

Sustainable Urbanization

Sustainable Eco-Edge District: Pinggu Recommendation Report April 2015



Authors:

Michael Bendewald, Rocky Mountain Institute
Cheng Maiyue, Rocky Mountain Institute
He Gang, Lawrence Berkeley National Laboratory
Hong Jianming, Capital Normal University
T. Destry Jarvis, Outdoor Recreation & Park Services, LLC
Clay Stranger, Rocky Mountain Institute
Leigh Wedell, The Paulson Institute
Yuan Yao, Lawrence Berkeley National Laboratory
Zhou Nan, Lawrence Berkeley National Laboratory

With Support from:

Moore Foundation

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INTRODUCTION

As one of Beijing's 14 districts, Pinggu is at the epicenter of a critical urbanization challenge: how to sustainably develop China's "edge districts" or suburbs. China's urbanization will be one of the defining issues of the 21st Century. To recharge its economy, the Chinese Government unveiled a New Style Urbanization Plan last March during the annual National People's Congress session. The plan hinges on moving more than 100 million people into cities over the next five years in an effort to spur the Chinese economy through domestic spending. Migration into the megacities will be restricted and tightly controlled; rather, rural residents will be incentivized to move into smaller cities—which in China can have populations in the millions—in an effort to develop suburbs and city clusters.

These expanding urban centers will impact all aspects of society in China – and beyond. Agricultural production, transportation systems and, most importantly, the residents' quality of life will be top priorities. Undertaking this historic initiative in a sustainable manner is among the highest priorities for the leadership. President Xi Jinping announced that China will no longer "drain the pond to catch a fish"; a call for quality growth over the growth than at any cost model that has dominated China's economic development over the past three decades.



Portland Urban Growth Boundary (UGB), Google Maps

China has the opportunity to turn this sustainable urbanization process into a competitive advantage and create a new model for addressing the challenges of urban encroachment. Many countries have gotten urbanization wrong. In the post WWII boom, there was a rush to develop US suburbs ushering in a new way of life that put people in

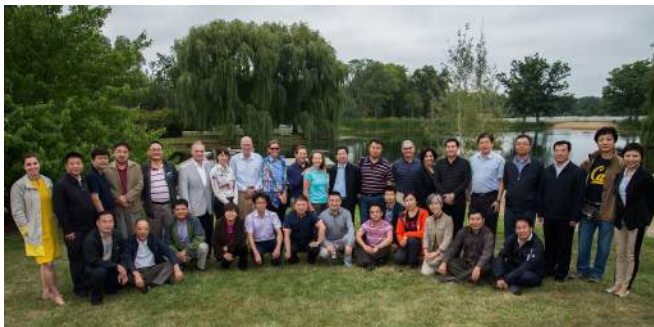
cars and abandoned the traditional mixed-use neighborhoods and walkable cities. Over the past few decades, US cities have had to find ways to deal with their existing urban plans in a more sustainable manner to reduce pollution and mitigate climate change. For example, Oregon State's Urban Growth Boundary plan created a comprehensive land-use planning system.

Passed in 2000, the plan, with its 19 citizen-created goals, features the key innovation of an urban growth boundary that separates urban areas from lands devoted to farming and forestry. Today, you know when you have reached the edges of a city in Oregon; residential neighborhoods quickly transition into vast vineyards, Douglas fir forests and wheat fields. And, the downtowns continue to thrive as areas where people live, work and play. Portland is a successful example of a city finding a balance between pursuing development and protecting all the environmental riches that we all share.

Finally, any new model of sustainable development for China's suburbs is incomplete without creating employment opportunities that complement the urban economy and encourage residents to remain in the edge districts. Most of the rural labor force in China see opportunities in the megacities, which has resulted in China's massive "floating population" estimated to be in the hundreds of millions unofficially (without a *hukou* or residency permit) living and working in the cities without access to services.

Why Pinggu?

