



Green China Design 中国绿屋开发中心

Greening China one building at a time

**Business Plan Submission for
Global Social Entrepreneurship Competition 2005**

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Market Need

The problem

China's industrial growth has been extremely rapid during the period of economic reform. Unfortunately, serious environmental damage has accompanied this rapid growth. In many urban areas, atmospheric concentrations of pollutants such as total suspended particulates (TSP), nitrogen dioxide (NO₂) and sulfur dioxide (SO₂) routinely exceed World Health Organization safety standards by wide margins. Exposure to high concentrations of pollutants can affect breathing, and may aggravate existing respiratory and cardiovascular disease (see appendix 1b). As a result, hundreds of thousands of people are dying or becoming seriously ill from air pollution. According to a World Bank report¹, approximately 4,000 people suffer premature death from pollution-related respiratory illness in Beijing. If current trends persist, the World Bank predicts that nearly 80,000 Beijing residents will die from air pollution-related illness in less than 15 years (see appendix 1a). Other cities in China have similar or worse problems.

Beijing, the capital of China, is representative of China's economic boom and the associated environmental costs. The gross domestic product (GDP) of Beijing was US\$53 billion for 2004, up 13.2% over the previous year. However, at the same time, Beijing has been ranked among the most polluted cities in the world.

The consequences have been severe and noticeable. Beijing's first Olympic bid was rejected despite their attempt to minimize perceived pollution by temporarily shutting off much of the factories supplying power to the city. Pollution causes serious health damages to Beijing residents which could affect productivity, effective employment, and long term economic growth. Political stability is also an issue. Poor environmental management has already proven a cause of social instability elsewhere in China. For example, in late April 2005, residents of towns south of Shanghai rioted over poor environmental conditions, among other issues.² And the noise pollution produced by the constant construction and transportation routinely exceeds 70 decibels in residential neighborhoods, resulting in an immeasurable degradation of quality of life. This has become the subject of numerous lawsuits.³

¹ Susmita Dasgupta, Hua Wang, and David Wheeler. "Surviving Success: Policy Reform and the Future of Industrial Pollution in China" World Bank March 1997 <www.worldbank.org/nipr/work_paper/survive/>

² Tremblay, Jean-Francois. "Chinese Riot Over Pollution." Chemical and Engineering News. April 18, 2005 <<http://pubs.acs.org/cen/news/83/i16/8316notw6.html>>

³ Case: Wang v. Beijing Public Transportation Corp. (Beijing Chaoyang District Court, May 2004);

The solution

Green roofs and **green walls** are vegetated membranes mounted on roofs and walls that help reduce the human footprint on the natural environment. Despite their recent popularity, green roofing is old technology. Scandinavian and Kurdish houses have featured green roofs for centuries. Simply constructed using mud, bark, wood, and grasses, ancient green roofs both preserved the roof structure itself, provided additional insulation, and served as a rooftop grazing area for pigs and goats.

There are extensive environmental and economic benefits to green roofing when compared to traditional roofing structures:

- The vegetation of the green roofs **reduces air pollution** by absorbing carbon dioxide and capturing suspended particulates.
- Green roofs and walls absorb heat and mediate temperature fluctuations, which both provides **increased insulation** in both hot and cold weather and **decreases the urban "heat island"**⁴ effect caused by the reflection of ultraviolet rays from traditional roofs and pavement.
- By insulating roofs from temperature fluctuations and ultraviolet light, they can **extend the life of a roof**.
- The same root cause of urban heat islands also causes **water quality** problems. Since most construction materials lack porous surfaces that absorb storm water. Green roofs **mitigate storm water runoff** as well as reducing the amount of concentrated pollutants that enter the water system by **filtering heavy metals** and other pollutants found in rainwater through the soil and root systems.⁵ Beijing has a heavy rain season which rinses pollutants off of paved surfaces and ultimately into creeks and rivers that lack the filtering capacity to absorb surges of water (see appendix 4 for information on the Beijing climate).
- **"Land grab."** In cities where land is at a premium, roofs tend to be an under utilized asset. Roofs can also be integrated with the growing practice of urban agriculture;

⁴ Urban "heat islands" are responsible for numerous deaths during heat waves and also exacerbate air pollution. They are caused by the concentration of cement buildings and roads that absorb heat without reflecting it or moderating it, causing cities to become disproportionately hot relative to surrounding areas.

⁵ "Green Roofs", US Department of Energy, Energy Efficiency and Renewable Energy September 2004.

according to one study, urban agriculture now feeds about a third of China's population, and usage of urban space for pig farming and other forms of agriculture is increasingly common⁶. In an urban agriculture environment, green roofing can provide a usage for animal and human waste that might otherwise create **hygiene problems** or pollute the water supply. In this our business will follow a traditional model: "night-soil" carriers of early Qing China purchased human and animal waste for use in agriculture. For the same reason, green roofing can consume **composting**.

- Dirt and plants are very effective at absorbing noise.

The evidence supporting the benefits of green roofing is powerful. The Toronto City Authority, Environment Canada, Green Roofs for Healthy Cities, and the Canadian National Research Council Institute for Research in Construction conducted a study⁷ that estimated that covering 6% of Toronto's roof space with green roofing would provide the following conservatively estimated benefits:

- Direct and indirect job creation: 1350 people per year
- Reduction in urban heat island effect of 2-4 degrees Fahrenheit
- Annual greenhouse gas emission reductions of 1.56 megatonnes, plus another .62 megatonnes indirectly from reduction in heat island effect
- Reduction in serious smog incidents by 5-10%
- Amount of particulate matter captured by plants: 29.5 tons per year.
- Storm-water retention capability: over 3.6 million cubic meters (127 million cubic feet) per year- the cost of constructing a storm water retention system to provide a similar effect is \$60 million
- Urban food production (assuming 10% coverage of green roof total): 4.7 million kg (10.4 million pounds) of food per year
- Annual energy cost savings: more than \$1 million per year

⁶ Honghai, D. (1992) "Urban Agriculture as Urban Food Supply and Environmental Protection SubSystems in China." Paper presented to International Workshop "Planning for Sustainable Urban Development: Cities and Natural Resource Systems in Developing Countries" (University of Wales, University of Birmingham, University College London, International Institute for Environment and Development), Cardiff, 13-17 July 1992. (Mimeo.)

