ecological benefits of green development and the applications of it in the Pearl River Delta. A vast array of information on green development has emerged over the last ten years. Hundreds of such projects are pushing the envelope and realizing tremendous benefits with the advancement of knowledge and technology in green building. This thesis presents leading international case studies and research in green building, including activities underway in south China. Challenges that currently impede the adoption of such practices in the region are identified and opportunities that could help bring about such positive development are explored.

**Thesis Supervisor:** Fred Moavenzadeh

**Title:** Director and Professor of Engineering Systems Center for Technology, Policy and Industrial Development

### **Biography:**

Jenifer Seal Uncapher is pursuing a Master of Science in Real Estate Development at Massachusetts Institute of Technology. While at MIT, she worked for the Alliance for Global Sustainability investigating sustainable business practices in Hong Kong and the Pearl River Delta region of China. She holds a Bachelors of Architecture and a Bachelors of Science in Environmental Design from Ball State University in Indiana. At Rocky Mountain Institute in Snowmass, Colorado, Jen was a Managing Director of the Natural Capitalism Practice and a Senior Associate with RMI's Green Development Services. She is a senior co-author of the acclaimed book *Green Development: Integrating Ecology and Real Estate* and managed its production. In addition, she is the co-author of the *Green Developments* CD-ROM and has contributed to several other RMI publications. Jen was active in RMI's Natural Capitalism Practice and GDS consulting services, business seminars, and workshops, serving such clients as the Pentagon, Disney Imagineering, Habitat for Humanity, and Hines. Along with the GDS team, she was awarded the President's Council on Sustainable Development and Renew America Green Building Award in 1999 for the instrumental work of GDS. As an architectural intern with William McDonough Architects in New York, she worked on a variety of environmentally-conscious designs. The Association of Collegiate Schools of Architecture and European Association for Architectural Education presented her an award in Prague, Czech Republic in 1993. She was the first student in the history of the American Institute of Architects to be awarded its Presidential Citation for her commitment to sustainable architecture education.

### **Acknowledgements:**

Many people have been so generous with me and supported my efforts. I would like to acknowledge my advisor, Fred Moavenzadeh, and the Alliance for Global Sustainability for support of my trip to China and to those who so graciously talked with me about my research. I am indebted to my wonderful friend Jen Cookke Mazurkie who made this year so enjoyable. The MIT *Green Mafia*, particularly CRE's Jeff, Gregg, Philippe, Rick, Scott taught me a great deal. To my adopted Boston family Michelle, Dan, Katie, and Lucy who swept me away from MIT on some wonderful adventures and to Jing for the spring-time walks. To all of my RMI and Colorado friends for their continued enthusiasm about my endeavors. I am very thankful for the gushing support of my family. Lastly, I especially am grateful to Michael for encouraging me to fly off to MIT for a year to study.

This thesis is dedicated to three people who have greatly influenced my life, professionally and personally: Dana Meadows, David Brower, and my little brother, William Seal. While their lives on this earth have passed, their contributions here live on.

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*"We can no longer afford the luxury of pessimism. Despair is a sin. Hope is more fun. So is rethinking. We can rethink progress, sustainability, mobility, design, conservation, preservation, restoration. And we must..."*

*David Brower,  
Foreward: The Land That Could Be  
2000*





## VALUING NATURAL CAPITAL IN REAL ESTATE DEVELOPMENT

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### Challenges and Opportunities in the Pearl River Delta, P.R. China

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#### Chapter 1: Introduction & Methodology

*“With its development start over other China regions, the Pearl River Delta will continue to serve as a rare laboratory for development and for assessing the effectiveness of different policies on planning approaches.”*  
*Lin, Chu-Sheng, Red Capitalism in South China, 1997.*

#### **Thesis Overview**

The Pearl River (Zhujiang) Delta of Guangdong Province and Hong Kong, People’s Republic of China, is one of the most dynamic regions in the world from an economic, social, and political perspective. Some have called it the “epicenter of a revolution.”<sup>1</sup> With the clash of such elements and a desire for rapid expansion, the environment has greatly suffered. As the center of economic transformation, the region has become the nation’s gateway to the outside world and is seeking to keep its competitive edge as other coastal regions open up. A cleaner environment is beginning to be seen as part of this competitive edge.

The region has tremendous potential for giving its economy and society ecological orientation. Only a more systematic, integrated view will enable this region to innovate for long-term profitability and sustainability. A strategy that values natural capital can help bring competitive advantage. Natural capitalism is a powerful new business model that integrates both business and environmental motives. As currently practiced, the business of real estate development does not place much value on natural capital. Green development is the vehicle through which natural capitalism can be practiced in

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<sup>1</sup> Campanella, Thomas, Joyce Lee, and Wallace Chang. “Planning for Sustainability in the Pearl River Delta: An Environmental Design Charrette in Zhongshan, PRC.” Department of

real estate. In the context of the natural capitalism model, this thesis explores the emerging financial, social, and ecological benefits of green development and the applications of it in this region.<sup>2</sup>

In recent years, China has made an effort to embrace some these concepts. China was the first nation in the world in affirming the environmental agenda (commonly known as Agenda 21) in its national policies.<sup>3</sup> In 1994, the State Planning Commission and the State Science and Technology Commission (STC) published the “White Paper on China’s Population, Environment, and Development in the 21<sup>st</sup> Century.”

Few green development projects, however, have been implemented in south China. So there is a great opportunity for education in this regard. Stephen Chung, Director of Real Estate Analysis with Real Estate Tech (a real estate consulting firm in Hong Kong), stated that from his observations environmental and sustainable design is primarily now used as a selling feature in marketing Chinese projects, especially residential ones.<sup>4</sup> He pointed out that the perception of what constitutes sustainable design may be somewhat less sophisticated or different than that of North America. For example, real estate

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Architecture, The Chinese University, American Institute of Architects, New York Chapter, Municipality of Zhongshan, PRC, and Hong Kong Institute of Architects. June 18-20, 1999.

<sup>2</sup> For the purposes of this thesis, the terms “green development,” “sustainable development,” and “green building” are used, for the most part, interchangeably. This approach is defined as an integrated framework of planning, design, construction, and operation practices that encompasses the environmental, economic, and social impacts of buildings and development. Such practices recognize the interdependence of the natural and built environments and seek to minimize the use of energy, water, and other natural resources and provide a healthy, productive indoor environment.

<sup>3</sup> Agenda 21 was produced at the landmark Earth Summit in Rio (1992) and considers the balance between economic development and the environment.

<sup>4</sup> This interview was conducted with Stephen Chung, Real Estate Tech—a service of Zeppelin Real Estate Analysis Limited—over email in July 2001. His company is involved in real estate development, investment and asset management and covers Hong Kong, mainland China and parts of Asia. Mr. Chung’s focus is on real estate analysis and strategy while his partners are involved in project management, architecture and facility maintenance. The firm also does do some development projects. As practitioners, he notes the firm does not install green design measures or features simply for installation’s sake, yet if there is a benefit to be derived e.g. leading to better life-cycle costing scenarios and asset values, they will strive to incorporate them. See <http://www.real-estate-tech.com> for more information on his firm.

marketers and advertisements treat the planting of trees, landscaped open spaces, and turf-laying, as sustainable design. More innovative sustainable design is only incorporated in some of the more 'expensive' projects which have an appeal to Hong Kong investors, many of whom he noted are starting to buy into the green building concept along with the more affluent people in China.

Progress is being made. As recently as this June (2001), China hosted its first large-scale exhibition and conference on green building. The national STC conference, sponsored by the National Environment Conservation Bureau, China Environment Conservation Society, and a major construction company, looked at the building industry's impact on the natural environment and quality of life. The green building projects and technologies highlighted at the conference demonstrate how to reduce the consumption of energy in operation and maintenance; to increase the efficiency and comfort of users; to reduce material waste; and to increase the lifetime and flexibility of buildings.

As the Pearl River Delta (PRD) region continues its rapid period of development, the government and the building industry—as an enormous consumer of energy and resources—are beginning to see how more sustainable development practices can be part of the solution. The government, business, NGO, and academic institutions in the PRD have various un-integrated sustainability and environmental pollution projects underway. The natural capitalism model can provide a framework to pull these disparate efforts together.

### ***The Natural Capitalism Model***

*“Natural capitalism is about choices we can make that can start to tip economic and social outcomes in positive directions. And it is already occurring—because it is necessary, possible, and practical.”<sup>5</sup>*

Natural capitalism is a powerful new business model that describes a future in which business and environmental interests increasingly overlap and in which businesses can better satisfy their customers’ needs, increase profits, gain competitive advantage, and help solve environmental problems, all at the same time.<sup>6</sup> One facet of this model lies in real estate development—showing how developers, facility owners, and building occupants can reap substantial bottom-line benefits while minimizing impact and possibly restoring the environment.

“Natural capital” refers to the natural resources and ecosystem services—air and water purification, climatic stabilization, waste detoxification, and so forth that make all economic activity and, more importantly, all life possible. Ecosystem services are of immense economic value; some are literally priceless, since they have no known substitutes. Current business practices, however, typically fail to take into account the value of these assets—which is rising with their scarcity. It liquidates, rather than values (or reinvests in), its largest stock of capital. Clearly, behaving as though these ecosystem services are valueless has devastated the environment.

To date, no one really knows the exact value of these eco-system services, but it’s not zero. As described in the recent book, *Natural Capitalism: Creating the Next Industrial Revolution*, valuing natural capital is at best a “difficult and imprecise exercise.” Studies have shown that biological services flowing directly into the stock of natural capital are

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<sup>5</sup> Hawken, Paul, Amory Lovins, and L. Hunter Lovins. *Natural Capitalism: Creating the Next Industrial Revolution*. New York: Little Brown, 1999. Pg 322.

<sup>6</sup> These ideas are described in *Natural Capitalism: Creating the Next Industrial Revolution*, 1999. Also see: [www.naturalcapitalism.org](http://www.naturalcapitalism.org) and Senge, Peter and Goran Carstedt. “Innovating Our Way

worth at least \$36 trillion annually.<sup>7</sup> “If natural capitalism stocks were given a monetary value, assuming the assets yielded interest of \$36 trillion annually, the world’s natural capital would be valued at somewhere between \$400 and \$500 trillion.”<sup>8</sup>

Sometimes the cost of destroying ecosystem services becomes apparent only when the services start to break down. In China’s Yangtze basin in 1998, for example, years of deforestation practice caused flooding that killed 3,700 people, dislocated 223 million and inundated 60 million acres of cropland. This \$30 billion disaster forced a logging moratorium and a \$12 billion crash program of reforestation.<sup>9</sup> Determining how to properly value ecosystem services and human worth is a challenge. Many, however, are taking on this challenge and progress is being made as the hundreds of examples of natural capitalism illustrate. Many of which are in green real estate development.

The natural capitalism business model enables companies to fully realize opportunities described above. Four major shifts in business practices are involved, all vitally inter-linked:

- Radically increase the productivity of natural resources.
- Shift to biologically inspired production models and materials.
- Move to a “service-and-flow” business model.
- Reinvest in natural capital.

As one of the most rapidly developing and affluent parts of the country, significant opportunities exist in the Pearl River Delta region of China to apply this model to the *business* of planning and real estate development.

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to the Next Industrial Revolution”, MIT Sloan Management Review: Reprint 4222; Winter 2001, Volume 42, Number 2, Pgs 24-38.

<sup>7</sup> Costanza, R. et al. “The Value of the World’s Ecosystem Services and Natural Capital.” Nature, 387:253-260, May 15, 1997.

<sup>8</sup> Hawken, Paul, Amory Lovins, and L. Hunter Lovins. Natural Capitalism: Creating the Next Industrial Revolution. New York: Little Brown, 1999. Pg 5.

<sup>9</sup> Lovins, Amory, L. Hunter Lovins, Paul Hawken. “A Road Map for Natural Capitalism.” Harvard Business Review. May-June 1999. Pg 146.

### ***Natural Capitalism Application in Building: Green Development***

For real estate development to embrace the natural capitalism business model requires consideration of a broader set of issues related to ecology and community. The typical economic analysis in real estate does not place value on the eco-system services—whether the project restores, enhances, or destroys these services. The practice of green development can help integrate these considerations into projects.

Green development is an integrated framework of design, construction, and operation practices that encompasses the environmental, economic, and social impacts of buildings. Such building practices recognize the interdependence of the natural and built environments and seek to minimize the use of energy, water, and other natural resources and provide a healthy, productive indoor environment.<sup>10</sup> The move toward green development has realized a dramatic growth in interest and projects in many countries over the last decade. Many organizations and businesses have emerged with a focus on this kind of development. This approach has provided building design and construction a new angle that surpasses traditional approaches in many aspects, even economically.

To create green development projects requires, perhaps most importantly, a whole-systems approach. This means treating the project as a whole, considering the location, form, structure, contents and relationship of its surroundings. In order to achieve these goals, the participation and collaboration of the entire interdisciplinary design team, including the developer, at the beginning of the process is necessary.

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<sup>10</sup> Adapted from the City of Portland Green Building Standards, 2000.

Green development includes the following considerations.<sup>11</sup>

- ❑ Design to fit the site
- ❑ Design to foster community
- ❑ Design for resource efficiency
- ❑ Design for a healthy indoor environment
- ❑ Design for adaptability
- ❑ Design for durability and easy maintenance

A hotly debated topic is the cost of such projects. More and more case studies are showing that green buildings are not inherently more expensive to build than conventional ones as the following projects show.<sup>12</sup> SC Johnson Worldwide Professional Headquarters Building, in Racine, Wisconsin, was \$137 per square foot including all land costs; the International Netherlands Group Bank headquarters in Amsterdam was built for \$161 per square foot, including fixtures, furnishings and equipment (see case study below); and Four Times Square, in Manhattan, was \$125 per square foot for core and shell. While the capital costs for these buildings are equal to their non-green counterparts, their operating costs are significantly lower, and the buildings are healthier and more comfortable to occupy and more productive to work in. Investigation of many case studies; conversations with several developers, REIT executives, real estate investors, and others in the industry; and through a review of the evolving research in this area, identify great potential for: higher asset value, reduced energy costs—higher net operating income (NOI), quicker lease-ups and lower turnover, and more desirable properties for projects that take a green development approach.

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<sup>11</sup> For more information see Chapter 6: “Building Design” in Green Development: Integrating Ecology and Real Estate. Pgs 156-189.

<sup>12</sup> Numerous case studies from US Green Building Council, US Department of Energy, Rocky Mountain Institute and others have documented this.

As a vehicle of natural capitalism, green development is reflected in each of its four principles.<sup>13</sup>

### Radical Resource Productivity

Environmentally-responsive development can significantly improve the comfort, aesthetics, resource efficiency, and value of properties while reducing pollution and saving money. On average, over 30% of total energy usage and 60% of electricity are linked to buildings.<sup>14</sup> Much of this consumption is inefficient and wasteful. Therefore improving the resource productivity of buildings both in construction and operations represents a huge business opportunity and a potent way to save money and improve quality of life. Greg Kats from the Department of Energy noted for the US, “in the public and commercial sectors alone there is over \$100 billion worth of potential efficiency investments.” A recent study by the U.S. National Academy of Sciences reports that federal research and development efforts to improve energy-efficiency and conservation have garnered significant economic and environmental gains. The \$13 billion federal investment since 1978 has returned \$40 billion.<sup>15</sup> About 75% of the economic benefits came from three programs that led to more efficient refrigerator and freezer compressors, fluorescent light ballasts, and heat-resistant window glass. Together these programs cost only \$11 million. Such state-of-the-shelf technologies can make old buildings three to four times more efficient and ten times more efficient for new buildings.

### Biological Inspiration

Biological models can inspire new and better ways to design buildings that make them more profitable and value natural capital. In her book *Biomimicry*, Janine Benyus points out that trees turn sunlight, water, and air into cellulose, a sugar stiffer and stronger than nylon but much less dense, and bind it into wood, a natural composite with a higher

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<sup>13</sup> Many of these ideas were raised in my article “The Value of Natural Capital.” Environmental Design & Construction. May/June 2000. Pgs 48-51.

<sup>14</sup> US Department of Energy: Center of Excellence for Sustainable Development.  
<http://www.sustainable.doe.gov>

<sup>15</sup> Shogren, Elizabeth. “Study Sees Green in U.S. Energy Research.” Los Angeles Times, 18 July 2001. <http://www.latimes.com/news/science/la-000058703jul18.story>



bending strength and stiffness than concrete, aluminum alloy, or steel.<sup>16</sup> New, biologically inspired textiles are just one of many types of building-related materials that illustrate this concept. When designing a Design-Tex fabric and manufacturing process, architect, William McDonough specified that at each step of the process, no toxic chemicals be used and no air pollutants emitted. The resulting fabric is biodegradable, made entirely of free-range sheep wool and organically grown ramie, and costs less to make. Innovative thinking like this in all areas of the building industry can help lead to a more environmentally and financially profitable future.

In the design of the Lewis Center for Environmental Studies at Oberlin College in Ohio, David Orr sought biological solutions by asking such profound questions as: How can my project not only consume as little energy as possible, but go beyond to actually generate energy? What can my project do to heal the environment (not just limit its impact)? How can the water discharge from my project be cleaner than the water that came into it? Asking these questions upfront resulted in a design that includes state-of-the-art energy and water efficiency measures, renewable energy technologies, innovative green materials, organic gardens, orchards and restored forest. Perhaps most indicative of biomimicry is the design's incorporation of a biological wastewater treatment system. The invention of Dr. John Todd, these "living machines" are gaining popularity as environmentally responsible and cost-effective sewage treatment systems. Wastewater is channeled through a series of ponds or tanks containing diverse aquatic ecosystems. The aquatic tanks are typically located inside a greenhouse to maintain temperatures high enough for optimal biological activity year-round. The system effectively removes nitrogen, pathogens, and other contaminants from water. Because these treatment systems are odor-free, they can be located close to municipal centers, saving the expense of piping effluent to more remote locations.

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<sup>16</sup> Benyus, Janine M. Biomimicry: Innovation Inspired by Nature. New York: Quill, an imprint of William Morrow & Company, 1997.

## Service and Flow

The third principle of natural capitalism describes a move to a “service-and-flow” business model. The traditional manufacturing business model is based on the sale of goods. In the new model, value is instead delivered as a continuous flow of services—such as providing illumination rather than selling light bulbs. This aligns the interests of providers and customers in ways that reward them for productive use of resources.