China's mayors are on the frontlines of this shifting development model. Their task is to balance growth with sustainability while building cities for people. The Paulson Institute is committed to working with China's mayors and local officials to provide tools and expertise to support this historic urbanization drive. To that end, we have launched a sustainability training program in cooperation with the China Association of Mayors, the China Center for International Economic Exchanges and with support from the University of Chicago's Graham School and Tsinghua University. This program is how we came to work with Pinggu.



Pinggu Delegation at Pritzker Farm

Our first sustainability cohort was from Beijing. Led by Party Secretary Zhang Jifu of Pinggu District, the delegation of 15 vice and district level mayors spent a week in classroom study at Tsinghua University and then traveled to the US to see firsthand how US cities have integrated sustainability and urbanization. Their US program began at the University of Chicago where they spent a week meeting with sustainability experts, officials and the current and former Mayor of Chicago. The delegation then traveled to Philadelphia and New York for site visits and further meetings with sustainability experts and their fellow Mayors.

Secretary Zhang was inspired by the program to develop a new vision for Pinggu; one that features sustainable development as a means of distinguishing his rural but growing District from Beijing massive business districts. It is his vision to capitalize on his District's rich tourism, agricultural and cultural resources to develop and brand a new model known as the Sustainable Eco-Edge District (SEED). This model incorporates key learnings from the Paulson Institute's training program and expertise in four key sectors: agribusiness, eco-tourism, energy efficiency, and water conservation. The intention is to create a model that can be replicated throughout China.

The SEED Model

The Paulson Institute is supporting the development of the SEED model in three ways:



In January, The Paulson Institute sent five experts to Beijing to meet with the Pinggu leadership and more than a dozen government officials with responsibility for agriculture, tourism, energy, and water. Experts conducted site visits and interviews to gather data and learn firsthand about Pinggu’s goals. Pinggu also provided several background reports in advance of the trip. The team of experts has developed a series of recommendations in this report that are meant to provide “quick wins” for the Pinggu leadership in order to build momentum for the SEED model while simultaneously setting up longer term gains in their four key focus areas.

This report is divided into four main sections focusing on the key sustainability priorities for Pinggu District: energy and energy efficiency, agribusiness, eco-tourism, and water. Together, these four sectors form the core of the SEED development model. A list of recommendations can be found in Appendix I.

A Word of Thanks

We want to thank the Pinggu leadership for this opportunity and for the great vision they have demonstrated in conceiving of this project. In particular, we want to thank Party Secretary Zhang Jifu for his personal support for an involvement in the development of this project. We look forward to working with the Pinggu Government further on this important initiative.

We also wish to thank the Rocky Mountain Institute and Lawrence Berkeley National Labs for their support and expertise in the agribusiness and energy sections, particularly Michael Bendewald, Chen Maiyue, Zhou Nan, He Gang, and Yao Yuan. Thank you also to our eco-tourism and water experts, Destry Jarvis and Professor Hong Jianming. This team has developed compelling and actionable recommendations, which we hope will be useful to the Pinggu officials for the years to come.

ENERGY AND ENERGY EFFICIENCY

Pinggu is at a critical stage in its development. The District must bolster its economic development while meeting the main national and local carbon and environmental targets. In its 12th Five-Year Plan (2011-2015), Pinggu proposed the establishment of a Demonstration Zone for Low-carbon Economy with a focus on low-carbon industry, energy saving and emission reduction, as well as optimization of its energy structure, in order to fulfill its role as capital area ecological conservation area. To achieve these lofty goals, a well-defined policy roadmap that clearly links economic development and those environmental targets will be essential. The approach of the 13th Five-Year Plan period poses a unique opportunity for Pinggu to achieve its economic and environmental development goals by clearly outlining a low-carbon pathway.

To develop the energy and efficiency recommendations for Pinggu, we applied the ELITE Cities Tool, an eco and low-carbon indicator tool developed by Lawrence Berkeley National Laboratory (LBNL) in 2012. ELITE Cities helps to benchmark and evaluate performance in key environmental metrics, track progress and provide practical and scientific prescriptions for Pinggu's low-carbon development. This section will also shed light on where Pinggu falls on the path to sustainability and quantifies the city's sectoral energy and carbon-saving priorities. Further, we have prioritized the top 10 policies – from a 72 policy pool of recommendations – that can provide Pinggu the instruments to improve its performance based on the impact of carbon savings, the city's capacity to act, and the government's program costs.