⁷ **Dunnett, Nigel and Noel Kingsbury. 2004. *Planting Green Roofs and Living Walls*.** Portland: Timber Press.

- Potential recreational space, public and private: 650,000 square meters (7 million square feet)

The opportunity

Fortunately the Chinese government has at last recognized the severity of the problem and is taking active steps. Both the central government and the Beijing municipality have passed a significant battery of environmental regulations mandating green policies on pollution, energy consumption, and noise. While implementation is still spotty, momentum has clearly been established. As part of its preparations for the 2008 Summer Olympics, and as part of wider environmental initiatives, Beijing has undertaken noticeable environmental cleanup activities. From 2004 through 2008, Beijing will invest US\$2.75 billion in environmental protection and environment-related services. In 2005, the Beijing government began promoting the "green roof" concept and has committed US\$25/m² for building green roof in new constructions. Currently Beijing has 69,000,000m² bare roof area that could be used for green roofing, and there will be 150,000,000m² new constructions through 2008. Due to municipal restrictions, most new residential and business buildings in urban area cannot exceed 25 meters in height, which is ideal for the physical requirements of green roofs. Beijing's positive government support and the huge market potential (including the national market) have created great opportunities for green roof business.

Additionally, many urban centers in the rest of the country have similar pollution challenges combined with increased economic growth. Today, nearly a dozen Chinese cities such as Harbin, Nanjing, and Shanghai are developing new city centers, creating large new amounts of roof acreage and simultaneously spewing dust into the air caused by construction⁸. We believe our business plan is regionally scaleable.

Therefore there are multiple opportunities, to "green" new construction and "green" existing buildings; to address the Beijing urban area and to expand into the wider Chinese market. Thus we must target landlords, real estate managers of existing units, construction and property developers, business and NGO tenants, and local governmental entities.

Therefore, Green China Design (GCD) will headquarter in Beijing, China, where it will design, assemble, market, and maintain "extensive [i.e. low maintenance] green roof" and "green wall [i.e. focused on vertical solutions employing climbing species]" modules in Beijing. We will use post-consumer and

⁸ Barboza, David. "In China, Wholesale Urban Flight." New York Times. November 25, 2005
<<http://www.nytimes.com/2005/11/25/business/25cities.html>>

post-industrial materials created locally: broken concrete and brick, rubber tires, wood frameworks, and recycled soil to construct the modules.

Product Description

Green roof modules

Our primary product is a modular green roof “box” that can be mounted on a suspended deck or applied directly to a waterproof roof, depending on structural considerations. The product will be composed of five layers (appendix 2a). The layers are as follows:

1. **Waterproof/root-proof layer:** A thin layer of recycled rubber that prevents water and roots from penetrating and compromising the roof integrity.
2. **Drainage layer:** This layer serves to draw off water into recycling cisterns. It can be composed of porous aggregate, of formed plastic, or a combination of both.
3. **Filter mat:** A simple screen preventing soil and granules from clogging the action of the drainage layer.
4. **Growing medium.** 30-40% recycled granular materials, 60-70% porous space containing mostly air and some water. Can be composed of pumice, recycled crushed brick or tile, recycled crushed concrete and low-fertility subsoil.
5. **Vegetation mat:** a matrix of roots and plants containing native sedums and other local plant species.

These modular units can be grown in a greenhouse, raised on our office roof, and then ported to installation sites on demand. Depending on site-specific requirements, they can contain varying types of plants and layer components.⁹

Green wall modules

Our secondary product is the green wall module. This product will be primarily marketed as an insulator (to the private sector) and a pollutant reducer. The advantage to this product is that it places no significant load on the roof itself; it is lightweight and is supported entirely by load-bearing walls. It also allows us to “cube” the green surface area (and to expose our logo, website, and telephone number to passers-by). These modules will consist of trellises that form a matrix on which climbing plants can propagate upwards—a sort of vertical vegetation mat— that can be easily affixed to existing walls for the growth phase, then sold, removed, transported, and fixed to a client’s wall once the vegetation mat is mature. This product will rely on sturdy climbing species with shallow root structures.

⁹ **Dunnett, Nigel and Noel Kingsbury. 2004.** *Planting Green Roofs and Living Walls.* Portland: Timber Press.

Since climbing species by definition get the majority of their nutrients and water from the atmosphere, there are many species native to the area that qualify (see appendix 3 for specific species). The green wall module will consist of the following components:

1. **Soil box:** This component can either rest on the ground or be mounted directly to the side of the building similar to a window box used to grow herbs. It serves to hold the root structure of the climbing species.
2. **Trellis:** This component is a mesh of recycled materials, which can include re-used chain-link fencing, nylon netting, wood lattices, and so on. It’s height cannot exceed the length of the truck bed required to transport it horizontally
3. **Suspension rod:** This bar is mounted at the top of the building and supports the trellis weight.

Please see appendix 2b for a graphic design of the green wall module.

Facilities and Production

GCD proposes a low impact “footprint” which will conserve costs and concentrate research, development, and sales in a single facility. We will headquarter in a building typical of our target market: a “class B” office building around 6 stories high, with ample roof and wall space accessible for greening. While our internal office space needs are modest, we intend to use the roof and walls of our building for research, development, production . . . and advertising. The roof will hold a greenhouse for “starter” modules of green roof modules. As green roof modules are started, they will be removed from the greenhouse and placed on the roof as a showroom and as inventory. As operations expand we expect to require additional roof space on other buildings for inventory, at which time we will convert our office roof into a pure R&D area.

We will also use our greened office building for tracking metrics related to energy conservation (such as reductions in heat and air-conditioning bills), water re-use, and health studies (for example, incidence of respiratory illness among building tenants). Our landlord will be our first client and our first testimonial as to the benefits of the system.

Competitor Analysis & Intellectual Property

The green business sector in Beijing, and in China as a whole, is in its infancy. However, there are signs that businesses are recognizing the opportunities in the sector, and in green roofing in particular. Thanks to the

mandate in Beijing to prepare for the Olympics by deploying green roofing, and their subsidization of green roofs, one American firm, Green Roof Blocks, has announced plans to enter the market. Additionally, a Beijing landscaping company called Lanyuan Green Engineering Company Ltd. has begun reselling green roofs imported from Zimco, a German green roofing company.