Carrier Corporation, one of the world’s largest manufacturers of HVAC equipment, has experimented with a leasing program to provide and sell the *service of comfort*, rather than selling just the equipment. Making the equipment more efficient or more durable, when it leases comfort instead of selling air-conditioners, will give Carrier greater profits and its customers better comfort at lower cost. Interface, a global supplier of carpet products and a leader in the growing movement to sustainable business, is developing a similar *Evergreen Lease* program for its products. The company never relinquishes ownership of the product, so it maintains responsibility for the carpet’s entire life-cycle. This makes sense since the user only wants the service of the carpeting, not the responsibility for disposal. In addition, their carpet tiles allow Interface to provide the user the same quality of carpet service with far fewer materials and vastly less waste, since just 20% of typical carpeting gets 80% of the wear. The *Evergreen Lease* was tried in the “recycled” building of Southern California Gas’ Energy Resource Center. This “service-and-flow” business model is better for customers, shareholders, and the environment than the sale of such products. Along the lines of biomimicry, Interface has also been developing carpet made from corn. The product is a polylactide polymer called *NatureWorks*, that the makers claim “is the only commercially viable polymer to combine performance and cost competitiveness with outstanding environmental benefits.”<sup>17</sup>

To a great extent, the real estate industry has long been exercising this principle through its leasing structures. Developers who create green buildings may find the buildings lease up more quickly and that they can charge more for their leasable space, because

tenants will pay for higher quality space. Harold Kalke, developer of a mixed-use, infill development 2211 West Fourth in Vancouver, successfully charges premiums on rents because tenants save money on their utility bills—due to the project’s attention to resource efficiency during design and construction. When the project was completed in 1994, 85% of the space had already been leased or sold, and the remainder was under contract within three months of completion. Green developer Jonathan Rose has had similar experiences with his mixed-use projects: Second Street Studios in Santa Fe and Denver Dry Goods building in Denver. Beyond just leasing space, developers are extending the concept by offering information technology services, concierge services, catering, fitness clubs, dry cleaning, transportation services and more.

### Reinvestment in Natural Capital

If natural capital is the most important, valuable, and indispensable form of capital, a true capitalist will reinvest in restoring it where degraded, sustaining it where healthy, and expanding it where sparse. There are many ways buildings and developments can incorporate such strategies to enhance natural capital. Brownfield redevelopment and native plant restoration are just two examples.

The “Athletes Village” that served last year’s Sydney Olympics is located on what was an abandoned naval weapons depot, a brownfield site. The project is comprised of three New Urbanist neighborhoods and served mass transit for 15,000 of the Olympic participants. Since the completion of the Olympics, it is being transformed into a community within walking distance of a commercial district. (This transformation was part of the initial design planning.) The site was cleaned up, a native savanna was planted, and the river was restored back to a meandering course. About 70% is parkland and open space. Many opportunities exist to redevelop such brownfield sites and revitalize landscapes. Brownfields are often in prime locations with easy access to public transit, infrastructure needs, and a near-by work force. Their redevelopment can also spearhead the revitalization of deteriorating neighborhoods.

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<sup>17</sup> *NatureWorks* was developed under a joint venture of Dow Chemical and Cargill, Inc.

Projects that embrace elements of green development are emerging in China. Several now underway in the PRD region are explored in Chapter 4.

### ***Methodology & Thesis Organization***

How can the Pearl River Delta make this transition to more environmentally- and ecologically-oriented planning and real estate development? Before an individual focus can be placed on any one area (i.e. integrated building photovoltaics), a roadmap is needed to articulate the path toward the goal—sustainability. The natural capitalism model is the roadmap that helps frame these concepts, and green development is the tool to achieve it in real estate.

To begin to grasp the complexity of issues in the region, I traveled to China in June 2001 to Hong Kong, Shenzhen, Guangzhou, and Gaoming. I interviewed various experts in real estate development and construction, architecture, urban planning, strategic planning, sustainable business and corporate governance, legal issues, PRD regional pollution issues, environmental management, and PRD sustainable development.<sup>18</sup> From our discussions and from my other background research, I have attempted to address the goals of this thesis.

The goals are to:

- Consider how the natural capitalism model and green development applications can be applied in the PRD.
- Obtain an understanding of the history, governmental structures, and environmental issues facing the Pearl River Delta.
- Understand the process of real estate development in south China and in Hong Kong and how they differ.
- Research the challenges and opportunities in the practice of green development in the PRD.

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<sup>18</sup> For a complete list of interviews conducted, please see the “Bibliography & Resources” section.

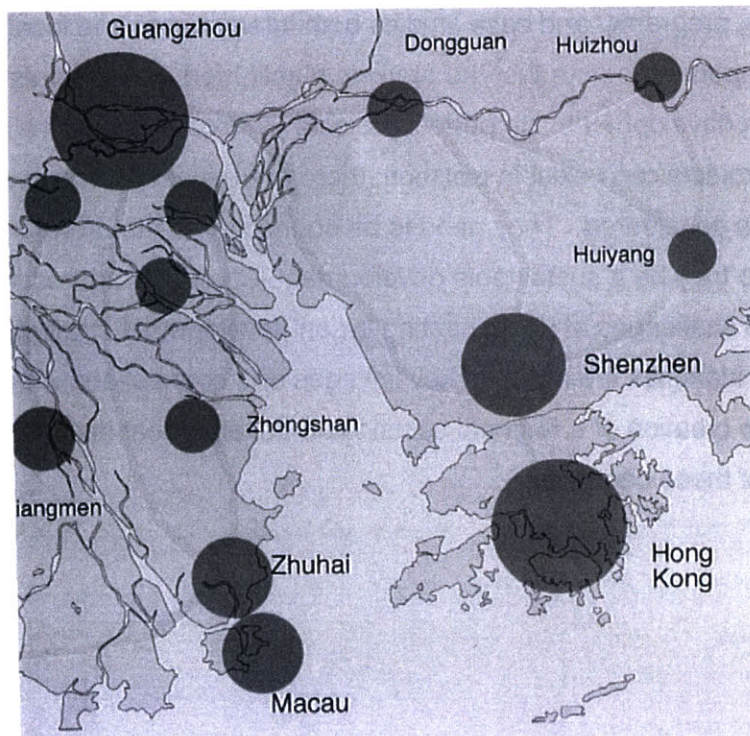
- Present a diverse set of green development: case studies, resources, and implementation models underway in the PRD and around the world.
- Investigate key leverage angles and entry points that would allow the green development approach to be embraced.
- Explore connections outside the traditional realm of real estate development that may contribute to bringing a more ecologically and socially responsible approach to real estate development in the PRD.

To address these goals, Chapter 2 provides an overview of the unique character of the Pearl River Delta and the various government zones and authorities. To emphasize the magnitude and urgency of issues to be addressed, a summary is given of the severe environmental pressures and challenges the region now faces and will face. The planning and development underway in the delta and fundamentals of real estate development in China are then explored. Next to gain a better understanding of the role green development plays in natural capitalism, Chapter 3 presents its key benefits and features. Policies, programs, and case studies both international and local are examined. It is important to note that the projects highlighted are *attempts* to move in the direction of green development. No perfect projects yet exist—anywhere in the world. Green building projects can't exist in isolation; there are dynamic flows in and out of them that must be considered. They need to be connected to the broader community, city, and region to truly be a sustainable development. Chapter 4 addresses the opportunities and challenges of implementing green development strategies regionally. The final chapter identifies the need for key linkages and connections within the PRD and describes the creation of a regional sustainable development institute to assist in implementation of these concepts.

## Chapter 2: Background of the Pearl River Delta Region

This chapter provides an overview of the Pearl River Delta region, its environmental status, and current real estate development fundamentals. The challenging combination of issues that face this region makes it different than any other area of the world.

The Pearl River Delta region is the area around the mouth of the Pearl River in southern China, consisting of Hong Kong, Macao, and the cities along the delta. The PRD includes the capital of Guangdong Province, Guangzhou, two Special Economic Zones: Shenzhen and Zhuhai, and the Pearl River Delta Economic Development Zone (PRDEDZ). The PRDEDZ was initially designated by the State Council in 1985 for the purpose of attracting foreign direct investments; it was later enlarged in 1987. It contains 28 cities in the south-central Guangdong Province, of which 17 are in the Inner Delta.<sup>19</sup>



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<sup>19</sup> Statistics and delta map from Massachusetts Institute of Technology, "Project 2022: Hong Kong and The Pearl River Delta: Expanding Horizons" report, 2000. [www.hkprd2022.org](http://www.hkprd2022.org)

### ***Overview of Demographic, Geographic, & Political Issues***

The Pearl River Delta region is one of the fastest growing regions in China and also the region with the highest per capita income and productivity in south China. When the PRDEDZ was officially demarcated in January 1985, it encompassed 22,800 km<sup>2</sup> and now it has grown to 47,600 km<sup>2</sup>. About 20 million people live in the region and its population is roughly 590 persons per square kilometer.<sup>20</sup> The following provides an overview of the major cities in the region.

- **Guangzhou:** municipal population of 6.7 million + 3 million floating population.<sup>21</sup> Since 1949, Guangzhou developed under the planned economy of the People's Republic of China (PRC) but is now being modified as the PRC evolves into a socialist market economy.
- **Hong Kong:** municipal population of 6.7 million. The city-state of Hong Kong was developed as a British colony between 1842 until the reunification in July 1997, when it became a Special Administrative Region (SAR) of the PRC. The SARs function almost as separate countries from China and are allowed to enjoy a high degree of autonomy from the central government. The "one country two systems" arrangement essentially has a separate government and its own currency and customs. Hong Kong developed as one of the key financial centers in Asia with an aggressive approach to real estate. Hong Kong's capitalist system and way of life are "protected" under the SAR until 2047.
- **Macao:** population of 430,000. Macao formerly a Portuguese colony was reunified with China in 1999 and is also a SAR.
- **Shenzhen:** population of 848,000. Demarcated as a Special Economic Zone (SEZ), Shenzhen is a rapidly growing industrial city to the north of Hong Kong. Of the municipalities or counties with different levels of 'openness' of economic

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<sup>20</sup> 1998 numbers from Massachusetts Institute of Technology, "Project 2022: Hong Kong and The Pearl River Delta: Expanding Horizons" Report, 2000. Pg 13. [www.hkprd2022.org](http://www.hkprd2022.org)

<sup>21</sup> Discussions with Guangzhou Planning Department, June 2001.

development policies, SEZs enjoys the highest autonomy.<sup>22</sup> It is a strategy designed to attract overseas capital and technology and to speed up the industrialization and modernization process. The central government gives SEZs special policies and flexible measures, allowing SEZs to utilize a special economic management system; to provide special tax incentives for foreign investments in the SEZs; and to have greater independence on international trade activities. SEZs are listed separately in the national planning (including financial planning) and have province-level authority on economic administration. SEZ's local congress and government has legislation authority.

- **Zhongshan:** population of 1.25 million. Administratively it is comprised of an urban center surrounded by 24 towns in nine districts. It gained official status as a city only recently in 1983 and was reclassified as a “superior city under the People’s Government of Guangdong Province” in 1988.<sup>23</sup>

**Selected Economic Indicators for the Pearl River Delta in comparison with Guangdong Province, and China.**

Items	Unit	PRD	Guangdong	China
Population	Persons/km2	437 (1990)	351(1990)	119(1990)
Density		590 (1998)		
Per-capita Income (1990)	Yuan/person	3,425.56	1,812.6	1,250.73
Per capita realized Foreign Investment	Dollars/person	75.49	32.39	8.99

Source: Lin, Chu-Sheng. *Red Capitalism in South China: Growth and Development of the Pearl River Delta*, Vancouver: UBC Press, 1997. Pg 82.

<sup>22</sup> Information on SEZs from Zhu Jieming. The Transition of China’s Urban Development: From Plan Controlled to Market Led. Westport, Connecticut: Praeger, 1999.

<sup>23</sup> “History of Zhongshan.” Zhongshan Window.



The location of the PRD offers a geographical advantage. Historically, the region has been a point of contact for the outside world and has engaged in foreign trade since the Han dynasty (206BC-AD220).<sup>24</sup> The large-scale penetration of global capital to the region was launched in the late 1970s by Deng Xiaoping with his announcement of the “Open Door Policy.”<sup>25</sup> The revolution this ignited primarily began in Guangdong Province. Deng Xiaoping specifically encouraged the province to “walk one step ahead” of the rest of China and lead the country on a path of change. This policy allowed foreign investors preferential treatment, such as tax concessions and duty-free imports. The cheap labor, unregulated land-use policy, inexpensive land, and location proximity attracted overseas manufacturers. As noted above, each of the cities in the region has been granted a degree of development autonomy and therefore can take advantage of their specific relationships (economic, cultural, etc) with Hong Kong and Macao to attract “external investments” from or through these international cities. By far, Hong Kong has been the most important source of foreign investment in Guangdong Province and the PRD accounting for 72% of capital inflows in 1996.<sup>26</sup> The municipalities in the PRD region all recognize the importance of infrastructure in attracting foreign capital and have placed the construction of infrastructure facilities on the top priority of their development agenda.

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[http://china-window.com/Zhongshan\\_w/index.html](http://china-window.com/Zhongshan_w/index.html)

<sup>24</sup> Yeu-man Yeung, et al. “Guangzhou: “The Southern Metropolis in Transformation” in China’s Coastal Cities: Catalysts for Modernization. Honolulu: University of Hawaii Press, 1992.

<sup>25</sup> The 50 year history of the PRC can be divided into two periods: an era of central planning from 1949-1978 (led by Mao Zedong) and an age of economic reforms 1979-present. The “Open Door Policy” of 1979 was initiated by Deng Xiaoping as a part of the economic reforms. John K. Fairbank and Merle Goldman. China: A New History. Cambridge: Harvard University Press, 1998. Pg 406.

<sup>26</sup> Lin, Chu-sheng. Red Capitalism in South China: Growth and Development of the Pearl River Delta, Vancouver: UBC Press, 1997.

***Overview of the State of Environmental Degradation which Threatens the Health & Vitality of the Region***

*“A century’s worth of industrialization has in effect transpired in twenty years, while the methods aimed at ameliorating such impacts are still evolving. It is a situation that will worsen dramatically if effective action is not taken soon.”*  
*Project 2022: Hong Kong and The Pearl River Delta: Expanding Horizons, 2000*

In the coming decades China will play a critical role in virtually all global and transnational environmental issues, including climate change, biodiversity, acid rain, ozone depletion, and the pollution of coastal waters and fisheries. By the year 2020, China is predicted to supplant the United States as the world’s largest emitter of carbon dioxide.<sup>27</sup>



Source: NASA [http://svs.gsfc.nasa.gov/imagewall/LandSat/pearl\\_river.html](http://svs.gsfc.nasa.gov/imagewall/LandSat/pearl_river.html)

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<sup>27</sup> Vanderbilt, Read. “China’s Environmental Impact: Opportunities for International Cooperation.” Stanford University Project on Sino-Foreign Environmental Cooperation. 11,28,2000.

According to Chinese definitions, “environment” encompasses all aspects of the human environment, including air, water, oceans, land, forests, national parks, pastures, and wildlife. In the past (pre 1972), China’s leaders claimed that pollution and environmental degradation were the result of capitalism and that socialism did not pollute.<sup>28</sup> However, now recognition of the severity of these issues and their profound impact on ecology is being made. As recently as March (2001), Chinese Premier Zhu Rongji launched the country’s first five-year environmental plan, acknowledging the need to balance economic development with environmental concerns. In recent years, environmental protection has become the top concern of Chinese citizens as well, according to the latest annual survey conducted by the Lingdian (Horizon) Market Research Company. The report’s survey of 3,000 people in ten Chinese cities found that unlike recent years, concern about the environment for the first time topped concern about corruption (number one in 1999), unemployment, and social order/crime.<sup>29</sup>

To understand why more comprehensive solutions that value natural capital in development are needed, it is necessary to first look at the dire situation the delta is facing. Throughout the region, cities and towns are threatened by deforestation, soil erosion, marine contamination, agricultural pesticides, salinization of groundwater, urban sprawl, overgrazing, hazardous-waste dumping. The regional pollution problems reflect the growing environmental impact of rapid development that has been taking place in the PRD since the introduction of the Open-Door Policy. In their recent paper “Political Integration, Transboundary Pollution and Sustainability: Challenges for Environmental Policy in the Pearl River Delta Region,” Peter Hills and Peter Roberts, argue that the development process for the most part has not been effectively planned and managed. Further, the implementation and enforcement gaps in the Chinese environmental

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<sup>28</sup> Wang Xi, Robert Bloomquist. “The Developing Environmental Law and Policy of the People’s Republic of China: An Introduction and Appraisal.” The Georgetown International Environmental Law Review. Vol 5, No. 1 (Fall 1992.) Pg 46.

<sup>29</sup> As cited in a US Embassy Report, January 12, 2000 of the Lingdian (Horizon) Market Research survey. [www.chinaenvironment.net](http://www.chinaenvironment.net)

regulation process exacerbate the problem.<sup>30</sup> Studies are just beginning to gain a more thorough understanding of the nature and causes of these problems. Suitable institutional structures and related environmental planning and management approaches have not yet been put into place to effectively deal with them. Strategies like green development could play a vital role in helping solve these issues.

### Pressures of Growth

Green development is about more than efficient buildings constructed in isolation throughout a city. These projects should be part of a larger comprehensive plan of a city into which a green developer can weave innovative projects. The current development philosophy of the PRD governments have posed tremendous pressure on their cities, pushing them further away from such a sustainable development route.

Widespread urban sprawl has taken over much of the region's rich farmland—once one of China's most important agricultural regions. The resulting loss of food production capacity is eroding the ability of these areas to sustain its development.<sup>31</sup> Government statistics show that arable land in the PRD has shrunk from 1,044.7 thousand hectares in 1980 to 898.2 thousand hectares in 1991 or 14% in 10 years.<sup>32</sup> Actual loss of farmland is certainly greater; some estimates state that one-third of the agricultural land in the delta has been encroached upon. Clearcutting of hills and land reclamation on a massive scale along rivers and estuaries have led to the destruction of natural habitats, an ecological imbalance in the region, and will eventually cause soil erosion and landslides. For reasons of food security, preservation of the delta's agricultural land is a stated goal of the Chinese central government.

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<sup>30</sup> See: Hills, Peter and Peter Roberts. "Political Integration, Transboundary Pollution and Sustainability: Challenges for Environmental Policy in the Pearl River Delta Region." Journal of Environmental Planning and Management, 2000. Pg 456.

<sup>31</sup> See: Moldenke, Kelsey. "Importing Growth Management Strategies to Curb Urban Sprawl in the Pearl River Delta, China." Cambridge: Massachusetts Institute of Technology, Department of Urban Planning, Master's thesis, 2000.