Low-carbon eco-city development is one of the key approaches utilized by the Chinese government to achieve its international commitment of reducing carbon intensity by 40 percent to 45 percent by 2020, amongst other national targets. Districts like Pinggu have planned and implemented various measures to fulfill these goals; however, most of the plans we have reviewed lack explicit targets, metrics and implementation mechanisms. Strategies undertaken are often too vague and piecemeal, therefore hindering their effectiveness. In order to provide a model for achieving a more comprehensive and detailed plan – and accelerate the development of low-carbon cities throughout the country – LBNL has developed a series of tools for use by local government. The available data is collected and analyzed, but the tool itself is given to the governments as well so they can continue to employ and adapt the tool.

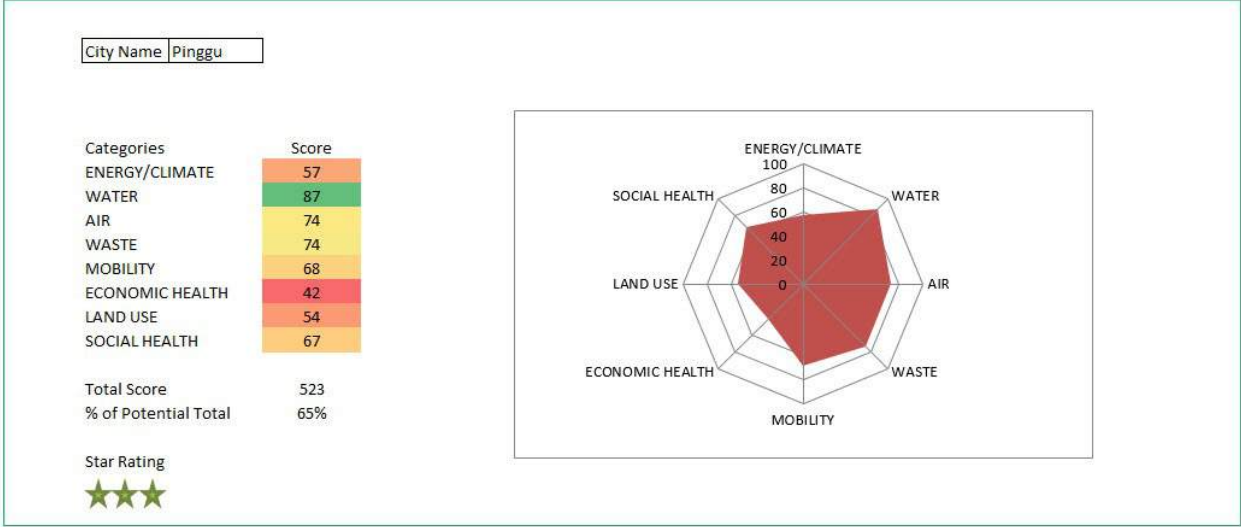
About the ELITE Cities Tool

The ELITE Cities tool was developed to evaluate a city's performance through benchmarking, by comparing it against performance goals and by ranking it against other Chinese cities. ELITE Cities measures progress on 33 key indicators selected to represent priority issues within eight primary categories. A Microsoft Excel-based tool was developed to package the key indicators, indicator benchmarks, explanation of indicators, point calculation functions, and transparency-oriented data recording instructions. ELITE Cities

can be a useful and effective tool for local city governments to support their efforts to define the broad outlines of a low-carbon eco-city and assess the progress of a city’s efforts towards this goal. The ELITE Cities tool uses a Star System (five stars being the best) to rate overall performance that enables policy makers to compare and rank participating cities on their performances. The star rating is determined by using the performance score calculated by the tool. It can be used to rate a city across different areas, with features to compare peer cities with similar economic structures, similar resource endowments, or within the same climate zone. Currently there are five cities participating in this tool. Lawrence Berkeley National Laboratory is working with Chinese partners to demonstrate these tools to more cities to expand the dataset of city performance.