The strengths of these competitors consist of their established status and their human capital of experienced employees. They also have access to sophisticated lightweight materials, including patented products that they use in their constructions. Green Roof Blocks also has a wealthy client base in the United States. However, given the specificity of climate, municipal and business regulation, and customer base, it is unclear whether the green roofing sector can or should support a transnational business model, particularly in regards to businesses that are accustomed to working in developed economies. Certainly a large portion of Green Roof Block's intellectual capital is not useful in China.

Additionally, given the fact that one can create a green roof without using any patented material, we believe that the usage of patented and trademarked materials is largely a product-differentiating branding strategy designed for the US and European markets. We believe the usage of these materials restricts both companies to targeting primarily wealthy corporate consumers in China. Furthermore, the importation of patented modules from abroad exposes our competitors to fluctuations in the currency market and requires them to speculate on the public commitment of the Chinese government to gradually ease its currency controls against European and American currencies.

Also, there are less obvious benefits to using lower-technology green roofing. For example, in many cases thicker, heavier, low-tech green roofing is actually **better at insulating, moderating heat island effects, and at absorbing and filtering water!** So using lightweight high-tech materials is not an unqualified benefit. As a matter of policy, GCD will use the thickest green roof layers that can be supported by the roof.

According to Linda Velasquez, Publisher & Design Consultant for www.greenroofs.com, American and European companies rely largely on consulting fees for their profits and thus the deployment of trademarked and patented materials serves to differentiate them from their competitors. Therefore it is not in our competitor's interest to encourage the rapid dissemination of non-proprietary green roof technology. We believe that the health and environmental issues caused by atmospheric pollution in China require us to abstain from attempting to establish a monopoly based on intellectual property protection. We also believe that the general construction of green roof components is so flexible in terms of specific materials that there would be little to no positive return on intellectual property investment in the Chinese markets. We do not propose to compete with landlords, owners, tenants, and

developers who want to install their own green roofs, but rather support them with our expertise and maintenance services. Since we propose to address the midrange market of existing housing, we do not believe that investing in the development and defense of intellectual property in China serves our business interests, given the ease with which competitors can develop or purchase alternative materials. Nor do we intend to become a manufacturer. GCD will concentrate on consuming post-industrial products.

The high material and labor costs of our competitors force them to target the upper end of the market, primarily developing intensive green roofs for new buildings that will rent to companies with deep wallets. While this is a worthwhile market, and one we intend to attack, the majority of Beijing (and Chinese) buildings do not fall into this category. Most Chinese landlords of existing properties cannot justify the high expense of employing horticulturalists earning American salaries or purchasing sophisticated materials. For example, Lanyuan's estimated installed price is \$62.50 per square meter¹⁰. Even with government subsidization of green roofs (at \$25 per square meter), this is too expensive a solution for the average Chinese landlord or property manager.

Indeed, the intellectual property involved is a disadvantage for these companies. Green Roof Blocks, for example, proposes to create a new manufacturing facility in Beijing, which drives up costs and risks, adds negative environmental impacts related to new construction and production, and forces them towards inflexible strategies regarding pricing and the usage of local recycled products.

Our strategy is to invest in "trade secrets" such as processes, human capital, knowledge related to local plants and resources, and connections to municipal authorities and real estate developers. We will employ a strong local sales force specializing in the Beijing market (and Beijing connections) and a flexible approach towards our usage of products using project-specific analysis. This will allow us the greatest flexibility in customizing solutions. For example, there are many patented (and unpatented) materials available on the open market. When customer requirements and budget allow for them, and when there is no local alternative, we will feel free to import the best material for the job at hand.

For example, our approach towards recycled rubber will focus on the processes used to recycle it. Since so much rubber is not recycled, but rather shipped to dumping grounds in the developing world, we may initially consume foreign recycled rubber mats if they are produced in a more sustainable manner than local products (for example, quick & dirty rubber recycling

¹⁰Mr. Liu, Executive Manager, Lanyuan Green Engineering Company. Telephone interview. November 21, 2005

can release heavy metals and other polluting products into the environment).

Conversely, in some cases the usage of post-industrial PVC may be justified for waterproofing in environments where the specific roof is difficult to access and maintain. Additionally, there is always a ratio between price and weight. A suspended green roof deck canted at 5°, using mostly broken cement and tile in the drainage layer, is the most affordable solution in the abstract. It obviates the need for sophisticated drainage, waterproofing, and root-proofing layers. However, it is also the heaviest possible solution and the acidity of cement requires continuous fertilization of the soil. In this case we believe that the difference in SROI is minimal, provided we continue to stimulate the recycling processes of local recycling industries.

Our competitive strategy will be two-pronged. We will begin by competing for the “low-hanging fruit” at the high end of the Beijing market and thus maximize revenues from available subsidization schemes. This will allow us to generate revenue quickly while conducting research and developing relationships with local manufacturers and construction companies.

We will also employ a distinct cost structure from our competitors. To be precise, we plan employ a mixture of extensive and intensive green roofing strategies. Thanks to the lower cost of manual labor in Beijing, we plan to leverage lower labor costs associated with basic maintenance of the structure and the plants and also develop deeper and more long lasting client relationships. This will generally include “leasing” options available to corporate clients for accounting and tax purposes. Currently most extensive green roofing companies market their products as high upfront costs, low/no maintenance. This is a wonderful strategy in Europe or the United States, where the cost of labor and maintenance is higher than the cost (albeit a cost that does not factor in SROI) of using sophisticated plastics. However, there are several problems with this approach in Beijing:

First, the Beijing summer rains place stress on green roofs designed for the 3 quarters of the year when the weather is dry. Drainage layers and plant mixtures designed for a relatively even level of precipitation, or gradual changes in precipitation, will have difficulty absorbing the massive change in precipitation in the Beijing summer; 14 of the average 23 inches of rain that fall in Beijing every year fall in the months of July and August alone. Roofing composed entirely of dormant, dry plants may not require maintenance to revive by the next season, but they will provide significantly reduced benefits in terms of storm flow mitigation, water filtering, noise pollution and so on. We, on the other hand, will promote the concept of low-cost, high maintenance roofing from the beginning that is also more affordable than our competition. Our modules will be swappable for the summer months so that we can apply more succulent, water-hungry plant mixtures that will continue to absorb carbon dioxide and

maximize storm flow mitigation. GCD will offer “rain” maintenance contracts that provide seasonal adjustments to mitigate the rainy season’s impact such as placement of water-retaining seasonal plants and installation of water routing and retention systems that can allow us to recycle “gray water” back into our green roof system during dry months. This will also extend our revenue cycle and our relationship with the customer.