<sup>32</sup> Although 10 years old, these are the latest numbers I could locate. See Kersten, Gregory and Anthony Gar-On Yeh. Decision Support System for Sustainable Development Applications & Methods. Hong Kong, University of Hong Kong, 2000. Pgs 55-57.

Rational use of land resources is only possible if urban expansion in China is guided by sustainable development. Hong Kong and Shenzhen have both adopted a pro-growth strategy to deal with challenges imposed by a globalizing economy.<sup>33</sup> Despite the “policy rhetoric” of sustainable development, both governments have done little in identifying and analyzing sustainable urban development issues. Environmental issues associated with the reunification of Hong Kong have attracted far less attention despite growing concern about the sustainability of the development process in the PRD.<sup>34</sup> While Hong Kong and Shenzhen are working hard to attain world city status, both cities lack a real sustainable development strategy.<sup>35</sup>

### Energy Issues

Many Chinese environmental problems are tied to energy consumption patterns. Various characteristics of the Chinese energy system have contributed to inefficient energy use. Coal is China’s principal energy source. It accounts for 76% of primary energy consumed in the last decade.<sup>36</sup> Due to the incredible size of this growing population and heavy reliance on fossil fuels, energy production and use in China generate large quantities of greenhouse gases. Sulfur dioxide from coal combustion causes acid rain. Two thirds of all Chinese cities already exceeded the residential area sulfur dioxide air pollution standard.<sup>37</sup> Air pollution has become a serious problem in the Pearl River Delta and the potential health and economic impact are estimated to be significant. (See section on pollution below.)

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<sup>33</sup> Ng, Mee-Kam speech, “Sustainable Urban Development Issues in Chinese Transitional Cities: Hong Kong and Shenzhen.” Sponsored by the Hong Kong University: The Centre of Urban Planning and Environmental Management, Spring 2001.

<sup>34</sup> Conversations with Dr. Yok-Shiu Lee, Hong Kong University: Department of Geography & Planning, June 2001.

<sup>35</sup> Conversations with Terry Mottershead, Dr. Yok-shi Lee, and Professor Peter Hills, Hong Kong University, June 2001.

<sup>36</sup> Wu, Z., Wei, Z. “Policies to promote energy conservation in China,” *Energy Policy*, 19:10, 1991, Pgs 934-939.

<sup>37</sup> See: <http://www.tradeport.org/ts/countries/china/mrr/mark0054.html>

The total energy requirement for Hong Kong increased by 79% between 1983 and 1993.<sup>38</sup> Hong Kong consumes a total of 28,233 terrajoules of energy a year, making Hong Kong one of the highest per capita users of electrical power in the world.<sup>39</sup> The power supply in the Pearl River Delta has been in shortage since 1980's. From 1986 to 1991, power generated in Guangdong province increased at an annual rate of 15% while industrial output increased at over 20%.<sup>40</sup>

On the positive side, in June 2001 a new generation of renewable energy sources was launched in Hong Kong. Friends of the Earth Hong Kong installed two wind-monitoring stations. "The feasibility study that will come from these stations will be revolutionary, as it will provide detailed information on wind speed and direction of the breezes around Hong Kong."<sup>41</sup> This will play an important role in the transition toward cleaner power sources.

Buildings consume a large fraction of energy and resources and produce a substantial amount of environmental pollutants. As the per-capita income and standard of living improves, the fraction of energy consumed by buildings in China is projected to reach one-third.<sup>42</sup>

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<sup>38</sup> Ngan Kwok-hip. "Building Conservation: An overview of Building Energy Performance in Hong Kong." Hong Kong University Master's Thesis, 1995. Pg 20.

<sup>39</sup> A 1996 number from Icon Group International. "Energy Efficient Building Products in Hong Kong, A Strategic Entry Report." Hong Kong: Icon Group International, 2000. Pg 15.

<sup>40</sup> Massachusetts Institute of Technology. "Project 2022: Hong Kong and The Pearl River Delta: Expanding Horizons" Report 2000. [www.hkprd2022.org](http://www.hkprd2022.org)

<sup>41</sup> Tobias Forster, Friends of the Earth Hong Kong, June 2001.

<sup>42</sup> Leon Glicksman, Massachusetts Institute of Technology Professor of Building Technology and Mechanical Engineering, "Sustainable Urban Housing in China project," 2001.

### Pollution in the Region

Although Guangdong Province has made some progress in limiting its air and noise pollution in recent years, pollution problems, especially water pollution, are still serious.<sup>43</sup> The province has implemented a series of programs to upgrade its general environmental situation, but it still has to catch up for years of environmental neglect. The average visibility in Guangzhou of 18 km is significantly less than the 30 km of the 1960s. Since that time, the average number of sunshine hours per year has decreased by 800. Air pollution is causing 2,000 premature deaths a year in the region, and it has been noted to be scaring away tourists, conference organizers and business executives.<sup>44</sup> Despite these dismal figures, Guangzhou is no longer one of the country's 10 most polluted cities.

The Pearl River Delta is confronted with a critical water shortage due to poor water quality. In 1999, 5.92 billion tons of waste went into the seas, rivers and lakes in the province, and water networks in the PRD—which alone received around 2.97 billion tons of effluent. Urban non-industrial sewage such as household wastewater also plays a significant role in contaminating the water. Every day, 8.6 million tons of household waste water flows into rivers and lakes in Guangdong. Further Guangzhou alone produces two million tons of such effluent.

Urban air quality in Guangdong Province has been improving. The content of sulfur dioxide, nitrogen oxides, suspended particles and falling dust in the air dropped in 1999. However, acid rain over the PRD is killing plant life and corroding buildings.

The pollution issues of the delta have a direct effect on business. The deteriorating environment in Hong Kong has been cited as a major factor against doing business in

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<sup>43</sup> The statistics from the first part of the Pollution section are from the recent U.S. Consulate General Guangzhou report: "Guangdong Environment: Some Progress, But Many Problems Remain" December 2000.

<sup>44</sup> Friends of the Earth, Hong Kong <http://www.foe.org.hk/publication/magazine/index.htm>, 2001.

the city. Some executives with small children are becoming reluctant to be based in the territory.<sup>45</sup> Even though some believe there is a greater sense of urgency in the government's plan to clean up the environment, a poll carried out by the British Chamber of Commerce revealed that 71% of respondents believe that things will deteriorate further over the next couple years. This will be a barrier to Hong Kong SAR Chief Executive Tung Chee-hwa's plan to turn Hong Kong into a high-tech center.

In the last decade, the Hong Kong government has spent over HK\$55.4 billion on environmental protection and conservation.<sup>46</sup> (Major expenditure includes infrastructure projects.) However, despite the large budget for the clean-up, the environment's health and vitality is still threatened. In addition, Hong Kong's political relationship with the rest of the China adds complexity to the environmental pollution situation. Under Basic Law, the Hong Kong SAR functions as an autonomous jurisdiction with respect to environmental policy. The PRC and Hong Kong approach environmental policy-making in different ways, and have different institutional structures, laws, regulations, and standards.<sup>47</sup>

### ***Overview of the Planning & Real Estate Development Issues***

An overview of the region's unique characteristics of the planning and development process is provided in this section. Because of their differences and for clarity, Hong Kong and China are discussed separately. The fundamentals in the real estate industry in China and the emerging property market are also described.

### **Hong Kong Planning and Development**

Because of its rising population, geographical, and economic characteristics, the property sector is particularly important to the Hong Kong economy and is regarded as

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<sup>45</sup> CNN: *Asia Week*, October 1, 1999, Vol. 25 No. 39.

<http://www.asiaweek.com/asiaweek/magazine/99/1001/hongkong.html>

<sup>46</sup> Friends of the Earth, Hong Kong <http://www.foe.org.hk/publication/magazine/index.htm>, 2001.

<sup>47</sup> Conversations with Terri Mottshead, a lawyer, founder of Sustainable Development Forum, Hong Kong and Hong Kong University Professional and Continuing Education Law Division, and Professor Peter Hills, University of Hong Kong, June 2001.



the key barometer of political, social, and economic stability. The Hong Kong government derives part of its revenue from property tax, lease renewals, rental income, and direct tax on income of property owners and developers.

Hong Kong is comprised of Hong Kong Island, Kowloon Peninsula, and the New Territories. About 80% of this land is hilly and 40% is held in preserve as parkland. As of March 1996, the built up area constituted 15.6% of all land.<sup>48</sup> All land in Hong Kong is owned by the government and leased for long-term use—usually 75 years, and automatically renewed up to 2047.

In Hong Kong, town planning has a much more flexible and adaptive approach and is much less restrictive than in the US. This situation has provided some freedom to developers. Planning is carried out at three levels: territorial, sub-regional, and district planning.<sup>49</sup> The Planning and Lands Bureau is responsible for organizing, coordinating, and administering all policy matters on land, building and planning in Hong Kong. It is headed by the Secretary for Planning and Lands who oversees the operations of four departments, namely the Lands Department, the Planning Department, the Building Department and the Lands Registry. However, with regard to the discussions of green development, a problem arises in that environmental considerations are not integrated into the land use policies. Further, the Environmental Protection Department is now no longer under the administration of a Planning and Lands Bureau.

The Housing Authority is the biggest developer and estate management agent in Hong Kong. The population densities in Hong Kong are some of the greatest in the world, because historically the government has built more new housing by going higher and by

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<sup>48</sup> Berry, James and Stanley McGreal, editors. Cities in the Pacific Rim: Planning Systems & Property Markets. New York: E&FN Spon, 1999. Pg 67-88.

<sup>49</sup> Hong Kong Interviews and Seabrooke, W., Yong, Li, et al. "Implementation of Agenda 21 at the operational level: with special reference to urban development in Hong Kong and Guangzhou." Guangzhou: Guangzhou Urban Planning Design & Survey Research Institute, Center for Urban Planning Studies and Hong Kong: Hong Kong Polytechnic Building and Real Estate, 2001.

reclaiming land from the sea. The government has projected that population is estimated to increase to 8.1 million by 2010 and thus has plans to build 85,000 new housing units per year during the next nine years.<sup>50</sup>

The price of office property increased throughout the early 1990s by 150% while rents increased 20%.<sup>51</sup> Traditionally, office space users prefer to lease rather than buy. Location is considered to be less critical than quality and availability. As noted above, Hong Kong and the mainland have become each other's largest trading partner, accounting for 36% of total trade for the territory and 47% for China in 1996.<sup>52</sup> Even though much of the manufacturing has shifted into the delta region, demand for high quality office space still continues because Hong Kong is so dependent on trade and finance. It acts as a regional headquarters and service center for many businesses.<sup>53</sup>

An increasing number of Hong Kong residents choose to settle in the townships of the delta region, commuting daily to work as one would from New Jersey to New York.<sup>54</sup> However, the lack of fully integrated infrastructure between Hong Kong and the Delta means that few Hong Kong people are willing to settle in certain Delta municipalities—despite the considerable cost savings in terms of property prices and rental levels. In addition, the limited development of international schools or world-class health care systems in the delta region is also a drawback. Older Hong Kong residents, however, are interested in retiring in the PRD. A recent survey in Hong Kong indicates that approximately one million people in Hong Kong (over 14% of the population) are interested in settling in the PRD, particularly for retirement.<sup>55</sup>

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<sup>50</sup> Icon Group International. "Energy Efficient Building Products in Hong Kong, A Strategic Entry Report." Hong Kong: Icon Group International. 2000.

<sup>51</sup> Berry, James and Stanley McGreal, editors, Cities in the Pacific Rim: Planning Systems & Property Markets. New York: E&FN Spon, 1999. Pg 81.

<sup>52</sup> Ibid. Pg 83.

<sup>53</sup> Regional headquarters of 816 companies were located in Hong Kong in 1996.

<sup>54</sup> Massachusetts Institute of Technology "Project 2022: Hong Kong and The Pearl River Delta: Expanding Horizons" Report 2000. Pg V.

<sup>55</sup> Ibid.

## China Planning and Development

The land-use policy-making mechanism in China consists of a more complex bureaucratic hierarchy than applies to Hong Kong.<sup>56</sup> Urban planning in China has been traditionally conducted in a top-down, hierarchical manner. Higher-level governments (i.e. provincial governments) supervise and oversee the planning and implementation processes at the lower level of governments (i.e. county and municipal governments) through redistributing the resources allocated from the central government. The Ministry of Construction is in charge of the real estate market, while the Ministry of Land and Resources is in charge of the land market—with both ministries' functions overlapping. Such departments involve planning, auditing, financing, and taxation, industrial and commercial administration, pricing and banking.

Regional planning is generally done at the provincial level to organize, balance, and coordinate the development of counties, municipalities, and rural areas. Depending on the state and provincial governments' investment decisions, local governments have little power in development decision-making other than providing information to facilitate site planning. The function of city planning at the local level is to coordinate the six major land use categories and to prepare a blue-print for 20 years according to population size and the nature of the city.<sup>57</sup>

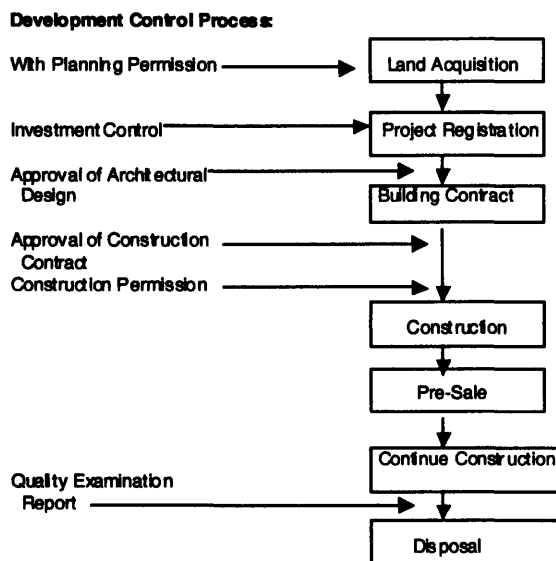
As one of the largest government ministries in China, the Ministry of Construction has an elaborate network of municipalities. For example, the Guangzhou municipal government contains the Guangzhou Municipal Construction Commission. This commission oversees all aspects of development in the city. The property development process is

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<sup>56</sup> Conversations in Guangzhou with the planning department and Ms. Li Yong of the Guangdong Research Institute of Planning, Surveying, and Design (June 2001) and review of proposal: Seabrooke, W. and Yeung Chi Wai "Establishing Criteria for Sustainable Urban Development with Reference to Hong Kong and the Pearl River Delta Region." Joint Project Proposal: Hong Kong Polytechnic University, Real Estate Department and Guangdong Research Institute of Planning, Surveying, and Design. Commissioned by the Royal Institution of Chartered Surveyors and the UK Environment Agency. 2001. Pg 12

subject to the government's development control until the building is completed and put up for sale or leased. However, developers take full profits or suffer whole losses when the market finally delivers the project's verdict.<sup>58</sup> To finance delta projects, developers rely on pre-sales and their own equity.

Source: Zhu Jieming, *The Transition of China's Urban Development*, 1999. Pg 75.



Under the central controlled government “urban planning was reduced to being a servant to the paramount industrialization.”<sup>59</sup> In the 1960s, urban planning was even abandoned. From 1949 to the late 1970s, China invested little in the cities especially in the area of infrastructure planning. Currently, it has been said that “even though the economy is stable and the construction industry is booming, under the present

<sup>57</sup> Ng, Mee Kam, Dr. and Tang, Wing-shing. *The Pearl River Delta Urban System Plan: An Analysis*, Occasional Paper No.71, Hong Kong Institute of Asia-Pacific Studies, 1997.

<sup>58</sup> Interview with Mr. Liu Sing-Cheung, Managing Director, Hang Cheong Real Estate Consultants, Ltd., Hong Kong and Guangzhou. Hong Kong property veteran formerly associated with Swire Properties and Hsin Chong Construction. Recently formed a joint venture with Hang Lung Development Company

speculative economic environment and the piecemeal planning approach, development is often carried out without any long-term systematic planning.”<sup>60</sup> Fragmented plots are being developed with randomly enforced or uncoordinated zoning and planning practice. Very often there is no coordination between lots and their supporting infrastructures, governing authorities are randomly distributed and are changed constantly.

### Emerging Property Market

Previously, under the socialist, centrally controlled economy with predominant state ownership, there were no explicit property markets in the cities of mainland China. The government as the trustee of public assets acted as an “all powerful” financier, landowner, developer, and investor for the construction of the urban built environment. This system did not have inherent mechanisms to encourage efficient production in buildings or to manage reasonable consumption. Significant changes in the government’s urban reforms are taking place in reforms toward marketization.

As a test case, property market mechanisms in Shenzhen have partially replaced central plans in guiding the production of the urban built environment for the first time since China adopted socialism in 1949. On December 1, 1987, a real estate market emerged as a parcel of land in Shenzhen was auctioned.<sup>61</sup> Now, development has happened so fast that at times, basic infrastructure is missing. In Shenzhen, regulations require that all new buildings be constructed with a sewage connection, (older buildings are exempt) but studies have shown that the effectiveness of the policy is limited due to the lack of sewage infrastructure and treatment capacity.<sup>62</sup>

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<sup>59</sup> Zhu Jieming. The Transition of China’s Urban Development: From Plan Controlled to Market Led. Westport, Connecticut: Praeger, 1999. Pg 73.

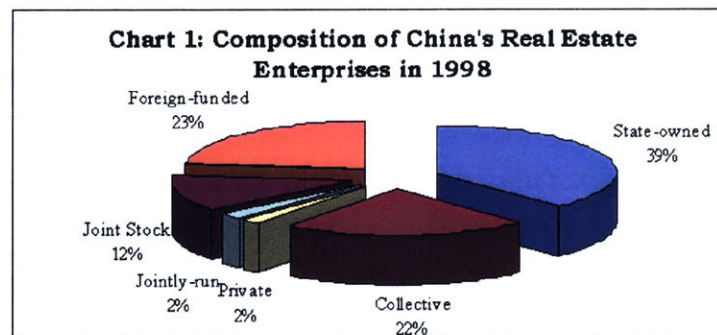
<sup>60</sup> Lu Leslie and Beisi Jia. “Continuity, Integration and Diversity: Sustainable Urban Design Concepts for Redeveloping.” Hong Kong: Asian Geographer 17 (1-2), 1998. Pgs 41-54.

<sup>61</sup> Walker, Anthony. Land Property and Construction in the People’s Republic of China. Hong Kong: Hong Kong University Press, 1991. Pg 35.