Second, low-maintenance roofing minimizes the low-level job creation impact of the business and results in an economic transfer to high-tech manufacturers in the US and Europe.

Finally, many small landlords do not have the large amounts of upfront capital to invest in low-maintenance green roofing. Producing more affordable green roof solutions that require more manual labor to maintain will result in net savings for the consumer and allow our product to more easily migrate into the private sector.

It is important to note, however, that the net effect of competition in this sector will be to create a green technology “cluster” in the capital of China. The market is vast, the need is likewise vast, and the environmental benefits will be intensified by market entry. There is little risk of being put out of business by competition in and of itself. Therefore we view the presence of other green roofing companies in Beijing in a positive light.

Marketing and sales plan

Our business headquarters in Beijing will help the company establish its brand and gain popularity in provincial cities. Most industry cities in China face the similar problems of severe air pollution and energy shortage. Our recycled green roof and green wall products will ultimately alleviate environmental damage in less wealthy areas. In the next twenty years, China’s expanding economy will continue to stimulate sustainable green roof/wall technologies and expertise.

Beijing’s green building market is dynamic and diversified. Based on market need, we will target the following major client groups:

Real estate developers: Beijing will have 150,000,000m² new constructions through 2008. We will sell to this group through established real estate development networking events and researching new construction projects. This group is critical because they have the best access to government subsidization funds, which they can turn and re-spend on contractors.

Municipal government administrators: The existing 69,000,000m² roof area in Beijing contains a significant proportion of government buildings. The government sector offers several attractive aspects. First, ownership is clear. Second, the subsidization and funding schemes are easier for them to take advantage of. And finally, they provide an excellent showcase for our

business, a means to establish contacts, and an information pipeline through which we can anticipate and influence Chinese environmental policy. We intend to exploit this market in tandem with the real estate development market since the two are more intimately related in China.

Western corporations and NGOs: These clients will have both the funding and the interest in presenting an environmentally responsible image to Beijing and to China.

Small landlords and real estate managers: This is our ultimate market target, being vastly more numerous than the other client types in combination.

Implementation Timeline

Phase 1: Generate “Buzz” (April 2006 – Oct 2006)

- ❖ Attend networking events to generate sales leads and establish local contacts. This will include reaching out to Chinese Green NGOs like Global Village of Beijing who are in the position to lobby for the implementation and enforcement of green policies that will stimulate demand for products like ours.

- ❖ Create contests and marketing events to stimulate buzz. Invite government officials, real estate developers and media. This may include “donating” green walls to certain key developers and media offices. Ideally we would like to create a “green neighborhood” around our office. Since environmental benefits accrue more efficiently when green roofing is concentrated in a given area, this is both good business and good SROI.

- ❖ Design and build green roof/walls for our own office building – showcase.

Phase 2: Initial Sales (Oct 2006)

- ❖ Exploiting first wave of contacts through intensive individual contact.

Phase 3: Promote recycling green roof products (April 2007)

- ❖ Trial period between 1-3 months targeting “template” projects in buildings most similar to our target market opportunities. Generate word-of-mouth product recognition.

- ❖ Citywide promotion of recycling green roof products. In the process of gaining market access we will continually focus on driving our costs downward. Thus we will be poised to exploit a wider range of the market and maximize the speed at which this technology is diffused. We intend to make our profit by relatively low margins and high volumes. We intend to capture a large market share and then continue to earn revenues through maintenance contracts and providing additional add-on services such as water recycling, rainfall alleviation, green wall installation, and so on.

Company Message

Our beautiful green building products save clients money on energy costs, preserve existing roof structures,

and provide innumerable benefits in terms of health, productivity, and quality of life to those who live and work in the Beijing community. Our products also directly protect those whose agricultural livelihood is impacted by downstream effluent from Beijing water runoff. Our products are designed to create jobs in China, to stimulate local green industries, and to help real estate developers meet new environmental regulations.

Pricing Structure

GCD will offer flexible pricing schemes that will allow customers to maximize their return from municipal subsidization schemes. However, our primary pricing scheme will employ a 3:1 install to maintenance ratio. To install a standard green roof module, we will charge \$9 per square meter for installation (1st year’s maintenance/warranty included), plus require purchase of a bundled 5 year maintenance/technical support contract at \$3 per square meter per year. Thus in 5 years a green roof module will generate \$21 per square meter. This will be critical for retaining revenue streams from an established customer bases and in maintaining and developing existing customers. It will also provide us with a larger “lab” and inventory space. If the customer would prefer not to have a maintenance contract, we will charge an upfront cost of \$13.50 per square meter, including 1 year of maintenance. After that maintenance calls will be charged at a higher rate than the bundled cost.

The benefits to this cost structure are also social. A landlord may decide to invest in a green roof largely because of the \$25/m² incentive. Once this transaction is complete, the landlord may allow the green roof to wither and die. This is an environmental hazard. Conversely, the structure may decay and become dangerous. By pushing a long maintenance contract, GCD will provide not just sales but follow-through that ensures that the green roof and its supporting structures are stabilized and sustained for a long period of time.

Financial projections

Sources and uses of capital

Green China Design will be searching for a capital call of **\$250,000** dollars that will be structured as common stock for our future investment partners. These funds will be utilized to purchase equipment and inventory, research and development and cash reserves to cover 3 months worth of operating expenses. The initial investment period will be five years. After this period investors will have the option to sell their stock and capture retained earnings for the investment period.

Projected revenues and Expenses

We estimated our revenues and expenses based on our average target price of \$9.00 per square meter of roofing installed, plus bundled maintenance contract revenues. Our cost structure for our roofing installment is based upon a tiered approach that places the COGS at 50% during year one, 30% in year 2 and 20% for the rest of the life of the business. The rationale behind this is that we will begin sourcing our material from construction and demolition debris from new construction sites. As we create relationships with developers and we reach economies of scale our COGS will decrease over time.

In five years we plan to install 386,411 m² of roofing, creating a NPV for the project of \$597,345 assuming a 15% WACC. The average expected return on a social venture is 10% and the typical venture capitalist expects an approximately 25% return. Due to some of the risks involved with monsoon season in China we added a 5% risk adjusted premium for our WACC. This will lead to a five year annualized return of approximately 18% for Green China Design. Detailed information on our financial analysis model is available in appendix 5. We expect to reach our break-even point in the latter part of year 5.

Social Return on Investment

This figure is difficult to calculate empirically because many environmental costs and other economic figures are not available for China. However, we can derive figures based on estimates of benefits in other cities, adjusted for the Beijing economy. Given our requested investment of \$250,000, we estimate a 5 year annualized **SROI of approximately 55%**, producing a blended social NPV of \$2,044,790 by the end of the 5 year period.

The areas in which we were able to accurately calculate the SROI dealt with energy savings created from the green roofs, indirect job creation of blue collar workers, and agricultural products created on 10% of our green roofing projects. These estimations were based on the Toronto study referred to previously that measured the social benefits of green roofs in the urban environment, and a study that looked into the issues of green roof agriculture in Singapore¹¹. We adjusted these measures to reflect the benefits in Beijing. There are other benefits that could not be calculated monetarily due to restrictions on information. For example, the benefits from reducing storm water runoff and the associated benefits from reducing the toxic pollutants from entering the waste water management systems could not be accurately monetized.

Furthermore, the green roofing system will decrease greenhouse gases and particulate matter accumulation as

¹¹ "The next profit frontier for green roof companies is...FOOD FROM THE ROOF." Geoff Wilson, Nov. 2005
<http://www.greenroofs.com/guest_features.htm#Guest%20Feature>

well, but these statistics are heavily influenced by ecological synergies created by the net amount of greenery in Beijing as an ecological unit. Also, net productivity loss resulting from noise pollution and sickness is difficult to measure. Nevertheless these are positive externalities resulting from our green roofing operations. Therefore we believe that our SROI calculations are profoundly conservative.

Management Team

The proposed management team will consist of a Chief Executive/Financial Officer, sales and marketing engineers, a materials engineer, an architect, and a horticulturalist. Our structure will be flat and we will rely heavily on the use of contractors during the startup phase. All staff will be required to be bilingual in at least one Chinese dialect and English. Maintenance and installation functions will be outsourced to local simple landscaping companies as necessary. Once growth momentum is established and demand saturates our installation and maintenance schedule, we will acquire a full-time landscaping capability.

Key Roles

Chief Executive Officer

The CEO will lead the team, staying abreast of competitive, political, and technological developments in the green field. The ideal candidate is an experienced business executive with knowledge of the Beijing real estate market and regulatory environment. Extensive municipal and private sector contacts a must. The ideal candidate will have ten years experience managing business in China, with at least five years in the real estate development sector. Commitment to environmental sustainability and social welfare combined with a demonstrated history of successful entrepreneurship and profit-making results required. A knowledge of Chinese and Beijing property law is a plus. **Note:** The startup phase of the operation may require the team to nominate an acting CEO until we can clearly identify and evaluate viable candidates.

Chief Financial Officer

This role will serve to provide all accounting and finance services to the team. Candidate must be familiar with Chinese corporate and municipal tax law. CPAs or their equivalent are preferred. To save costs, we will likely consolidate this role in the person of the CEO, assisted by contractual accounting services when necessary.

Staff Horticulturalist

The horticulturalist is responsible for developing the "vegetation mat" layer of the product, both for green

roofs and green walls. The candidate will have an advanced degree in horticulture and specific knowledge of the plants native to the Beijing area. We intend to retain team member Lei Zhang as staff horticulturalist.

Sales and Marketing Engineers

The sales and marketing engineers must have both a demonstrated record of selling real estate development and management services and an intimate knowledge of the Beijing property market. They will be responsible for creating media materials for dissemination and cultivating and maintaining a customer base. We intend to retain the proposal development group for this role. Liyun Sang and Stephanie Renzi will target marketing to Beijing property developers and municipal authorities. Chris Devine and Pete Sweeney will concentrate on marketing to western clients renting or developing office space in Beijing.

Architect/Materials Engineer

This position will support the development and implementation of the rest of the green roof structure, including both layers and supporting framework, and ensuring that our green roofs meet Beijing regulations and are supportable by the customer's roof.

Consultants and Contractors

GCD will initially outsource many of its occasional functions, including the delivery and manual labor functions, legal counsel, and other services as needed. Construction companies will provide the physical features to support our green roof/ green wall products, and will generate construction waste to produce our recycled products.

Local recycling companies will help collecting construction waste from construction sites and supply our recycling green roof products.

Proposal Development Team

Lei Zhang

Proposal focus area: local horticultural practice and viable plant species

Lei Zhang is a current Beijing resident and Chinese citizen. She has the equivalent of a B.S. in Horticulture and is currently studying for her Master's degree in ornamental horticulture. She is fluent in Mandarin Chinese and has a CET-6 level English certificate.

Liyun "Jessica" Sang

Proposal focus area: Beijing property market, public health impacts

Liyun Sang is a former Beijing resident and Chinese citizen. She has a bachelor's degree in Life Sciences from Peking University. She is a current UW PhD candidate in molecular and cellular biology. Her current research project is conducted in the Fred Hutchinson Cancer Research Center where she studies cancer stem cell quiescence.

Chris Devine

Proposal focus area: Financial projections and SROI

Chris Devine is currently in his second year of the University of Washington's MBA program. The focus of his studies is corporate environmental management and social responsibility. Before returning for his MBA, Chris worked for several years in personal finance and institutional investment consulting. Chris is currently the President of Net Impact and recently worked as a consultant for a start up Construction & Demolition recovery facility.