<sup>62</sup> See: Hong Kong Planning Department. “Development Trends in the Pearl River Delta and related Transboundary Issues.” Topic Report 3, Study on Sustainable Development for the 21st Century, Hong Kong Planning Department, 1998.

With these market changes, urban land has now become a commodity with a price and development of buildings has become an entrepreneurial undertaking. “A challenge facing China’s urban governments is to understand property as an economic asset, the characteristics of property development, the nature of property investment and the meaning of property in a wider context.”<sup>63</sup> State-users from the public sector do still enjoy free land and premises.

As a newly emerged industry in China, the real estate industry’s position in the entire national economy is in the process of being consolidated and strengthened.<sup>64</sup> A more complete real estate market system is beginning to take shape, but at present, the existing laws and regulations have no explicit provisions concerning real estate investment.

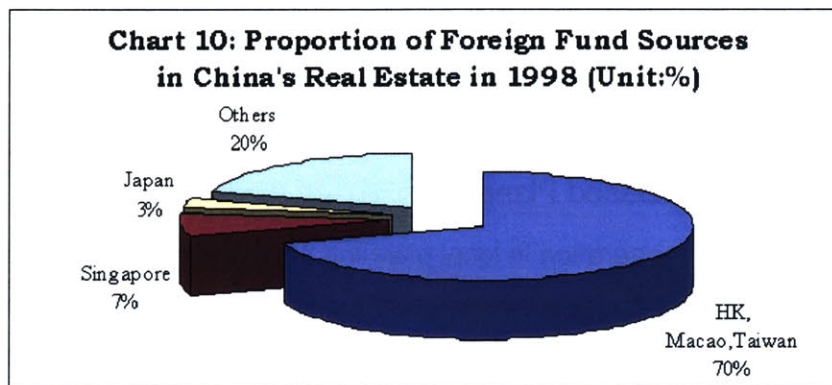


Source: CIEC Industry Report, Date: June 30, 2000

<sup>63</sup> Zhu Jieming. “An Emerging Property Market in the Transitional Economy.” The Transition of China’s Urban Development: From Plan Controlled to Market Led. Westport, Connecticut: Praeger, 1999. Pg 49.

<sup>64</sup> In 1998, a total of RMB 357.96 billion was invested on real estate development in China, up 12.6% over the previous year; a total floor space of 515 million square meters was under construction, 14.5% up, of which 187.513 million sq m were newly started, 33.7% up; a floor space of 106.622 million sq m of commodity houses were sold, 34.76% up; and the sales value of commodity houses reached RMB 213.49 billion, 36.50% up. Source: China International Economic Consultants Co and China Economic Information (10th Issue, 1999); www.homeway.net.cn October 29, 1999.

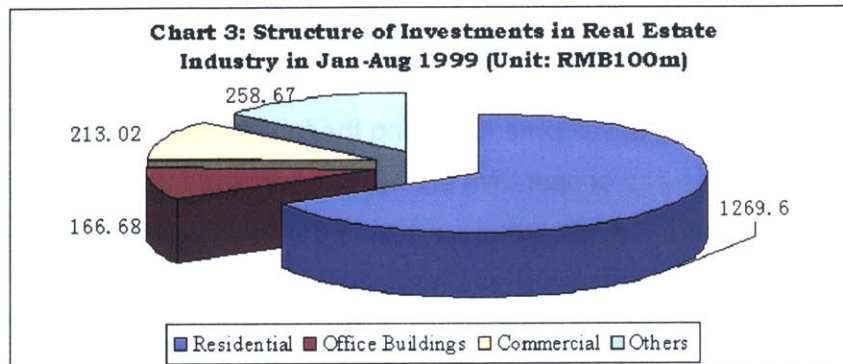
The major forms of China's real estate industry in using foreign investment are: solely foreign funded, joint ventures, cooperative operation, foreign-related leasing, foreign-related sales, and overseas development. Among the foreign-related property developers, joint ventures and cooperative enterprises account for a major part and the number of solely foreign funded developers are also growing. The proportion of foreign funds in Chinese real estate has grown dramatically.



Source: [www.homeway.net.cn](http://www.homeway.net.cn) (October 29, 1999)

In 1992, foreign funds in Chinese real estate was only US\$700 million and in just one year rose to US\$2.265 billion in 1993. From 1992-1998, the foreign investment in China's real estate industry totaled US\$50 billion. In 2000, the number exceeded 5,000, accounting for 20% of the country's total real estate businesses, according to the Ministry of Construction. Of these real estate firms, 3,800 are jointly run with Hong Kong, Macao and Taiwan investors.<sup>65</sup> Of the total investment, funds from Hong Kong, Macao and Taiwan accounted for 70%. As described above, in the early stage of foreign investment in real estate industry foreign investors concentrated mainly in Pear River Delta and mostly in the residential market.

<sup>65</sup> Statistics from China Council for Promotion of International Trade. April 30, 2000.



Source: China Real Estate News (October 13, 1999).

### A Need for Regional-Based Planning

The lack of regional cooperation in local planning and development is particularly problematic in the PRD and has exacerbated the issues with rapid growth. The shift of economic responsibilities to the cities and enterprises has led to “local protectionism and competition.” Many cities compete among themselves and try to provide large scale or higher grade infrastructure to attract foreign investment. This leads to uncoordinated urban and regional infrastructure development and a waste of resources. Unfortunately, there are numerous redundant infrastructure projects being planned or being implemented in the Pearl River Delta. The most obvious example is the development of new airports in Hong Kong, Macao, Zhuhai and Guangzhou.

The provincial government did attempt a Regional Planning effort in 1994, but with limited success. Various legal, managerial, fiscal, land supply, and transportation policies and mechanisms have been proposed to improve coordinated planning and implementation of the PRD Regional Plan. A recent Massachusetts Institute of Technology study “Project 2022: Hong Kong and The Pearl River Delta: Expanding Horizons” analyzed the regional report and stated the following.

“The PRD Regional Plan signifies China’s efforts at searching for a new way of regional governance in reforming China. The drawbacks of the Plan lie at the limited scope considered and that it is still a functionally oriented one initiated by the provincial government. External factors that may affect the development of the PRD region were not fully recognized in the Plan and Hong Kong and Macao



are treated superficially. The incorporation of a more thorough analysis of the role of Hong Kong in the development of the PRD may change the PRD's development strategies significantly. In addition, the roles of non-government actors in the regional development process were omitted. A better approach is to coordinate with Hong Kong planning organization and others in the region to jointly develop the regional plan for the greater PRD region.”

### ***Overarching Factors***

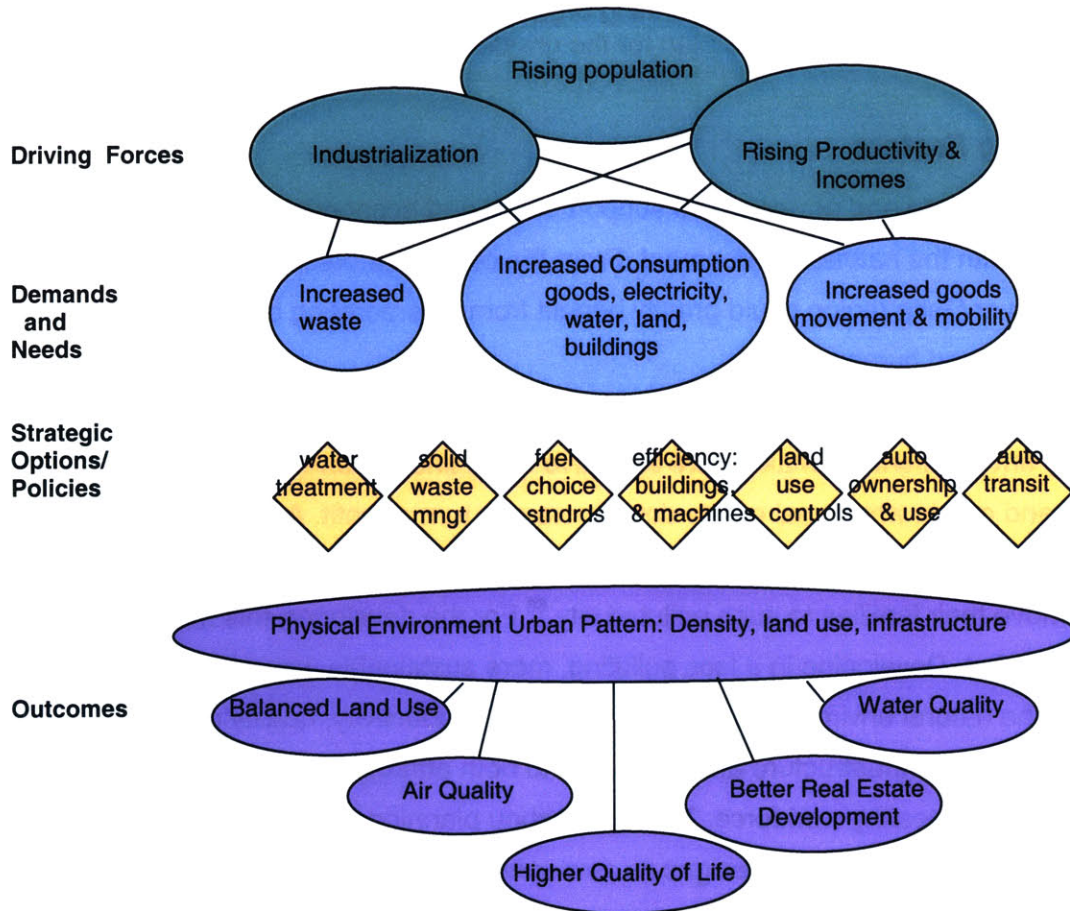
Patterns of land use and development support social and economic prosperity through its interface with the natural environment. From the overviews presented, it is clear that the Pearl River Delta region could greatly benefit from incorporating development that values natural and human capital.

A cleaner environment will make more attractive cities and region—one that people want to live in and one in which real estate developers can turn a profit. As mentioned above, Hong Kong has already been facing difficulty in attracting senior executives who do not want to move their families to such polluted city.<sup>66</sup> For the developer, this means a reduced market. Developing in a less polluting, more sustainable way can be part of the solution. The natural environment is linked to health, productivity, quality of life, transportation and infrastructure and this is key to both attracting investments and keeping a happy healthy workforce. The Guangzhou planning department has shown interest in such strategies as it designs its new central business district.

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<sup>66</sup> Citation and conversation with Barrie Cook, Executive Director, Cheung Kong Infrastructure Holdings, Ltd, Hong Kong, and head of the Business Coalition on the Environment, June 2001.

The following diagram summarizes the overarching issues and outcomes affecting the physical environment.



Source: Adapted from MIT, "Hong Kong Pearl River Delta 2022 Project." 2000. Pg 32.

### Chapter 3: Emerging Practice of Green Development

*“Environmental responsibility is the future of real estate—the choice is not whether, but when. As the public begins to understand that healthier and more productive buildings are possible, they will demand them! Smart companies, well positioned in the marketplace, will benefit.”*

*Douglas Durst, President of The Durst Organization, Inc.*

Green development is a solutions-oriented approach for south China as it strives to meet the demands of its growing population and seeks answers to its environmental problems. The provocative questions posed by David Orr in the Introduction are a true challenge and push the building industry to think more broadly about how it develops its product to value natural and human capital.

- ❑ How can this project not only consume as little energy as possible, but go beyond to actually generate energy?
- ❑ What can this project do to heal the environment (not just limit its impact)?
- ❑ How can the water discharge from the project be cleaner than the water that came into it?
- ❑ How can this project give back to the community?

This section provides examples of how the practice of green development is beginning to take on the challenge of such questions. It first describes the many potential benefits such an approach offers.

#### ***The Benefits of Green Development***

Leading international developers such as Hines and Bovis Lend Lease are recognizing the value of green development. Gerald Hines, Chairman of Hines stated, “Green development is good business. Tenants, owners, purchasers, and brokers are all becoming more sophisticated and are realizing the financial and social benefits of green product.”<sup>67</sup> The Durst Organization embraced this approach with its recent Four Times

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<sup>67</sup> As quoted in the endorsements of Green Development: Integrating Ecology and Real Estate, 1998.

Square skyscraper in New York that features solar panels in the spandrels, fuel cells, and other energy technologies while reducing energy use by 40-50% compared to standard buildings. For a 250,000 square foot Shell / Lend Lease building still on the drawing board in London, a 50-60% energy savings is projected with no increase in capital costs.<sup>68</sup>

There are numerous benefits to building in this way. Green development can significantly improve the comfort, aesthetics, resource efficiency, and value of properties while reducing pollution and saving money. Property value of such developments is typically increased as a result of reducing operating costs, primarily utility expenses, resulting in capturing greater NOI. Space is delivered more efficiently—resulting in either lower rent structure, a lower pass-through cost to the tenant, or savings that can be repositioned to other areas of additional services or amenities. Doug Walker, President of Harwood Management Services in Dallas, says there is higher tenant retention in such buildings. Such strategies can also help owners and investors in valuing and differentiating building portfolios and asset-management strategies.<sup>69</sup>

According to developer Kevork Derderian of Continental Offices, Ltd. in Chicago, green buildings have higher asset value. Every dollar invested in energy efficiency can yield as much as US\$3 increased asset value of a building.<sup>70</sup> Such high performance buildings can create a much greater NOI, which equates to greater asset value. Derderian is convinced that the environmental improvements and flexibility of workspace create demand for green buildings. He has first hand experience leasing two very similar buildings near the Chicago area. One is a high performance green building and one is not. They are located near one another and are similar in square footage and type. The

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<sup>68</sup> Conversation with William D. Browning, Founder Green Development Services, Rocky Mountain Institute, who is on the consultant team advising the project, July 2001.

<sup>69</sup> Walker, Doug. "Create Value Through Energy Efficiency." Energy & Environmental Management. Second Quarter, 2000. Pg 19-21.

<sup>70</sup> Sturdevant, Nicole. "Multi-tenant Buildings: The Energy Opportunity." Building Operating Management. May, 2000.

high performance building leases “50% faster than the conventional building.” This means rent cash flow input to NOI can increase by 50% in a lease turn over situation.<sup>71</sup>

### Productivity Benefits

The idea that green buildings might produce benefits beyond their energy savings has received serious media attention recently.<sup>72</sup> From office buildings to schools to manufacturing facilities, buildings designed with the green development approach offer the possibility of increased productivity. Rocky Mountain Institute’s 1994 *Greening the Building and the Bottom Line* was one of the first reports to preliminarily document cases in which efficient lighting, heating, and cooling have measurably increased worker productivity, decreased absenteeism, and/or improved the quality of work performed. The study’s cases show that productivity gains from energy-efficient design can be as high as 6% to 16%, providing savings far in excess of the energy savings.

To understand these savings, the typical costs of office space and workers are considered. A building’s rent on an annual basis is approximately \$21 a square foot. Total energy costs are usually about \$1.81 per square foot. Office worker salaries are \$130 a square foot plus the equipment, benefits, and insurance. This makes the total salary cost over \$200 per square foot a year. With ten times the rent or a hundred times the energy bill, an increase of 1% in productivity can provide savings to a company that exceed the entire energy bill.<sup>73</sup> This means efficient design practices are cost effective from their energy savings alone. The resulting productivity gains can be the real selling point of green building to owners and developers.

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<sup>71</sup> Conversations with Kevork Derderian in April 2001.

<sup>72</sup> As evidenced by articles in the Wall Street Journal, New York Times, and building industry books, magazines, and conferences. The U.S. Department of Energy (DOE) has funded a study by the Center for Building Performance and Diagnostics at Carnegie Mellon University, “The Intelligent Workplace Retrofit Initiative” and an on-going study by Pacific Northwest National Laboratory Green Building Benefits Study to develop a scientifically based protocol to assess the relationship between green buildings and human outcomes.

<sup>73</sup> Romm, Joseph and William D. Browning. “Greening the Building and the Bottom Line.” Snowmass, CO: Rocky Mountain Institute, 1994.

Since the potential economic payoffs are so great and would further justify investment in green buildings, a number of studies are underway to further investigate the connections between worker health and productivity. The U.S. Department of Energy is funding an on-going study by Pacific Northwest National Laboratory (PNNL) *Green Building Benefits Study* to develop a scientifically based protocol to assess the relationship between green buildings and human outcomes. Dr. Judith Heerwagen, an environmental psychologist focused on workplace ecology and a senior scientist at the Pacific Northwest National Laboratory, and Betty Hase, a workplace futurist formerly with the Knowledge Resource Group at Herman Miller, Inc., are studying why natural features seem to improve worker health and productivity of workers. They note that a growing body of scientific research illustrates that the human brain and behavior are intricately linked to the natural world. Their studies are based on the “Biophilia Hypothesis” by Harvard scientist Dr. E.O. Wilson and others that suggests humans are innately attracted to—and prefer—nature and natural processes, because of our long evolution in natural landscapes.

This study of biophilia relates to the biomimicry principle of natural capitalism described above. “The patterns, forms, textures and colors of nature provide abundant models that can be used in building and product design to enhance their aesthetic appeal, not just their functionality and efficiency. Studies show that incorporating the natural environment into buildings can have a positive influence on psychological, physical, and social well being.”<sup>74</sup> Heerwagen and Hase note that many of the world’s most highly regarded buildings contain biomimic features. These projects draw on the design principles of natural forms, through for example, fractal patterns in their spatial layouts and surface materials. A truly biophilic building, they say, incorporates such features as large trees and plants, changes in elevation, viewing ledges, water features, daylight, multiple view corridors, comfortable retreats, and an interior “big sky” created by skylights and high ceilings to all spaces and all occupants throughout the day.

Heerwagen and Hase have identified a number of studies that show how biophilic features of environments have consequences for psychological, physical, and social well being. In Rachel Kaplan's field study of office workers who had window views of nature, many "felt less frustrated and more patient, and reported more overall life satisfaction and better health, than workers who did not have visual access to the outdoors or whose view consisted of built elements only." Increasingly, Heerwagen and Hase note evidence of a strong link between nature and cognitive functioning, which provides a preliminary basis for the potential link between green buildings and work performance. A laboratory study by Virginia Lohr illustrates that people working in a windowless room with plants worked more efficiently, had lower blood pressure, and felt more attentive than those working in the same room without plants.<sup>75</sup> Heerwagen argues that a more comprehensive view of health and well being beyond productivity benefits measured by reduced absenteeism suggest that these additional indicators should fall broadly under the topic of "human resource sustainability."

With funding from the PNNL *Green Building Benefits Study*, a Battelle Pacific Northwest Laboratories study examined two Herman Miller buildings in Zeeland, Michigan, an older Phoenix Design building and the new Herman Miller GreenHouse (formerly known as the Simple Quality Affordable-SQA-manufacturing facility). Before and after assessments were conducted while looking at how natural habitat can become a model for creating a "habitable workplace." The 290,000 square foot Herman Miller GreenHouse incorporates nature through integration with the site, passive solar heating and natural ventilation, indoor plants, extensive views to the outdoor native prairie landscape, and daylighting throughout the building. The study's overwhelming evidence demonstrated that office workers and daytime manufacturing workers perceived the new

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<sup>74</sup> Heerwagen, Judith Ph.D., and Betty Hase, "Building Biophilia: Connecting People to Nature in Building Design." *Environmental Design and Construction Magazine*, March/April 2001  
<http://www.edcmag.com/archives/04-01-8.htm>

<sup>75</sup> Ibid.

building as more positive across design features.<sup>76</sup> There is strong evidence that the enhanced habitability is associated with increases in psychological and social well being. In her article, “Do Green Buildings Enhance the Well Being of Workers? Yes,” Heerwagen summarized the following findings.

A significant 80% of daytime workers rated temperatures and daylight as better in the new building, and 60% perceived the new building as healthier. Over 40% rated contact with nature, electric light, and air quality as better. Almost 30% also rated control over the environment as better— an important factor in psychological and physical comfort.<sup>77</sup> For office workers, 40% or more said the new building was better for their work performance, privacy, and overall work spirit. Ratings of building design features show that over 90% of the office workers said daylight and windows were better in the new building, and more than 50% said air quality, contact with nature, electric light, and temperatures were also better.

The topics of biomimicry and biophilia could arguably be related in some form with the ancient traditions of feng shui in China. Feng shui is a philosophy that creates an environment that is ergonomic; it lets people work efficiently, comfortably and successfully by following the patterns of nature. When building in cities like Hong Kong, international architecture firms that ignore feng shui have had to learn some tough lessons. When the Chinese-American architect I. M. Pei designed the new Bank of China building, he neglected to consult a feng shui expert. During the planning and construction of the seventy-story tower in the middle of Hong Kong’s Central district there was widespread opposition to the building. One of the problems with Pei’s building was that it was taller than almost anything else in Hong Kong. “It is a well known fact of feng shui that taller buildings attract the qi<sup>78</sup> more effectively. Another problem was that the pointy angles of the building created arrows of qi that pierced buildings all over Hong

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<sup>76</sup> Research was conducted by the Battelle Pacific Northwest Laboratories. Team members included J. Heerwagen, J. Wise, M. Ivanovich, and D. Lantrip.

<sup>77</sup> As described in Heerwagen, Judith Ph.D., “Do Green Buildings Enhance the Well Being of Workers? Yes.” Environmental Design & Construction, July/August 2000. Pgs 24-29.

<sup>78</sup> Chatley, H. “Feng Shui.” in Samuel Couling (ed.) Encyclopaedia Sinica. Pg 175. Shanghai: Kelly and Walsh, 1917 and <http://www.spiritweb.org/Spirit/feng-shui.html> July 17, 2001.



Kong.”<sup>79</sup> In their own stores, offices, and homes, individuals tried to remedy the imbalanced feng shui caused by the building’s construction. Much can be gained from this ancient wisdom which may actually have originated from pragmatic environmental matters such as erosion control or wildlife habitat to ensure food supply.<sup>80</sup>

### **An Innovative Office Building**

The benefits of green development have been quantified in the study of hundreds of case studies—including the international cases briefly described in the Introduction. The ING Bank’s headquarters, described here, is one of the most significant green commercial buildings in the world and demonstrates the multiple benefits of this approach, including productivity.<sup>81</sup> Located in Amsterdam, it is a classic example that has been studied widely.

The building is the result of a detailed vision articulated by the bank’s board of directors and of a integrated planning and design process in which the performance goals were identified up-front. As described above, a crucial element in the approach to green development is a whole-systems, front-loaded process. This is key to the integration so important in capturing the synergies of this approach. The ING project could serve as a model for Guangzhou as it considers the development of a new central business district as well as for Hong Kong, Shenzhen, and Zhongshan with all of the new buildings planned.

In 1978, the board of directors set out to create a new image for the bank. They outlined out a strategy to deliver a functional yet cost-effective new headquarters that would be

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<sup>79</sup> Conversations with Ken Pang, feng shui expert and student of Master Nan, Hong Kong, Dr. Peter Senge, MIT Sloan Lecturer and Society for Organizational Learning, and Wilton, Jermiah. “Is feng shui really superstition?” Earlham College. [www.speakeasy.org/~jwilton/fengshui.html](http://www.speakeasy.org/~jwilton/fengshui.html).

<sup>80</sup> Campanella, Thomas, et al. “Planning for Sustainability in the Pearl River Delta: An Environmental Design Charrette in Zhongshan, PRC.” Department of Architecture, The Chinese University et al, 18-20 June 1999. Pg 15.

<sup>81</sup> ING is the headquarters of the country’s second-largest bank, previously known as Nederlandsche Middenstandsbank or NMB. This case has been documented extensively. For

both appealing and environmentally responsive in design and function. Similar to the discussion of biophilia above, the strategy stated that the building would be “organic” and would integrate “art, natural materials, sunlight, green plants, energy conservation, low noise, and water.” Their directive to the design team of architects, building engineers, landscape architects, energy experts, and artists had three statements. “First, the building must be thoroughly functional using the latest technology, including a specially designed security system and options for individual climate control. Second, the building had to be flexible, able to respond to inevitable changes in space needs over time. Third, the building had to be energy efficient, yet not cost one gilder more than conventional construction.”<sup>82</sup>

The multidisciplinary team designed a 540,000 square-foot building that is almost entirely daylit, very energy-efficient, and innovative architecturally with such features as local materials, plants, artwork, and flow-form water sculptures incorporated into the building in a highly integrated fashion. The construction is all pre-cast concrete and the materials palette is fairly simple. The building's curvilinear form is designed as a series of ten interconnected towers. Although virtually unheard of for a building this size, it does not use conventional air conditioning but relies primarily on passive cooling with back-up absorption chillers. The windows have a three-part construction: the louvers in the upper section of the windows bounce daylight into the core of the building; the center section is for view; and the bottom section is operable to allow for passive ventilation. The building even generates some of its own power through the solar cells on the top of the towers and the building also makes use of cogeneration in recaptured heat. The building sits on a plinth of 300,000 square feet of parking. Beautiful, lush gardens sit atop sections of the parking lot and are entirely watered with rainwater collected in cisterns off the roof of the building.

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more information see the second chapter of Rocky Mountain Institute's Green Development: Integrating Ecology and Real Estate. New York: John Wiley & Sons, 1998.



Photo: William Browning,RMI

The building uses less than a tenth the energy of its predecessor and a fifth that of a conventional new office building in Amsterdam. The annual energy savings are approximately US\$2.9 million (1996) from features that added roughly US \$700,000 to the construction cost of the building—and were paid back in three months.<sup>83</sup>

For ING, perhaps the most important number of all is what happened with the productivity of its people. Absenteeism among bank employees is 15% less in this building than it was in the previous facility.<sup>84</sup> Driving down energy use through daylighting, better lighting design, and better thermal comfort, significantly raised worker productivity.

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<sup>82</sup> Ibid. Pg 25-26

<sup>83</sup> Ibid, Pg 26.

<sup>84</sup> Romm, Joseph and William D. Browning. "Greening the Building and the Bottom Line." Snowmass, CO: Rocky Mountain Institute, 1994.

## Cutting Edge Mixed-Use Development

In London, another progressive green building is currently under construction. Design for the Swiss Reinsurance Company (Swiss Re) designed by Foster and Partners began in 1999. Swiss Re motivated the design of this first tall green building in London and also wanted to make sure it would cost effective. Robin Pennington of Foster & Partners commented that “at every stage we had to demonstrate that it meets standard investment criteria. This is part of Swiss Re’s investment portfolio. Green buildings should attract premium rents because they are cheaper to run and offer better staff conditions.” Related to the productivity argument, Pennington states persuasively that “attracting quality staff is the reason why occupiers choose city centers and they make up a much higher proportion of overall costs than buildings.”<sup>85</sup>

The 40 story mixed-use project features office space, new public spaces, and retail amenities. Conceptually, the project builds on ideas first explored in the design of the Climatroffice with Buckminster Fuller. “Climatroffice suggested a new rapport between nature and workspace; its garden setting created a microclimate within an energy-conscious enclosure, while its walls and roof were dissolved into a continuous triangulated skin.”<sup>86</sup>



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<sup>85</sup> Lawson, David. “New Design Techniques Turn Landmark London Tower ‘Green’” *Property Week*, Sept. 1999. [http://www.artful.demon.co.uk/Files/FOSTER\\_SE9.htm](http://www.artful.demon.co.uk/Files/FOSTER_SE9.htm)

<sup>86</sup> Quote and photo from: Foster and Partners Re Swiss Project profile: <http://www.fosterandpartners.com/news/22-7-99a.html>

The building's egg-shaped geometry was created using parametric modeling. (A technology developed by the aerospace industry.) In biophilic form, "sky gardens" spiral up the building's radial plan. These serve environmentally to regulate the internal climate, becoming the building's 'lungs.' Working with airflows in the second skin, its aerodynamic shape creates pressure differentials that move air up the 590-foot building. "Fresh air for mechanical ventilation is drawn in at each floor via slots lining the outer edges of each floor-plate, and exhausted into the gardens, where the plants have an oxygenating effect."<sup>87</sup> The stack ventilation system is so effective that air conditioning will not be required during most of the year. The resulting reduction in energy use is dramatic—an estimated one-third less than a conventional office building.

Hundreds of development projects like these are pushing the envelope and realizing significant savings with the advancement of knowledge and technology in green building.

### ***Key Groups & Applicable Tools & Strategies***

Such a vast array of information on green building has emerged over the last ten years. As the topic at professional conferences and workshops, the subject of dozens of journals and hundreds of articles, and a focus of many on-line discussion groups, there is much the Pearl River Delta building industry could gain from these sources. A particularly interesting organization that could serve as a model is the U.S. Green Building Council.

Founded in 1993, the U.S. Green Building Council (USGBC) is a non-profit trade association whose primary purpose is to promote green building policies, programs, and technologies.<sup>88</sup> Membership is offered to manufacturers, utilities, building owners, real estate advisors, scientific and technical organizations, and non-profit trade associations that are supportive of green buildings. The USGBC holds conferences, produces

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<sup>87</sup> Ibid

<sup>88</sup> For more information see: <http://www.usgbc.org>

innovative learning tools such as books and CD-ROMS, and other educational material to help further push the envelope. Chapters of the Green Building Council have been started in Japan and Spain and are in the works in Australia. This kind of multi-disciplinary consortium could be instrumental for China in seizing the green development opportunity.

The USGBC has also been developing a rating system for green buildings called Leadership in Energy and Environmental Design™ (LEED). After meeting certain prerequisites and then a comprehensive set of performance standards, buildings receive a plaque of certification and national recognition through a marketing program. Participation in LEED offers a clear way for developers and owners of commercial buildings to distinguish their product in the marketplace. For design teams it provides a learning opportunity and guide in how to create a green building. For the users or potential users, it quantifies specifically what a green building is and what it features. As large developers like Bovis Lend Lease adopt these practices their development activity world-wide will benefit and set a new standard. The success of LEED so far in the US is testament to the fact that the building industry is beginning to make significant shifts towards improving the resource and energy efficiency of its building stock.

The USGBC and other groups are providing the industry with an invaluable body of knowledge. While the focus of this thesis is not to detail every emerging green technology, tool, or system, the following describe some innovations that go beyond just the building envelope to consider the broader applications of green development. These examples are particularly relevant to the Pearl River Delta issues of growth and industrial development: the UGrow Model and Zero Emissions Research Initiative's Industrial Clusters.

## UGrow Model

A specific tool that may prove to be helpful with regard to the growth issues for the PRD region is the UGrow Model. Developed by NASA and Prescott College, this system dynamics model assists decision-makers in building sustainability through “resilience and longevity” into their changing communities.<sup>89</sup> UGrow calculates over 300 variables grouped into major sectors: Quality of Life, Economic & Business, Housing, Population, Land Use, Transportation, Climate Change, Sustainability and Energy. Typical variables include: land use by type, population, employment, level of business activity, air quality, vehicle miles traveled, house hold energy use, school quality, acres of park lands, average vehicle energy use, tax rates, urban heat island effect, and attractiveness to immigration. The model responds to a variety of policy options selected to generate a variety of future scenarios for a community. At present, there are ten policy option categories that encourage or discourage efficiencies, including: housing density, energy consumption, transportation, land use, surface albedo, and business activity. Each of these is adjustable for “intensity,” representing the strength of the policy implemented. The model may be stopped anytime, producing a “time slice” of the community’s characteristics. The system’s flexibility permits its use from simple educational events to interactive public meetings requiring decisions on complex and inter-related issues.

## Zero Emissions Research Initiative and Industrial Clusters

The Zero Emissions Research Initiative (ZERI) started by the United Nations University is an effort very much in line with natural capitalism. ZERI represents a shift in the concept of industry away from linear models in which wastes are considered the norm, to integrated systems in which everything has its use.<sup>90</sup> As noted in the forward of the

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<sup>89</sup> Conversations with and presentation by Will Orr, Prescott College: Sustainability and Global Change Program /NASA Earth Science Applications Program system dynamics model, UGrow ©1998. Also being developed: a 3-screen data interpretation and presentation system using familiar 2-D geographical information system (GIS) maps on one screen, 3-D modeling/visualization/fly-through capabilities on another, and issue education/decision support software on the third. Also see: [www.prescott.edu/NASA](http://www.prescott.edu/NASA)

<sup>90</sup> Information from email exchanges with Gunter Pauli, March 2001 and [www.zeri.org](http://www.zeri.org)

Chinese version of *UpSizing* by ZERI founder, Gunter Pauli “sometimes only a re-engineering of the process will be needed, and at other times new technologies will have to be invented. ZERI is in conformity with the Chinese philosophy that by-product (waste) from one resource use must, wherever possible, be put into another resource use. This means that the ZERI vision is appropriate for China.”<sup>91</sup>

Pauli argues for the creation of “industrial clusters” as an important part of implementing this concept. He says that all forms of waste will have to be integrated into the mechanism. Waste from one industry in whatever form must become an input factor for another business. In this way, companies decide to locate next to each other because they need each other’s wastes. This concept could have particular resonance in the PRD with the high level of manufacturing factories and industry. Pauli says, “improving the efficiency of industry, securing investments, implementing redevelopment, and enhancing sustainable and economic development for the first time go hand in hand.”<sup>92</sup> The emergence of new industrial clusters can offer cities and regions the opportunity to mobilize investment. New cluster development requires an estimated 80% less infrastructure investment than a conventional industrial park, according to Pauli.

This concept of industrial clusters is being studied in the emerging field of Industrial Ecology (IE). IE is as much about sustainable land use practices and community planning as it is about state of the art production methods. Like ZERI, IE signals a shift away from end-of-pipe pollution control methods toward strategies for more comprehensive, integrated pollution prevention planning of environmentally-sound industrial and economic development. This is accomplished by incorporating tools such as full cost accounting and green design for integrating environmental objectives into production processes, product design, and decision about selection of materials and

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<sup>91</sup> Excerpt from the Foreword by Li Kangmin of the Chinese version of Pauli, Gunter, et al. *Upsizing: The Road to Zero Emissions, More Jobs, More Income and No Pollution.* Sheffield, UK: Greenleaf Publishing, 1998.



technology. IE also looks at ways in which firms can share resources such as water, power, and waste resulting in closed-loop operations. The Guangzhou Planning department has expressed keen interest in learning more about IE.

A heralded example of industrial ecology can be found in Kalundborg, Denmark. A network of private companies, energy producers, and agricultural enterprises use one another's waste products as resources—turning unwanted by-products and waste into valuable inputs. Through 1993, the \$60 million investment in infrastructure (to transport energy and materials) has produced \$120 million in revenues and cost-savings.<sup>93</sup> Currently, ZERI is working on a number of innovative projects that apply this closed-loop concept in the development of breweries, farming, and restaurants.<sup>94</sup>

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<sup>92</sup> Email conversations with Gunter Pauli, March 2001 and Pauli, Gunter. "Industrial Clusters of the 21st Century" Chapter 10 in Capra, Fritjof and Gunter Pauli, Editors. Steering Business Toward Sustainability. New York: United Nations University Press, 1995.

<sup>93</sup> Source: Ehrenfeld, J. and Gertler, N. "Industrial Ecology in Practice: The Evolution of Interdependence at Kalundborg," *Journal of Industrial Ecology*, Volume 1, Issue 1, MIT Press, 1997. Available at <http://mitpress.mit.edu/JIE>

<sup>94</sup> See [www.zeri.org](http://www.zeri.org).

## **Chapter 4: Opportunities & Challenges**

There are a number of efforts underway in the Pearl River Delta, primarily now in Hong Kong, that begin to address elements of green development. This section identifies some of these policies, activities, and research as well as a couple development projects. The transition to better development is not easy; a summary of the challenges and barriers found for implementing green development in the PRD are described in the latter part of the chapter.

### ***Policy, Legislation, & Committees at Work***

The following provides a history and summary of some of the initiatives in building energy policy, legislation, committees and conferences.

#### **Hong Kong:**

- The Joint Steering Committee on Energy Conservation in Buildings was established in 1980 by the Hong Kong government.
- In 1981, the Hong Kong government started to raise awareness on the importance of energy efficiency by providing an energy saving guideline “Energy Conservation in Buildings.”
- The Energy Efficiency Advisory Committee was set up in April 1991 and renamed the Energy Advisory Committee (EnAC) in 1996. The committee is comprised of representatives from the business sector, utility companies, professional associations, government, academics, and environmentalists. EnAC targets building energy codes, energy management of government, and public sector buildings, energy labeling schemes, and Demand Side Management programs working with local utilities. It has four working groups: New buildings, Existing buildings, Energy Data, and Educational Campaign.
- In 1994, the Energy Efficiency Office (EEO) was set up within Planning, Environment, and Lands Branch to provide advice on possibilities for energy savings, and to plan, implement and monitor energy efficiency programs. A major area of EEO’s activities is the development of comprehensive Building Energy Codes.