Stephanie Renzi

Proposal focus area: Team assembly and coordination, problem identification and description

Stephanie Renzi has an undergraduate degree in China studies and is currently studying for her Masters Degree in the China Studies program at UW. She has lived in Beijing twice, in 2003 and 2004 and can read, speak, and write advanced Mandarin. She has also been employed at the New York City Botanical Gardens.

Pete Sweeney

Proposal focus area: Product development, intellectual property, proposal development and management.

Pete Sweeney is currently mastering in International Studies at UW. He is also applying for a dual master's in China studies and pursuing a certificate in Global Trade, Transportation, and Logistics. He also studied graduate level international macroeconomics at George Mason University's International Commerce and Policy program. He speaks Spanish and is currently in his first year of Chinese language study. He resided in Ecuador for a year, during which he started that country's first successful microbrew distributorship. He has studied US and international patent law and has conducted patent research at the US Patent Office in Alexandria, Virginia. He is also an experienced proposal writer with for-profit and non-profit project management experience.

Key Partners & Contacts

Prototype Board of Directors

The following persons have been invaluable supporters during the development of the problem statement and the solution. We consult with them regularly and plan to continue to leverage their experience and connections as we start the business.

Dr. Charles Zhang, CEO of Sohu.com: Dr. Zhang runs China's largest real estate portal and is a major Olympics sponsor.

Dr. Zhangliang Chen, President of China Agriculture University: In addition to his technical support of the green roof product and his feedback on product design, Dr. Chen also has strong relationships with the Beijing municipality and the central government.

Ms. Grace Ho-Ching is a powerful real estate developer with connections to CCTV.

The Beijing Botanical Garden of the Institute of Botany

The Beijing Botanical Garden of the Institute of Botany serves as a research institution engaged in plant-introduction, acclimatization, breeding, conservation and sustainable use. We will coordinate our research efforts with the researchers at the Institute of Botany and rely on their knowledge base of local plants. Since the majority of works discussing green roof species suitability restrict themselves to discussions of plants suitable for European or American climates, this resource will be a key partner in localizing our institutional knowledge.

Beijing Olympic Committee (BOC)

BOC monitors Beijing's green roof projects. A good relationship with BOC will facilitate our smooth business development in Beijing.

www.greenroofs.com

[greenroofs.com](http://www.greenroofs.com) is a non-profit website that serves as a clearinghouse for ideas, promotion of products, publication or press releases, and discussion of green roof technologies. Our project is currently supported by Christine Turing, the student editor at [greenroofs.com](http://www.greenroofs.com).

Sustainable Marketing

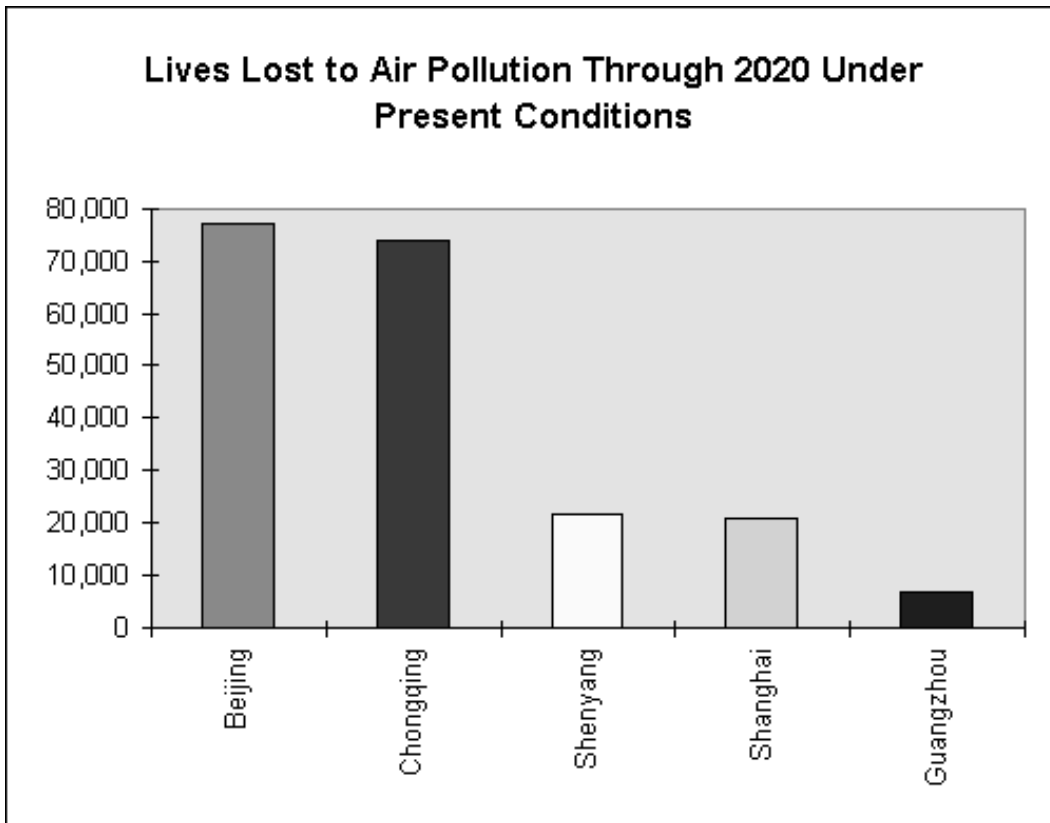
Ivan Storck, president of Sustainable Marketing (www.sustainablemarketing.com), is serving as an advisor on marketing methodologies to promote green technologies. Sustainable Marketing gives traditional marketing methods and discipline to entrepreneurs in the

green marketing sector, and teaches corporate social responsibility and green marketing to existing well-established companies and individuals. Sustainable Marketing currently markets wind power using a combination of direct sales and network marketing schemes.

House.sohu.com

House.sohu.com is one of China's biggest online housing forum with millions of visitors each day, including real estate developers, landscape designers, as well as consumers. House.sohu.com will be an excellent base for our online advertising.