- In July 1995, the government put in place legislation on new building design via the overall thermal transfer value (OTTV) of the building envelope. This was intended to help reduce the overall heat gain from sunlight through the wall and window of office buildings.
- Hong Kong Energy Efficiency Registration Scheme for Buildings was launched in October 1998.
- The Hong Kong Building Environmental Assessment Method was developed by The Real Estate Developers Association of Hong Kong with the assistance of several universities. The scheme, while voluntary, provides guidance to owners and operators on practices that minimize the adverse effects of building on the global and local environments.
- Hong Kong/ Guangdong Working Group on Sustainable Development and Environmental Protection is looking at regional pollution issues and conservation of natural resources. It was created in early 2000.
- In an effort to embrace the guidelines of Agenda 21 locally, Hong Kong undertook “The Study on Sustainable Development for the 21st Century in Hong Kong” (SUSDEV 21).<sup>95</sup> The study was commissioned by the Hong Kong SAR government in the fall of 1997 and released to the public in February 2001 in report and CD-ROM formats. It is the HKSAR’s first formal step towards bringing sustainability considerations into the management of day-to-day activities in Hong Kong. The SUSDEV 21 study has been primarily concerned with developing a systematic process to enable Hong Kong’s decision makers to gain an understanding of the long term implications of strategic development decisions, using a set of forward-looking sustainability indicators. The key outputs of the study were: a definition of sustainable development; a series of guiding principles and indicators; a Decision Support Tool (called the CASET) to assist in evaluating the sustainability implications of strategic policy and project proposals; recommendations for institutional changes

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<sup>95</sup> From interviews with the Hong Kong planning department and from review of the Environmental Resources Management’s “Sustainable Development for the 21st Century Final Report.” Hong Kong: Planning Department, The Government of Hong Kong, Special Administrative Region, August 2000.

to help government take better account of sustainable development issues in its decision making; and undertaking public consultation and awareness of sustainable development issues.

- To implement the SUSDEV21 plan, the government created the Sustainable Development Unit in May 2001. Their charge is to work with all government bureaus and the public to ensure the integration of sustainability. All government projects and policy will go through the SDU for approval.<sup>96</sup>
- February 2001, the Hong Kong Buildings Department, the Lands Department, and the Planning Department developed an incentive-based program to promote the construction of green and innovative buildings.
- Hong Kong representatives presented at the second international Green Building Challenge Conference, in the Dutch city of Maastricht. This intense Conference brought together some of the best green development information from around the world and features an array of exhibits, lectures, and discussion.

**China:**

- As a market-oriented energy efficiency program, China Green Lights was established in 1996 to improve the manufacturing capacity for high-quality, economic lighting products while educating consumers about the benefits.<sup>97</sup> By using compact fluorescent lamps, the project goal is to save 22 TWh and thus avoid building seven large power plants of 7.2 GW capacity. This pays off environmentally with an annual reduction in sulfur emissions of 200 thousand tons and carbon emissions of 7.4 million tons.
- The Energy Conservation Law of 1997: Building Energy Savings Plan states that the energy consumption for new heating residential buildings built in 2000-2005 should be 30% less than the energy consumption of similar buildings in 1999.

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<sup>96</sup> Note: Many individuals I spoke with in Hong Kong were very skeptical about how effective both this report and SDU would be in implementation.

<sup>97</sup> Logan, Jeffrey. "Energy Conservation with Chinese Characteristics: An Update on Projects to Empower the Market." Sinosphere. Spring 2001.

- In 1998, Guangdong Provincial Government forwarded the “Circular on Launching a Movement of Building Model Cities in Environmental Protection in the Country” by the National Environmental Protection Bureau to governments at all levels and formally started this movement in Guangdong.<sup>98</sup>
- The 1999 China Solar Energy Development Conference brought together over 400 Chinese companies to focus on photovoltaics, solar thermal, wind and biomass energy technologies and applications and included an exhibition of renewable energy products. The workshop reviewed some of some major renewable energy projects in China, including the World Bank, UNDP and the Brightness Program; highlighted experiences of international companies doing business in China; and introduced innovative new projects and products.
- The “Planning for Sustainability in the Pearl River Delta: An Environmental Design Charrette in Zhongshan, PRC” was organized in 1999 by the Department of Architecture at The Chinese University. (See below.)
- Recently, China has developed the Energy Conservation Certification Label, equivalent to DOE-EPA Energy Star label in US.
- The US based Natural Resources Defense Council is currently working with Shenzhen on a residential green building code.
- Guangzhou’s planning department has outlined some very innovative and comprehensive strategies for planning and transportation. A study is underway with Hong Kong Polytechnic University, Real Estate Department and Guangdong Research Institute of Planning, Surveying, and Design to highlight case studies in Guangzhou and Hong Kong. In one of the cases in Guangzhou, Haizhu Orchard, the planning department is considering a “protection belt” or what in the US is called an urban growth boundary (UGB). The UGB prohibits development outside of an established boundary, encourages increased density within the urban environment, and leaves an undeveloped ‘green ring’ outside the city as agricultural land or open space.

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<sup>98</sup> [http://china-window.com/Guangdong\\_w/hjbh/hjbh\\_1e.html](http://china-window.com/Guangdong_w/hjbh/hjbh_1e.html)

- In Macao's tourist based-economy, the Green Hotel Initiative and the Sustainable Development of Chinese Tourism Industry conference has attracted attention.
- The Chinese Ministry of Construction's Green Building Guidelines, 2000 outlines ten guidelines. At this point, these are very basic, covering: energy, water, air/ IAQ, insulation, heat, lighting, and plants.
- As mentioned in the Introduction, the International Conference of Green Building & Sustainable Building took place in June 2001.
- South China will be hosting the International Symposium on Sustainable Development of Mountainous Human Settlements and Eco-environments November 6-11, 2001.

### ***Hong Kong Green Building Opportunity & Knowledge Transfer***

A great opportunity is emerging in Hong Kong with the government's recent endorsement of the green building approach in the city's redevelopment and in the establishment of incentive program.

The city's plan outlined in *Hong Kong 2030: Planning Vision and Strategy* commits to "promoting environmentally friendly buildings that are compatible with nature and of better quality," by designing for natural ventilation and daylighting, among other features. It will apply this strategy in its sizable development plans. "Our plan for the next 20 years is to complete 200 urban renewal priority projects, including the redevelopment of 1,400 dilapidated buildings; rehousing 16,000 households; providing 50,000 square meters of open space and 70,000 square meters of community facilities." Secretary for Planning and Lands, Mr. Gordon Siu stated, "the government will take steps to modernize and liberalize building rules and regulations and to remove barriers to innovative green design and modern technology."<sup>99</sup>

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<sup>99</sup> Quote from the HKSAR Bureau's Policy Objective booklet entitled "Developing Hong Kong" and Hong Kong 2030: Planning Vision and Strategy. "Better Planned City with Greener Buildings," October 18, 2000.

Just in February 2001, the Hong Kong Buildings Department, the Lands Department, and the Planning Department launched a program to promote the construction of green and innovative buildings. The objective is to encourage the design and construction of buildings that encompass the following features:

- Adopting a holistic life-cycle approach to planning, design, construction and maintenance;
- Maximizing the use of natural renewable resources and recycled/green building material;
- Minimizing the consumption of energy, in particular those non-renewable types; and
- Reducing construction and demolition waste.

Under its first incentive package, the departments are encouraging the industry to explore ways to improve environmental performance during the construction and throughout the life-cycle of new buildings. This is a tremendous step forward and will hopefully set a course that other municipalities in the PRD region will follow. The Ministry of Construction's preliminary Green Building Guidelines, mentioned above, could be strengthened in this way and could weave this approach into its government contracts. A forum such as the US Green Building Council and the green building rating system LEED previously described could further help define and encourage these practices.

### ***University-Based Projects Underway***

Universities in the Pearl River Delta have conducted a number of innovative green building and sustainability research projects. In 1999, the Department of Architecture at The Chinese University partnered with the Municipality of Zhongshan in the PRD, the American Institute of Architects, New York Chapter, and Hong Kong Institute of Architects to conduct an environmental design charrette (an intensive whole-systems workshop) specifically focused on Zhongshan. The aim of the "Planning for Sustainability in the Pearl River Delta" project was to develop an applicable framework for these

concepts and a process that could be adapted to other cities in China and be a reference model for other developing regions.<sup>100</sup>

The following discussion describes three other university-based projects: 1.) The Green Building Concept in Hong Kong survey; 2.) Sustainable Development Appraisal, a Joint Project: Hong Kong Polytechnic University, Real Estate Department and Guangdong Research Institute of Planning, Surveying, and Design; and 3.) Environmental Impacts of Building Energy Codes on Energy Management in Building Service Installations.

### The Green Building Concept in Hong Kong

In a 1997 survey entitled "The Green Building Concept in Hong Kong," Lok, Shiu Choi from Hong Kong University assessed the viewpoints on green buildings of architects, building service consultants, developers, academics, and local authorities.<sup>101</sup> In addition, it considered the major local factors that affect development of green buildings and ways to tackle obstacles that impede adoption of such practices. He found that about 20% of firms conduct environmental and energy assessment over basic code requirements. None of the firms surveyed indicated that they had conducted green building optimization in the design phase. Most of the designs are based on the "rules of thumb" or general practice of the industry. However, Lok Shiu Choi did find that there is an increasing awareness of professionals about integrating environmental protection into their designs and a willingness to create a movement in the market for sustainable development.

Lok Shiu Choi's report summarized the recommendations made by the survey respondents to move green building forward in Hong Kong.

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<sup>100</sup> Campanella, Thomas, Joyce Lee, and Wallace Chang. "Planning for Sustainability in the Pearl River Delta: An Environmental Design Charrette in Zhongshan, PRC." Department of Architecture, The Chinese University, American Institute of Architects, New York Chapter, Municipality of Zhongshan, PRC, and Hong Kong Institute of Architects. 18-20 June 1999.

<sup>101</sup> Lok, Shiu Choi. "The Green Building Concept in Hong Kong." Hong Kong University Master's Thesis, 1997. Pgs 24- 30.



- Government supported guidelines and code practice for implementing green building. Progress in this area is being made. The HKSAR government's new green building incentive program begins to address this.
- Establish a statutory requirement.
- Arouse public awareness and hence creation of a green market orientation for long-term solutions
- Government support of redevelopment of old district with proper attention to environmental considerations.
- Improve the availability of alternative environmentally friendly products, materials and systems to reduce overall materials and installation costs.
- Develop new programs for environment and energy assessment. The concept of a contract energy management scheme under an energy service company (ESCO) might be a good alternative to existing management schemes. This strategy has been successful in the US at reducing energy loads and costs. Essentially, an ESCo signs a contract with the building owner for a set period of time (i.e. 5 years) and agrees to: install new equipment; repair and replace existing systems; and assist in the operation and maintenance of the facility. The ESCo then can stabilize or reduce energy use costs, make capital improvements, and maintain and operate the facility at a cost less than the current energy bill. For developers with constraint in financial resources, the lack of technical expertise and perceived risk associated with such an undertaking, the ESCo offer an attractive option.

The shortage of land that results in the high land cost was also identified as a barrier since this “forces” developers to demand the building design be “cost effective and time saving.” This perceived barrier is a common misconception that green building has to cost more and take more time. More and more projects are demonstrating that a green development approach can yield a competitive project, financially and in delivery time. As design and development teams become more familiar with the approach and as the educated market demands such buildings, it will move from the fringes of understanding to an approach that is more widely accepted.

### Appraising Green Development Projects

In part, the difficulty in implementing green development lies in the lack of tangible criteria about how to measure or appraise it. At the Hong Kong Polytechnic University Real Estate department, Professor Seabrooke and his colleagues are conducting

research to help solve this issue of differing approaches to development appraisal.<sup>102</sup> Seabrooke remarks that much has been written about sustainable development, but little has been done to indicate to developers, planners, and appraisers just how the principles of sustainable development can be applied in project evaluation. The team is investigating standards of sustainability that would compel developers to acknowledge and value green concepts in their projects. By identifying how private developers could incorporate more comprehensive cost and benefit considerations into project evaluations and by helping planning authorities establish clearer criteria for expected standards of sustainability, the team hopes to produce specific guidelines applicable to Hong Kong and cities in the Pearl River Delta. These guidelines would be in the form of codes of acceptable practice and methods for new development and infrastructure projects. Seabrooke notes that Hong Kong is at a more advanced stage of developing its principles for sustainable development through the SUSDEV 21. (See above.)

The conventional tools developers use for assessing value are expressed merely on financial terms (income stream), but there is also benefit in evaluating the social and environmental benefits. However, as has been debated, these are more complex and less easy to quantify financially. As described under the natural capitalism model, precisely quantifying non-market goods, like air quality, is very difficult. Appraisal, in terms of the net present value approach, applies a probability function to discount the value of future benefits of a project. Seabrooke argues that this “presupposes that future benefits are less valuable than similar present benefits. In the case of environmental values the reverse might be true, future benefits may be higher in value today because of the likelihood of increasing scarcity in the future. There also might be considerable

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<sup>102</sup> Conversations in Guangzhou, June 2001, with Ms. Li Yong of the Guangdong Research Institute of Planning, Surveying, and Design and review of proposal: Seabrooke, W. and Yeung Chi Wai “Establishing Criteria for Sustainable Urban Development with Reference to Hong Kong and the Pearl River Delta Region.” Joint Project Proposal: Hong Kong Polytechnic University, Real Estate Department and Guangdong Research Institute of Planning, Surveying, and Design. Commissioned by the Royal Institution of Chartered Surveyors and the UK Environment Agency. 2001.

differences in the relevant time horizons of different costs and benefits, some of which may take many years to become significant.”<sup>103</sup>

Economic appraisal alone may not provide all of the information required for good decision making. A more flexible appraisal tool that evaluates the full range of values should be employed. Seabrooke is investigating the Multi Attribute Criteria analysis model to look at alternative ways to score and weight the additional values.

### **Environmental Impacts of Building Energy Codes on Energy Management**

In his Hong Kong University research, Yeung Chi-Hung produced “A Survey of Environmental Impacts of Building Energy Codes on Energy Management in Building Service Installations.” The report provides a synoptic view of the applications, implementation, and effectiveness of the Hong Kong building codes and evaluates their impact on the environment by considering the reduction of fuel use and pollutant emissions for power plants if the building energy code programs become statutory.<sup>104</sup> Pilot buildings were used to more clearly demonstrate the effectiveness of the codes.

As noted above, a set of building energy codes has been developed by the Hong Kong government to cover various aspects of building design and conservation. The substantial increase in electricity consumption prompted the development of a series of guidelines. In 1991, the Energy Efficiency Advisory Committee laid out five codes of practice on energy-efficient design of buildings and building services. Installations were published under the building legislation code in 1995 and launched through the Hong Kong Energy Efficiency Registration Scheme for Buildings in late October 1998. These covered:

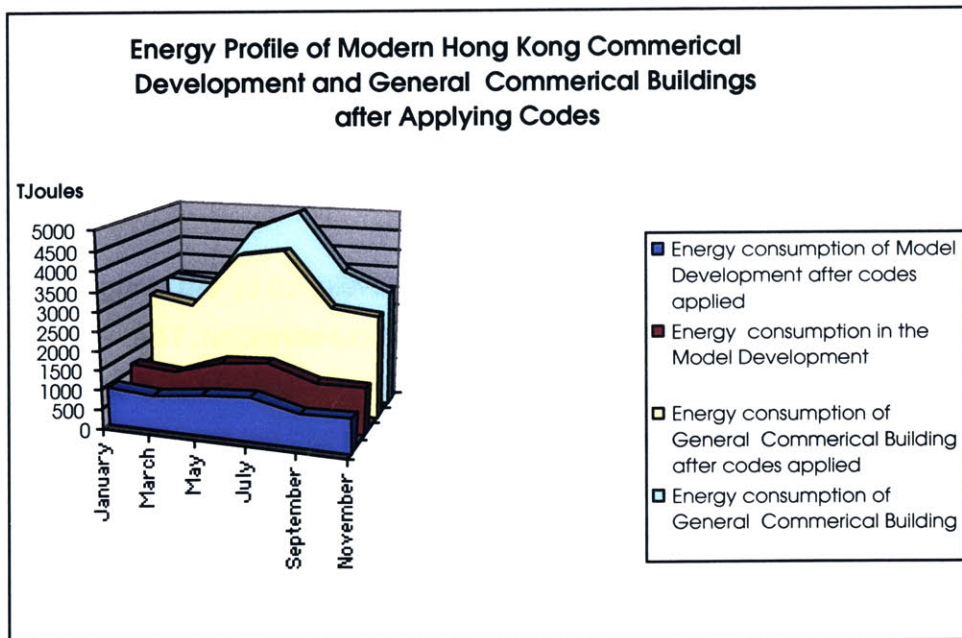
- Overall Thermal Transfer Value
- Lighting Code

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<sup>103</sup> Similar remarks have also been made by Christopher B. Leinberger in his paper “Financing Progressive Development.” A Capital Xchange Journal Article, Prepared for the Brookings Institute and Harvard University, May 2001.

- ❑ Air Conditioning Code
- ❑ Energy Efficiency Code
- ❑ Lifts and Escalator Code—Launched through the Hong Kong Energy Efficiency Registration Scheme for Buildings in 2000.

In his study, he evaluated the total energy savings as the codes become regulation. Energy requirements of the commercial sector for electricity account for 59% of the total energy consumption in 1997. Commercial buildings saw a 5% increase in 1996. For a pilot building, a benchmark was used to predict total energy savings in commercial buildings with similar characteristics. Energy savings were converted to the reduction of pollutant emissions. The following graph represents his findings.



Source: Adapted from Yeung, Chi-Hung. Pg 76.

<sup>104</sup> Yeung, Chi-Hung. "A Survey of Environmental Impacts of Building Energy Codes on Energy Management in Building Service Installations." Hong Kong University Dissertation, 2000.

### **Chinese Case Study Examples**

The two case studies described here demonstrate what developers are experimenting with in green development . Additional opportunities that could be investigated are described.

#### **VANKE and Sustainable Urban Housing in China**

One of the projects for the “Sustainable Urban Housing in China” program is with China VANKE developers in Shenzhen.<sup>105</sup> The aim of the project is to identify new technologies, and applications of existing technologies that will significantly increase the efficiency of new and renovated Chinese buildings. The design, prototype testing, and evaluation of residential projects is the main focus. In addition, the project is investigating the appeal to Chinese builders and consumers of such approaches toward energy efficiency and a clear communication of the inherent advantages of green strategies. Design processes have investigated integrated building systems and heating and cooling strategies. Assumptions are tested using computational fluid dynamics and energy modeling. For such complicated research and testing, VANKE has teamed up with Massachusetts Institute of Technology through the Alliance for Global Sustainability. The research is led by Leon Glicksman, MIT Professor of Building Technology and Mechanical Engineering. He notes that for developing countries, it is even more important to follow environmentally-conscious paths than earlier western world precedents to assure that they reach comparable standards of living.