Appendix 1a: Air Pollution Mortality in Modern China



Source: Susmita Dasgupta, Hua Wang, and David Wheeler. "Surviving Success: Policy Reform and the Future of Industrial Pollution in China" World Bank March 1997 <www.worldbank.org/nipr/work_paper/survive/>

Appendix 1b: Correlation between Air Pollution and Disease

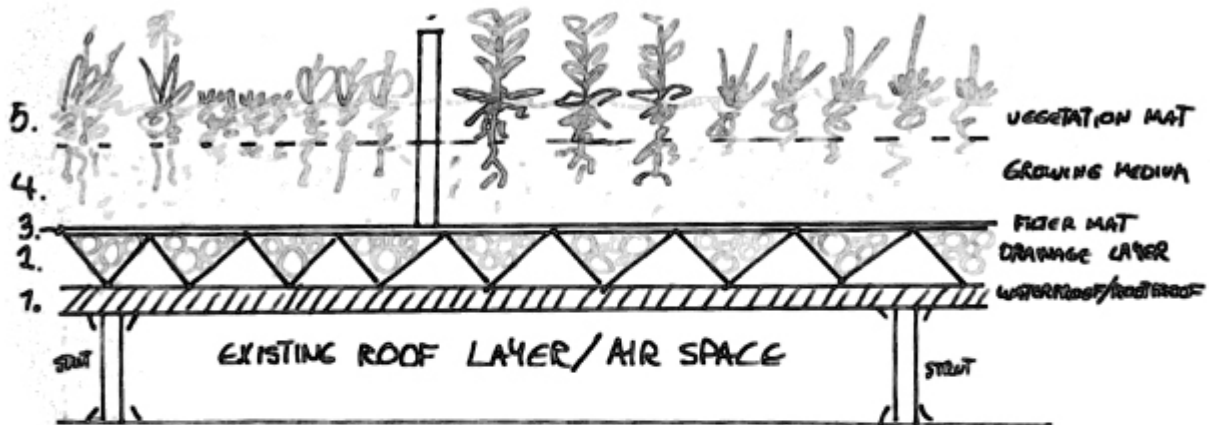
Table: Increase in mortality (%) with each 100ug/m increase in air pollutants

Pollutant	Respiratory Disease	Cardiovascular Disease	Coronary Disease	Chronic Obstructive Pulmonary Disease	Digestive System Tumor
NO _x	4.27 %	2.56 %	8.95 %	45.25 %	–
SO ₂	3.56 %	1.74 %	6.77 %	30.98 %	–
CO	0.20 %	0.11 %	0.43 %	1.84 %	–
TSP	2.74 %	0.73 %	–	11.39 %	1.55 %
PM ₁₀	4.08 %	4.98 %	3.77%	4.95 %	–

Source: Chang G., Pan X., Xie X., and Gao Y. (2003), "Time-Series Analysis on the relationship between Air Pollution and Daily Mortality in Beijing". *Journal of Hygiene Research*, 32(6): 565-8. (Original in Chinese)

Appendix 2a: Green Roof Components

Green Roof Module Components



5. **Vegetation Mat:** a matrix of roots and plants containing native sedums and other local plant species.
4. **Growing medium.** 30-40% recycled granular materials, 60-70% porous space containing mostly air and some water. Can be composed of pumice, recycled crushed brick or tile, recycled crushed concrete and low-fertility subsoil.
3. **Filter mat:** A simple screen preventing soil and granules from clogging the action of the drainage layer.
2. **Drainage layer:** This layer serves to draw off water into recycling cisterns and to prevent saturation of the root system. It can be composed of porous aggregate, of formed plastic, or a combination of both.
1. **Waterproof/root-proof layer:** A thin layer of recycled rubber that prevents water and roots from penetrating and compromising the roof integrity.

Species Mixture for Green Roof vegetation mat

1, 乔木层: 选用油松 *Pinus tabulaeformis* (常绿)、银杏 *Ginkgo biloba* (观叶)、玉兰 *Magnolia denudata* (观花)

Tree Layer: *Pinus tabulaeformis* (evergreen), *Ginkgo biloba* (with nice leaves), *Magnolia denudata* (with flowers)

2, 灌木层: 选用珍珠梅 *Sorbaria sorbifolia* (夏末秋初观花), 迎春 *Jasminum nudiflorum* (春季观花), 金银木 *Lonicera maackii* (观花、观果), 红瑞木 (观干), 月季类 (生长季节, 月月开花)

Shrub layer: *Sorbaria sorbifolia* (bloom in late summer), *Jasminum nudiflorum* (bloom in spring), *Lonicera maackii* (with flower and fruit), *Rosa chinensis* Jacq (with nice stem), *cornus alba* (bloom throughout the year)

3. 地被植物: 玉簪 *Hosta undulata*, 白三叶 *Trifolium repens*, 砂地柏 *Sabina vulgaris*, 小菊 *Chrysanthemum*, 石竹 *Dianthus chinensis*

Ground layer: *Hosta undulata*, *Trifolium repens*, *Sabina vulgaris*, *Chrysanthemum*, *Dianthus chinensis*

Appendix 2b: Green Wall Components

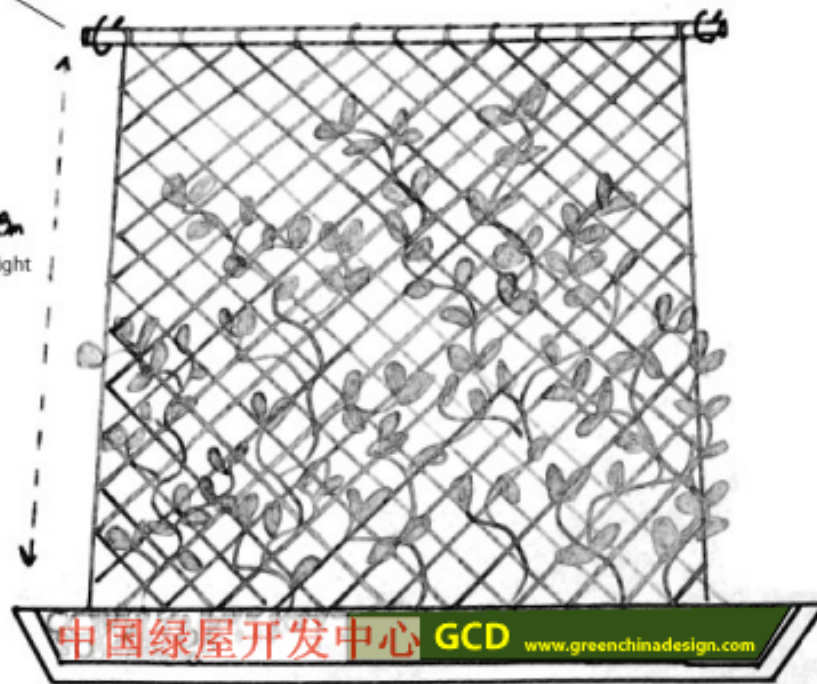
Green Wall Modular Components

suspension rod:

holds the weight of the trellis and the climbing plants on it.
mounted impermanently to a bearing wall

trellis:

provides a light-weight mesh for climbing plants no greater than 3 meters high



soil box:

holds the root system in a matrix of soil
impermanently mounted to a bearing wall

Appendix 3: 常见攀缘植物名录 native climbing plant species suitable for green walls in Beijing:

一、草质攀缘植物 herbaceous climbing plants

1、一、二年生草质性攀缘植物 annual and biennial

Chinese name, Latin name, Application, English name:

牵牛花, *Pomoea nil*, 篱笆、阳台绿化, morning glory

茑萝 *Quamoclit pennata* 庭院花架、窗、门、墙

月光花 *Calonyction aculeatum*, 住宅庭院、夜花园棚架

扁豆, *Dolichos lblab*, 房前宅旁、篱边、阳台, haricot bean

旱金莲, *Tropaeolum majus*, 园林墙垣、台阶、栅篱, *tropaeolum*

观赏南瓜 *Cucurbita pepo*, 棚架、花门, ornamental pumpkin

观赏葫芦 *Lagenaria siceraria*, 攀缘、阳台、棚架绿化, ornamental cucurbit

丝瓜, *Luffa cylindrica*, 住宅、庭院棚架绿化, towel gourd

二、木本攀缘植物 woody climbing plants

1、木本常绿攀缘植物 evergreen (will defoliate seasonally in Beijing, but remain evergreen in southern areas of China)

木香, *Rosa banksiae*, 棚架、墙篱、岩壁

胶东卫矛 *Euonymus kiautschovicus* 墙垣、老树、岩石

常春藤, *Hedera helix*, 壁面绿化、盆栽, ivy

金银花, *Lonicera japonica*, 篱墙栏杆、花廊, honeysuckle

2、木本落叶攀缘植物 **defoliated climbing plants**

铁线莲, *Clematis* spp. , 墙篱、花架、拱门, *clematis*
木防己, *Cocculus trilobus*, 攀缘绿化、廊柱等
五味子, *Schisandra chinensis* 攀缘绿化
藤月季, *Rosa cvs.* , 篱笆、拱门、墙垣, *liane rose*
刺梨, *Rosa roxburghii*, 刺篱、角隅
紫藤, *Wisteria sinensis*, 花架、枯树绿化, *wistaria*
葛藤, *Pueraria lobata*, 围墙、凉棚等
南蛇藤, *Celastrus orbiculatus* 棚架、墙垣、岩壁
葡萄, *Vitis vinifera* 棚架、门廊
地锦, *Parthenocissus* 垂直绿化 *tricuspidata*
美国地锦 *P. quinquefolia* 垂直绿化
杠柳, *Periploca sepium*, 篱栅、围墙、棚架
凌霄, *Campsis graniflora*, 棚架、花门、墙垣 *trumpet creeper*
连翘, *Forsythia suspense*, 墙篱、屏篱, *forsythia*
迎春, *Jasminum undiflorum*, 篱、斜坡悬崖绿化
枸杞, *Lycium chinensis*, 棚架、绿篱、壁面 , *medlar*
蛇葡萄, *Ampelopsis*, 棚架拱门攀缘绿化 *brevipedunculata*
乌头叶蛇葡萄, *Ampelopsis*, 棚架拱门攀缘绿化 *aconitifolia*

Appendix 4: Beijing Climate Averages

H	MONT	Average High	Average Low	Media n	Average Precipitation
	Jan	34°F	15°F	24°F	0.10 in
	Feb	39°F	19°F	29°F	0.20 in
	Mar	52°F	30°F	41°F	0.40 in
	Apr	67°F	45°F	57°F	1.00 in
	May	79°F	55°F	68°F	1.10 in
	Jun	86°F	64°F	76°F	2.80 in
	Jul	87°F	70°F	79°F	6.90 in
	Aug	85°F	68°F	76°F	7.20 in
	Sep	78°F	57°F	67°F	1.90 in
	Oct	66°F	45°F	55°F	0.70 in
	Nov	50°F	31°F	40°F	0.20 in
	Dec	37°F	19°F	28°F	0.10 in

Beijing's climate is defined as "continental monsoon." The four seasons are very clear in Beijing with a temperate spring, rainy summer, clear autumn, and a cold, snowy winter. The average temperature throughout the year is 53°F. The coldest month is January with an average temperature of 24°F and the hottest month is July at an average temperature of 79°F. Spring and autumn are shorter than summer and winter. The average precipitation in a year is 23 inch and the frost-free period is 180-days.

Toronto Derived Calculations

Jobs	1350
Reduction in Heat Island (degrees Fahrenheit)	3
Direct Reduction in Greenhouse gases	1560000
Indirect Reduction in Greenhouse gases (heat island effect)	620000
Reduction in Smog Incidents by Particulate Matter Captured by Plants	10%
Storm Water Retention	29.5
Annual Energy Cost Savings	3600000
Potential Rec. Space (sq Meters)	1000000
	0.21666667

Total Greening Space for Green China Design

		% of Toronto
Year 1	25,365	0.008455002
Year 2	59,539	0.019846199
Year 3	115,818	0.038605985
Year 4	195,054	0.065018157
Year 5	325,232	0.108410681

Note: Financials presentation available upon request and signature of Non-Disclosure Agreement.