VANKE’s mixed use “Wonderland” development in Shenzhen is one of the pilot projects.<sup>106</sup> As a firm, VANKE is very interested in learning more about green building. Its employees have gone through the training of an ecologically responsible building

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<sup>105</sup> Interview with Dr. Xiao Jing Wen, China VANKE Co., Ltd, Group Design and Construction Dept, June 2001 and project material and MIT Alliance for Global Sustainability China Housing project. Conversations with Leon Glicksman, Spring 2001.

<sup>106</sup> I toured the project and their headquarters with Dr. Xiao Jing Wen, with VANKE's Group Design and Construction Dept. June 2001.

program. With this certification, they hope to “more easily sell space.” Working with MIT, VANKE has been able to employ green development into its Wonderland project.

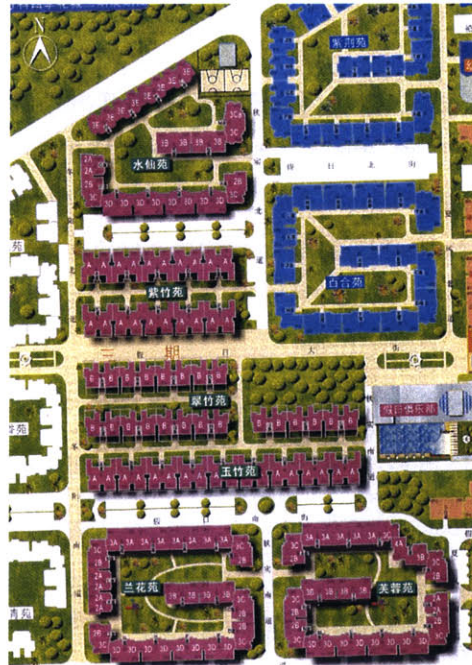
Wonderland stands out as a unique development from others in south China. In its development of Wonderland, VANKE created varying apartment sizes and purchase options to encourage a mix of residents. Courtyards flow around the development’s fourteen buildings. A lush garden in the public plaza space is designed for community activity. Cisterns capture rainwater, which is used to water the landscaping. The retail stores on the first floor spill out into this space creating a lively place for interaction. To allow air to travel through courtyards, the east west edges are perforated. The buildings are oriented north/south to minimize solar heat gain. Unit designs all optimize fenestrations to shade from sun in warmer months and natural ventilation. The development is buffered from train noise by higher buildings with better wall treatments placed to the north. No cars are allowed within the development so electric carts are used carry people around. VANKE also provides bus transportation into Shenzhen.



Wonderland photo by: Jen Uncapher

The VANKE team noted that energy efficient low-e windows are easy to get but are double the price. Typically, they only specify them for luxury units while others get single pane. The same applies for photovoltaics. “They are expensive and there is no government support or subsidies yet—and coal is still a very cheap source of energy.” For the most part, VANKE uses locally made products, which supports the local economy, reduces transportation (and thus emissions) and is cheaper. In their developments, they are beginning to learn energy modeling with the help of the MIT team.

The development has been very successful. Units sold quickly for the area—80% sold in two weeks. Townhouses sell for \$5,000 RMB per square meter as a shell while apartment units sell for \$3,500 RMB per square meter but are fit out.<sup>107</sup> Retail space is either purchased or leased from VANKE’s property management arm. The financing structure for the project consisted of bank loans backed by pre-sales and developer equity.



## Cheung Kong Infrastructure Holdings

Barrie Cook, executive director of Cheung Kong Infrastructure Holdings, leads the cement division of the largest conglomerate in Hong Kong, with a market cap of US\$100 billion.<sup>108</sup> “One of the biggest credentials I have is that I’m both an environmentalist and a businessman,” he says. The company’s newly built headquarters, The Cheung Kong Centre on Queens Road Central in Hong Kong, features access flooring. First introduced nearly three decades ago, this improved underfloor innovation used for conditioned air and data delivery offers numerous economic and environmental benefits. Access to data cables, telephone lines, and power outlets along with space flexibility are important functionally in today’s office environment.<sup>109</sup> According to the International Flooring Manufacturing Association benchmarks III Survey, the typical workplace has a 40% chance of being in some state of change. In all of Cheung Kong projects, clients are now demanding such features. In line with Kevork Derderian’s comments mentioned above, Cook is convinced that the environmental improvements and flexibility of the workspace create demand for green, high-performance buildings.

The benefits of access flooring include: ease of reconfiguring the space (particularly important with the increase in the rate of churn), energy savings, improved air quality, increased ceiling height, enhanced comfort and control, wiring and cabling savings, more forgiving design, and overall cost savings.<sup>110</sup> A reduction in construction time offers

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<sup>107</sup> Conversion: Chinese RMB exchange @ 8.7RMB to \$1 US—as of June 2001.

<sup>108</sup> Interview with Barrie Cook, Executive Director, Cheung Kong Infrastructure Holdings, Ltd, Hong Kong, and head of the Hong Kong Business Coalition on the Environment. June 2001.

<sup>109</sup> According to Andy Karvonen in “The Revolution is Underfoot,” currently, raised floor systems comprise an estimated 58% of new commercial building projects in Japan and about half of all new commercial projects in Europe and the United Kingdom. In North America, the market for raised floor systems is much smaller, including only about 10% of new commercial square footage. Environmental Design and Construction, January / February 2001, <http://www.edcmag.com/archives/01-01-3.htm>.

<sup>110</sup> Research from an unpublished paper “An Analysis of Financing High Performance Office Buildings: Innovative development strategies to increase profits, create healthy, efficient places to



significant savings in the total interest charge on the development. A 20-week reduction could offer a significant saving in interest charges. In addition, an access floor based system permits delivery of key mechanical and electrical elements far later in the construction schedule. In some cases, it permits the equipment to be supplied at the time of the tenant fit out and thus cash flow and cash demand can be improved, offering savings in interest charges on the development. For example, if 20% of the contract is mechanical and electrical services and 50% of that figure can be purchased three months later in the program, significant savings can be garnered. Earlier release of the building allows occupancy to take place sooner.

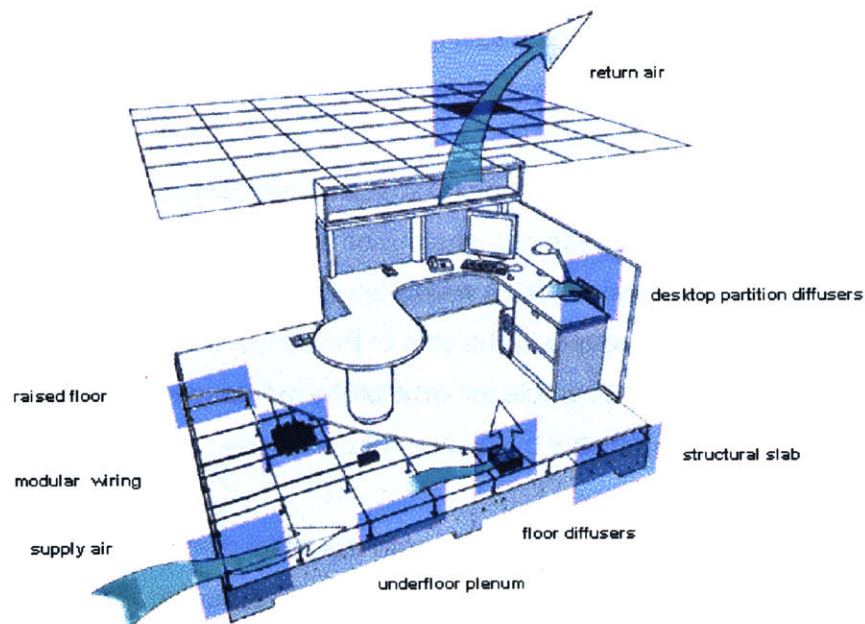
In Hong Kong, rental expense for commercial space is approximately \$US30 per square foot per year. With 50% of the space of a one million square foot building to be released early, the increased rental revenue for 20 weeks is nearly \$6 million. The savings, simply in the cost of reconfiguration, equate to the cost of the rent in many offices. The reduction in time taken is immeasurable in terms of the increase in staff productivity and it is recognized to be very significant by leading organizations.

Considerable cost savings can be realized at both the initial cost stage and the operating life cycle cost of the building. The savings mentioned above add up to the following:

Construction costs savings	=	\$6/sqft
Financing costs saving	=	\$6.5/sqft
<u>Earlier rental revenue</u>	=	<u>\$0.45/sqft</u>
Net savings	=	10% on the project

In addition to their reduction in construction time and flexibility benefits, underfloor air distribution systems are more energy efficient than conventional HVAC systems because they take advantage of the natural convection properties of air. As the cool air introduced at the floor level rises, it increases in temperature because it is exposed to

people and office equipment. The warm air rises and is exhausted through the return vents above the space. "By taking advantage of this natural convection, the HVAC system can be operated at lower pressures (typically 0.05 to 0.1 inch), reducing central fan operations. Additional energy savings result because the supply air is introduced directly in the occupied zone, instead of from the ceiling."<sup>111</sup> Buildings can achieve up to 25% energy savings. These savings include reductions in cooling energy for conditioning air as well as central fan energy for distribution.



Source: The Center for the Built Environment, University of California, Berkeley.  
<http://www.cbe.berkeley.edu/underfloorair/typicalofficeworkspace.htm>

As more and more projects adopt this style of construction (as Hines and Fidelity have done), noticeable reduction in the cost of reconfiguration, lower energy costs, improved indoor and outdoor air quality through reduced pollution in operation, reconfiguration and eventual demolition can be expected.

<sup>111</sup> Karvonen, Andy. "The Revolution is Underfoot" Environmental Design and Construction. January / February 2001. <http://www.edcmag.com/archives/01-01-3.htm>.

A green development angle that Cheung Kong Infrastructure Holdings is experimenting with is the incorporation of flyash into one of its cementitious products. Cement production is one of the most energy intensive of all industrial manufacturing processes. Including direct fuel use for mining and transporting raw materials, cement production takes about six million BTUs for every ton of cement.<sup>112</sup> In China, 92% of tall buildings employ concrete (and thus cement) as the primary structural material.<sup>113</sup> With this material being used so readily, there is much to be gained in increasing its efficiency and environmental impact.

Flyash, a byproduct of coal-burning power plants (China's primary energy source), is being used to produce stronger, more durable, and more environmentally friendly concrete.<sup>114</sup> Most of the time the flyash is landfilled. The key to successfully using flyash in concrete is the mix design—how the flyash is combined and proportioned with the other ingredients. While most concrete incorporates up to 15% flyash, high percentages (50 % or more) must be used to obtain maximum benefits, such as reduced permeability and increased durability. Further incorporation of innovations like this could help Cheung Kong—as such a huge player in the market—lead in environmental initiatives throughout the delta and Asia.

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<sup>112</sup> Shell, Scott "High Volume Flyash: A Concrete Solution." Environmental Design & Construction, May-June 01. <http://www.edcmag.com/archives/05-01-2.htm>.

<sup>113</sup> Dajun, D. 'High-Rise Concrete Buildings in China,' Concrete International, June 1995. Pg 48-52.

<sup>114</sup> Shell, Scott "High Volume Flyash: A Concrete Solution." Environmental Design & Construction, May-June 01. <http://www.edcmag.com/archives/05-01-2.htm>.

### ***Challenges & Implementation Barriers***

This section summarizes the challenges and institutional barriers that fall in the path of adopting green development more expeditiously.<sup>115</sup>

**Education and Terminology:** To many in China, “green building” refers to green space and plants vs. ecologically- and environmentally-responsible development. Clearly, there is a need for education and new terminology. As noted in the Introduction, Stephen Chung, director of a real estate research and consulting firm in Hong Kong, commented that real estate marketers and advertisements treat the planting of trees and landscaped open spaces as sustainable design. Developers want to appear green to their customers, but there is no standard yet for what that means.

In writing her thesis, MIT graduate student Lara Greden surveyed developers in China asking their views on green building. She asked, “How can we make the market work for green buildings?”<sup>116</sup> One of her interviews was with the Director of the Office of Energy who is focusing on performance based codes. When asked about economic incentives during Greden’s interview, he stated that the government tried a tax break for energy-efficient investments several years ago and every developer found a way to qualify. “There were too many loopholes.” One of Greden’s survey questions asked about how a developer perceives his property as “green” and the most typical reply was “trees, sunlight, and grass.” Headlines such as one in June from the *South China Morning Post*, “Cheung Kong Adding Balconies in Response to Green Incentives” further miscommunicate the scope of green building.<sup>117</sup> While these are nice amenities and address

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<sup>115</sup> Distillation of my China interviews and in particular a conversation with Stephen Chung, director of research for Zeppelin, a real estate consulting firm in Hong Kong, July 2001 and review of Yeung, Chi-Hung. “A Survey of Environmental Impacts of Building Energy Codes on Energy Management in Building Service Installations.” Hong Kong University Dissertation, 2000.

<sup>116</sup> Greden, Lara. “The Demand Side of China’s Evolving Housing Market and Sustainability: Stakeholder Analysis and Policy Approaches.” Massachusetts Institute of Technology Master’s Thesis, 2001.

<sup>117</sup> Chan, Doris. “Cheung Kong Adding Balconies in Response to Green Incentives.” *South China Morning Post*, Business Post section, June 12, 2001. Pg 2.

some biophilic elements, they are not as comprehensive as the full green development approach. The US Green Building Council's LEED rating system, mentioned above, could be a better model for how to define and create green projects.

**Practices Die Hard:** Essentially, the typical building techniques and approaches have remained relatively intact and unchanged for the past 30 years in China/Hong Kong—reinforced concrete frame, infill brick walls, exterior tiles, aluminum windows. Except for a few very luxurious residences, grade A offices and government projects, serious green measures are not widely adopted or even contemplated. Some of the green measures adopted seem more cosmetic rather than a reflection of an understanding of the comprehensive approach. There are signs that these may change in the future especially with people having changed their perception of real estate from being a pure speculative asset to an end-product for use. As the costs related to utilities, maintenance, and management become more of a concern, there is likely to be greater appreciation of energy-saving, green development measures.

**Imperfect Market Structure and Information Barrier:** The lack of legislation, strategies, incentives, and education on energy efficiency as well as the lack of institutional support and coordination at the community and national level are all barriers. Information on land use and land-use changes is often inaccurate, inconsistent, and incomplete. There are often distortions of information because the local governments are, for example, unwilling to report the precise area of agricultural land lost to urban development to the central government.<sup>118</sup> Information is important for making good decisions. Before doing a land-use plan, the government could use remote sensing and GIS to do an inventory of land resources and set up a plan to monitor land-use change on an ongoing basis.

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<sup>118</sup> See Kersten, Gregory and Anthony Gar-On Yeh. Decision Support System for Sustainable Development Applications & Methods. Hong Kong, University of Hong Kong, 2000. Pgs 74-86.

**Prescriptive building codes:** Present building construction is handicapped by prescriptive building codes. In addition, many new residential projects exhibit serious construction flaws and inferior products.

**Economics:** There is a perception that China has to reach a certain point where people feel 'affluent' enough to increase their demand and appreciation for green development. In short, "willing and able to pay for it." The growing number of case studies is showing that such practices don't necessarily result in higher costs. However, when something is still new or perceived as novel, it usually does enter the market at a high-end level then "trickle down" and is eventually absorbed more readily in the market.

**Business Culture and Mentality:** While there are some reputable or serious real estate developers operating in China, there are also many who do it to "earn a quick buck"—bearing in mind that China is in a rapid stage of economic development.<sup>119</sup> Green development requires the support from more sophisticated developers (whether willingly or unwillingly—i.e. enforced by law.)

**Bureaucracy and Discretion:** Prospective WTO entry notwithstanding, there are rules and regulations governing the 'import' of building materials and equipment. While some of the green development related materials or equipment is manufactured locally (albeit not affordable—according to VANKE), getting other materials into China may involve cumbersome (import) processing and taxation procedures. With development and building schedules usually tight, there is the perception that incorporating green practices may not be always feasible.

**Separation of Interests:** Building developers usually bear the costs with energy efficient investment while savings accrue to the building owner and user. An innovative strategy

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<sup>119</sup> Conversation with Stephen Chung, Real Estate Tech. July 2001.

being experimented with in the US that realigns incentives is performance-based fees.<sup>120</sup> A performance-based fee compensates the design/development team for the extra time spent making a building more efficient. Conventional compensation provides no extra reward (a cut in the savings) for additional effort. At times, design teams actually get paid less because their fees are typically negotiated based on a percentage of cost and green buildings need smaller and simpler mechanical systems for cooling, heating, and air handling. With performance-based fees, the design team is paid a bonus if the building exceeds energy performance targets set in an initial agreement. The targets are determined through well-established computer energy models. The results after the building is commissioned determine whether there is a bonus or a penalty due.

**Land Prices and Corruption:** Land use transfer for foreign-related property is typically not made through public bidding and auction, except in special zones. Therefore many localities compete with one another to cut prices and provide foreign developers with low-price opportunities, thus resulting in China losing considerable land profits. The impact of corruption is also a factor in local land affairs. For example, in some SEZs, the local government acquires land from farmers for a small sum and then pockets a hefty profit when it sells the land to developers. The shortage of land in Hong Kong results in high land cost—causing developers to look for the cheapest way of building.

**Low Cost of Energy:** There is a lack of energy-efficiency in Chinese building design. For most commercial and residential buildings in the PRD, little effort is made to promote good thermal insulation, efficient heating and cooling systems, proper orientation and size of windows relative to the sun. According to research conducted at Hong Kong University, “in Hong Kong, only a small number of architects and engineers take into consideration energy efficiency in the design and operation of buildings and there is no coherent energy policy to monitor the growth of energy consumption.”<sup>121</sup>

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<sup>120</sup> Experiments have been conducted by Eley Associates, San Francisco, CA and Rocky Mountain Institute, Snowmass, CO with funding from The Energy Foundation beginning in 1995.

<sup>121</sup> Pok, Yuk-fu. “Building Energy Conservation and the Environment in Hong Kong: A Case Study of Glazing Wall Office Building.” Hong Kong University Master’s Thesis. 1998. Pg 11.

In the past decades, there has been a substantial increase in residential ownership of major durable goods such as air-conditioners. Efforts put into better design, such as passive ventilation exhibited by VANKE and the Sustainable Urban Housing in China project, could eliminate or minimize the need for such intensive energy appliances.<sup>122</sup>

**Unfamiliarity by Lenders or Investors:** As is the case in the US, green development practices are not familiar to lenders or investors and there is skepticism from financing institutions. Until more comparable projects exist in the PRD (and globally for that matter) there is a natural reluctance by conservative lenders and “path-of-least-resistance” developers to enter into the unknown.

**Political and Legal Regional Differences.** Hong Kong’s political relationship with the rest of the country adds further complexity to the situation. As previously noted, the HKSAR functions as an autonomous jurisdiction with respect to environmental policy. It approaches such policy-making differently than the PRC with its own institutional structures and laws, regulations and standards.<sup>123</sup>

Little implementation guidance is given in China’s energy conservation law and the impact varies substantially by region and industry. Another problem is that Chinese managers are rewarded for creating jobs and generating revenues without regard to environmental impact.<sup>124</sup> Jobs and the environment need not be separate endeavors.

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<sup>122</sup> Conversations with Leon Glicksman and information from his project poster at the Alliance for Global Sustainability conference, Lausanne, Switzerland, January 2001.

<sup>123</sup> Conversations with Terri Mottrhead, a lawyer, founder of Sustainable Development Forum, Hong Kong and Hong Kong University Professional and Continuing Education Law Division, June 2001.

<sup>124</sup> Sathaye, J.A., Sinton, J., Heller, T. “Doing Better with Less Energy” IEEE Spectrum magazine. December 1999. Pgs 42-49.



## **Chapter 5: Looking Ahead & Conclusions**

*“Sustainability implies a system that can persist over generations, one that is far-seeing enough, flexible enough, and wise enough, not to undermine either its physical or its social systems of support.”*

*Dana Meadows, et al.  
Beyond the Limits, 1992.*

The Pearl River Delta is in the midst of dramatic change—change that has already caused serious impact to the environment and people’s lives. Green development can play an integral role in China’s strategy toward providing better development for its people while restoring and protecting ecosystems. Valuing natural and human capital in this way will help the region and the country save energy, reduce pollution, improve economic competitiveness and create better places to live.

The importance of linking green building efforts into the context of a greater sustainable development plan cannot be overstated. Further, connections of green development with efforts of sustainable business practices in the region are key to pushing this strategy forward.

### ***Regional Institute on Sustainable Development***

Dr. Yok-Shiu Lee, with the University of Hong Kong argues that for environmental programs to be effective, further research and policy actions on the environment would need to be placed in a larger regional context. “Given Hong Kong’s geographical location, the success of any major environmental initiative would require concerted efforts on the part of our neighboring jurisdictions. Moreover, given the substantial differences in environmental standards and the environmental governance structures between Hong Kong and its neighbors, it is paramount that the existing (and any alternative) cross-border cooperation mechanisms be examined in detail and their respective strengths and limitations be assessed thoroughly.” Dr. Lee seeks to create a framework to start working toward an effective partnership to resolve region-wide environmental problems.

The MIT Project 2022, mentioned earlier, used scenario planning to consider the fate of the Pearl River Delta over the next 20 years. Based on both analysis and assumptions, these scenarios generate a dialogue that can help develop such a framework that might aid in creating a desired regional plan for development in the PRD. The third scenario gave a glimpse at what cooperation and sustainable development would look like. It describes the importance of a regional organization to help guide development and effectively manage environmental control. A unified land-use plan of clustered development could weave the region together and minimize sprawl preserving agriculture land.

Many in the Pearl River Delta and experts beyond the region (through the Alliance for Global Sustainability) are investigating such an organization.<sup>125</sup> It is envisioned as a regional independent think-tank or institute for information on urbanization, development, transportation, environment, science, technology, and best practices such as those described in the natural capitalism model. The institute's focus on education, environment, and economy would help the PRD gain a distinct and sustainable advantage over other Asian regions. As the regional coordinating body, the institute would assist the government, business, and organizations of the region by identifying their specific needs and responsibilities: formulating region-wide strategic plans, proposing investment and incentive programs, and work toward a common environmental standard. The institute would be responsible for continually reviewing regional conditions and revising development strategies. This group would also conduct policy studies on key issues drawing on the expertise of local talent, and worldwide leaders in the field.

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<sup>125</sup>Three universities the Massachusetts Institute of Technology, the Swiss Federal Institutes of Technology, and University of Tokyo created the Alliance for Global Sustainability in order to increase knowledge and understanding of the scientific, technological, and political dimensions of sustainability problems through joint research and by enhancing the role of universities as objective facilitators for consensus building among decision makers in industry, government, and in the public at large.

### ***Connections & Linkages***

Some argue that greater integration of Hong Kong with the Pearl River Delta would result in reduced competitiveness of the Hong Kong economy.<sup>126</sup> However as Hong-Kong Chief Executive, Tung Chee-hwa recently stated “What we are seeing is that economics are becoming more and more regional, rather than city-oriented. Hong Kong and Guangdong economies are very complementary.”<sup>127</sup>

The Asian economic crisis awakened some government, corporations, and citizens to the need for a more responsible way of doing business, it provided a pause to look at how the environment could better managed. Many are seeing the benefits of investing in the environment. This front-end approach outweighs the costs of health-care for pollution-related illnesses, loss of crops, and clean-up efforts. Barrie Cook, the executive director of Cheung Kong Infrastructure Holdings mentioned above, is also the founder of Hong Kong Business Coalition on the Environment. Recently, he brought together 30 international and local business groups to speak out on PRD pollution and he says the government listened this time. “The only way to drive the economy forward is with attention to the environmental health.”<sup>128</sup>

One such company paying attention to these issues is Esquel Enterprises, Ltd., the largest garment manufacturer in Hong Kong.<sup>129</sup> To lead the efforts, its visionary chairwoman, Margorie Yang, has designated a “Sustainability Manager”—one of the first such positions in China. Already saving thousands of dollars a year, Yang views sustainability as a competitive advantage in how she runs her business. Margie was

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<sup>126</sup> Laquian, A. “Pearl River Delta Development in the World Development” 1996.  
<http://www.hkpri.org.hk/bulletin/5/Red%20Tides.html>

<sup>127</sup> Tung, C.H. “Quality People—Quality Home: Positioning Hong Kong for the 21st Century.” Address by the chief executive at the Legislative Council meeting October 1999.

<sup>128</sup> Mr. Cook’s group sponsored the “Building a Sustainable Community in Hong Kong in the spring of 2001 and a report of results is being produced on the “Social, Economic, and Environmental Priorities for Sustainable Development in Hong Kong.” Quote from media response: Ghahremani, Yasmin. *Asian Week*, March 10, 2000 VOL. 26 NO. 9  
<http://www.asiaweek.com/asiaweek/magazine/2000/0310/sr.3warriors.html#5>

inspired to begin to think about her company's environmental impact by her sister's children who all have allergies from the pollution in the region. "We can't shy away from our responsibility," she says, "when you pollute you're also paying for pollutants, so it makes sense to minimize or eliminate them." In addition, she says she undertakes these efforts to satisfy stakeholders, buyers, local government, suppliers, employees, and for health.

The multi-disciplinary Sustainable Development Forum is working to bring these ideas to the forefront in Hong Kong and through the region as well. The newly formed Civic Exchange is playing a pivotal role by promoting civic education, public awareness and participation in governance by strengthening civic participation in public life. It undertakes research and development in policies and practices to help shape the public policy debate advancing policies that are "sustainable, resilient, non-violent, economically efficient, just, participatory, locally appropriate and spiritually rewarding." It is particularly important to include such NGOs for a more critical perspective on how environmental issues are being handled. Other NGOs such as GreenPeace China, Green Power, Friends of the Earth, and The Conservancy Association (the oldest environmental group in Hong Kong—started in 1968) are active in a range of environmental sectors, including biodiversity, conservation, water systems protection, and public education.<sup>130</sup>

While it is just in its infancy, the government's Hong Kong/ Guangdong Working Group on Sustainable Development and Environmental Protection is looking at regional pollution issues and conservation of natural resources (created in early 2000.) The group begins to address some of the challenging structural issues addressed here which

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<sup>129</sup> From interviews and factory site visit in Gaoming with Ms. Yang and Leo Jar, Sustainability Manager.

<sup>130</sup> From interviews in Hong Kong and see: Yok-shiu F. Lee and Alvin Y So, Editors. Asia's Environmental Movements: Comparative Perspectives. Armonk, NY: ME Sharp, 1999.

will allow for a freer exchange of information and a more comprehensive way of exploring solutions.<sup>131</sup>

### ***Final Remarks***

For real estate development in the Pearl River Delta to embrace a natural capitalism business model it must consider a broader set of issues and connections. Since the business of real estate will continue to be a dominant player in the economy of the delta region, many opportunities exist. With the advent of its entrance into the WTO, it is increasingly important for China to rapidly enhance its real estate services. The knowledge transfer of green development will allow it to be competitive in real estate and sustainable business. Aided by the push of the market, real estate developers along with the rest of the building industry *can* bring positive changes toward restorative efforts in the Pearl River Delta and in the long-run create sustainable development that values both natural and human capital.

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<sup>131</sup> Conversation with Professor Peter Hills, Hong Kong University, June 2001.



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- ❑ Liu Sing-Cheong, Managing Director, Hang Cheong Real Estate Consultants, Ltd., Hong Kong and Guangzhou. Hong Kong property veteran formerly associated with Swire Properties and Hsin Chong Construction. Recently formed a joint venture with Hang Lung Development Company, “Guangzhou Top Home Technology.”
- ❑ Stephen Chung, Director of Real Estate Analysis with Real Estate Tech, a service of Zeppelin Real Estate Analysis Limited, Hong Kong.
- ❑ Chau Kwong Wing, Phd. Department of Real Estate and Construction, Hong Kong.
- ❑ Sun Woo Thomas Nam, Rodamco Asia Management Limited, Hong Kong.
- ❑ Oliver John Treneman, Real estate developer for China’s first ‘campus style’ business park in Shanghai, “Arlington.”
- ❑ Professor Peter Hills, Director, Hong Kong University: Centre of Urban Planning and Environmental Management, Hong Kong.
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- ❑ Ray Cheung, University of Hong Kong, Environmental Program Coordinator Journalism and Media Studies Center, Hong Kong.
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- ❑ Professor Jia Beisi, Hong Kong University, Department of Architecture, Hong Kong
- ❑ Tan Jianjun, Director, Guangzhou Branch, Centre For GIS Industry, Development, Guangzhou, Chinese Academy of Sciences, Guangzhou.
- ❑ Yumin Xia, Principal Staff Member Guangzhou Environmental Policy Bureau.

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- GIS maps of the Pearl River Delta: Australian Centre of the Asian Spatial Information and Analysis Network (ACASIAN) A/Professor Lawrence Crissman, Director School of Asian and International Studies Griffith University Nathan, Brisbane, Australia. <http://www.asian.gu.edu.au/tsunami/index.html>
- China Information Network for Sustainable Development: Environmentally Sound Technology Related Information Sharing <http://www.estinfo.net.cn/english/eindex.htm>
- Centre for Environmentally Sound Technology Transfer <http://www.cestt.org.cn/acca21/>
- The APEC Virtual Center for Environmentally Sound Technology Exchange in the People's Republic of China <http://www.apec-vc.org.cn/>
- China Agenda 21 Site: <http://www.acca21.edu.cn/>
- China Environmental Protection: <http://www.zhb.gov.cn/english/>
- ISO 14000 China <http://www.zhb.gov.cn/english/>
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- World Bank <http://www.worldbank.org/> See: Working With China (New Ideas in Pollution Regulation at the World Bank)
- Sino-US Energy Efficiency Cooperation. [www.oit.doe.gov/international/china.shtml](http://www.oit.doe.gov/international/china.shtml)
- Pacific Northwest Laboratory newsletter on energy efficiency in China [www.pnl.gov/china](http://www.pnl.gov/china)
- Tufts University Energy Policy in China [www.tufts.edu](http://www.tufts.edu)
- Massachusetts Institute of Technology has several projects on China with regard to sustainable development [web.mit.edu](http://web.mit.edu) and specifically for the PRD [www.hkprd2022.org](http://www.hkprd2022.org)

### **Hong Kong Based Groups:**

- Sustainable Development for the 21<sup>st</sup> Century Report, Hong Kong Planning Department: [http://www.info.gov.hk/planning/index\\_e.htm](http://www.info.gov.hk/planning/index_e.htm)
- Hong Kong Sustainable Business Forum [www.hksdf.org.hk](http://www.hksdf.org.hk)
- Conservancy Association <http://home.netvigator.com/~cahk/> (Chinese only)

- ❑ Friends of the Earth <http://www.foe.org.hk/>
- ❑ Worldwide Fund for Nature (Hong Kong) <http://www.wwf.org.hk/eng/index.html>
- ❑ Civic Exchange <http://www.civic-exchange.org/>
- ❑ Hong Kong Institute of Education <http://ied.edu.hk/esdweb/>
- ❑ Hong Kong Business Environment Council <http://www.bec.org.hk/>
- ❑ Hong Kong Productivity Council <http://www.hkpc.org/hkpc/html/>
- ❑ Hong Kong General Chamber of Commerce <http://www.hkgcc.org.hk/>
- ❑ Hong Kong Government Bureaus and Departments: Planning and Lands Bureau <http://www.plb.gov.hk/>
- ❑ Environment and Food Bureau <http://www.info.gov.hk/efb/front.html>
- ❑ Hong Kong Environmental Protection Department <http://www.info.gov.hk/epd/index.htm>
- ❑ Hong Kong Planning Department <http://www.info.gov.hk/epd/index.htm> Vision 2030 – Planning Vision and Strategy [http://www.info.gov.hk/planning/index\\_e.htm](http://www.info.gov.hk/planning/index_e.htm)
- ❑ Netvigator environment and conservation site (English) <http://www.netvigator.com/mega/eng/emega.html>
- ❑ ArchSD HK <http://www.archsd.gov.hk/.htm> Gives advice and comments on particular projects and town planning proposals, encouraging practice of environmental protection.

**International Environmental/Sustainable Development Links:**

- ❑ International Chamber of Commerce <http://www.iccwbo.org>
- ❑ Business for Social Responsibility, San Francisco, CA [www.bsr.org](http://www.bsr.org)
- ❑ Rocky Mountain Institute [www.rmi.org](http://www.rmi.org) and Natural Capitalism [www.naturalcapitalism.org](http://www.naturalcapitalism.org)
- ❑ Coalition for Environmentally Responsible Economies, Boston, MA [www.ceres.org](http://www.ceres.org)
- ❑ Global Reporting Initiative, Boston, MA [www.globalreporting.com](http://www.globalreporting.com)
- ❑ International Institute for Sustainable Development Winnipeg, Canada 204-958-7724
- ❑ The Natural Step, Stockholm Sweden, [www.naturalstep.org](http://www.naturalstep.org)
- ❑ World Resources Institute, Washington, DC [www.wri.org](http://www.wri.org)
- ❑ World Business Council for Sustainable Development, Geneva Switzerland, (China Branch. China Enterprise Confederation) [www.wbcscd.com](http://www.wbcscd.com)
- ❑ SustainableBusiness [www.sustainablebusiness.com/](http://www.sustainablebusiness.com/)
- ❑ United Nations Commission on Sustainable Development <http://www.un.org/esa/sustdev/>
- ❑ United Nations Environment Programme (Working Group on Sustainable Product Development) <http://unep.frw.uva.nl/>
- ❑ SD Gateway <http://sdgateway.net/>
- ❑ Environmental News Network <http://www.cnn.com/>
- ❑ International Institute for Sustainable Development <http://www.iisd.ca>
- ❑ World Watch Institute <http://www.worldwatch.org/>
- ❑ The International Corporate Reporting Site <http://www.oecd.org/>
- ❑ United Nations Framework Convention on Climate Change <http://www.unfccc.org/>
- ❑ Asian Development Bank <http://www.adb.org>

- ❑ National Renewable Energy Lab's U.S. China Renewable Energy Workshop, co-sponsored by the U.S. Department of Energy and China's 20th Solar Energy Conference [www.nrel.gov](http://www.nrel.gov)

**General China information:**

- ❑ Asian Week online magazine: <http://www.asiaweek.com/.html>
- ❑ China Window: <http://china-window.com/>
- ❑ China pages: <http://www.chinapages.com/>
- ❑ China Economic Information (10<sup>th</sup> Issue, 1999) [www.homeway.net.cn](http://www.homeway.net.cn)

**General Real Estate Development in China**

- ❑ Real estate related law, policy and regulations
- ❑ Chinese Ministry of Construction: <http://www.cin.gov.cn/>
- ❑ <http://www.realestate.gov.cn/web/default.asp>
- ❑ <http://www.realestate.cei.gov.cn>
- ❑ [http://www.sohu.com/business-economy/real\\_estate/index.html](http://www.sohu.com/business-economy/real_estate/index.html)

**The major real estate finance resources in China**

- ❑ Construction Bank of China <http://www.ccb.com.cn>
- ❑ Commercial and Industrial Bank of China. <http://www.icbc.com.cn>

**Real estate developers for mainland China developers:**

- ❑ <http://www1.vanke.com.cn>
- ❑ <http://www.hyp.com.cn>
- ❑ [http://www.sohu.com/business-economy/real\\_estate/index.html](http://www.sohu.com/business-economy/real_estate/index.html)
- ❑ <http://www.newhousing.com.cn>
- ❑ <http://www.cbud.com.cn>
- ❑ <http://www.newtown.com.cn>
- ❑ <http://www.t-h-h.com.cn>
- ❑ <http://www.cei.gov.cn>
- ❑ <http://www.soufun.com>

**Acronyms**

AGS	Alliance for Global Sustainability
AIA	American Institute of Architects
EnAC	Energy Advisory Committee
ESC	Energy Service Company
GIS	Geographical Information System
HK	Hong Kong
IAQ	Indoor Air Quality
IE	Industrial Ecology
LEED	Leadership in Energy and Environmental Design
MIT	Massachusetts Institute of Technology
NGO	Non Governmental Organization
NOI	Net Operating Income
NPV	Net Present Value
OTTV	Overall Thermal Transfer Value
PBF	Performance-Based Fee
PNNL	Pacific Northwest National Laboratory
PRC	People's Republic of China
PRD	Pearl River Delta
PRDEDZ	Pearl River Delta Economic Development Zone
RMI	Rocky Mountain Institute
SAR	Special Administrative Region
SEZ	Special Economic Zone
STC	Science and Technology Commission
SUSDEV21	Study on Sustainable Development for the 21st Century
UGB	Urban Growth Boundary
USGBC	US Green Building Council
WTO	World Trade Organization
ZERI	Zero Emissions Research Initiative