Current Sustainability Performance in Pinggu: Preliminary Results

In Pinggu, we applied the ELITE Cities tool to energy and climate data as well as other indicators, such as water, to achieve a comprehensive assessment of Pinggu’s current performance. Figure 1 shows the results of Pinggu’s performance against the low-carbon eco-city indicators compared to best practices. In the eight major categories of the ELITE Cities tool, Pinggu demonstrates good performance in the water and waste categories. Pinggu’s scores in energy and climate, economic health and land use are currently low; each with a score below 60. The total score of 523 out of 800 gives Pinggu a three-star rating out of five stars. The tool also provides a detailed evaluation of each indicator compared to an embedded database of best practices for each indicator developed by LBNL’s research and expert input.



Results Summary for Pinggu from the ELITE Cities Tool

The results indicate that Pinggu is in the mid-range compared to its peers in China. The results also show that Pinggu has good potential to make significant progress in low-carbon eco-city development with some basic policy fixes. The unique feature of the Elite Cities tool is that it not only ranks cities, but also provides insights on areas for improvement, and the policy instruments and priorities for the city to achieve those

improvements. Therefore, the Pinggu case study not only provides Pinggu with an actionable plan, but also provides a plan that can be replicated throughout China so that other similar districts and cities can emulate Pinggu's work.

Recommendation 1: Set targets for efficiency and renewables in buildings

Pinggu is in the midst of rapid urbanization; in 2013 alone, 7.5 million square meters of new building construction took place. This rapid construction rate makes building energy efficiency and renewable energy use a top consideration in the development of a low-carbon plan. There are four main types of target-based policies to save energy and reduce emissions for the building sector:

- energy and/or carbon emission targets for new buildings;
- retrofit targets for existing buildings;
- broad voluntary and negotiated agreements; and,
- building technology dissemination goals.

For new buildings, all construction should meet energy-performance or energy-reduction targets by a certain year. These targets are being applied throughout the world. In the United Kingdom, the target for zero energy and zero carbon dioxide (CO₂) emission homes is 2016. California's target for zero net energy¹ in 100 percent of new residential construction is 2020 and by 2030 50 percent of existing commercial construction should be zero net energy. China has also set a target of 65 percent reduction in the energy intensity of new construction relative to inefficient 1980s buildings in the three climate zones: severe cold, cold, and hot summer cold winter (MOHURD, 2012).

Targets for retrofitting existing buildings may include overarching energy reduction targets for certain building types or total floor area targets for specific retrofit measures. California again is a good example of retrofit targets for existing buildings with their zero net energy target of 50 percent of existing commercial buildings by 2030, with the actual change in total energy use of commercial buildings to be used as a performance metric (California Public Utilities Commission, 2008). The city of Chicago has set a target of auditing and retrofitting 15 million square feet (1.39 million square meters) of public buildings with efficient heating, ventilation, and air conditioning (HVAC) equipment and lighting (ICLEI, 2009). China has also set targets for total retrofit areas of 400 million square meters in the "northern region" and 50 million square meters in the "hot summer zone," "cold winter and hot summer zones," and "warm winter climate zones" for envelope, heat metering, and heating network retrofit incentives. Co-benefits of setting retrofit targets include creation of employment and new business opportunities as demand for retrofitting grows. Improvements in thermal comfort and social welfare and a reduction in poverty with new

¹ A zero-net-energy building employs a combination of energy-efficient design features, efficient appliances, clean distributed generation and advanced energy management systems to result in no net purchases of energy from the utility grid (California Public Utilities Commission, 2008).

or expanded residential retrofit programs that specifically help low-income households reduce energy expenditures are also possible, such as in California's plan.

Broad voluntary and negotiated agreements on building targets are exemplified by the UK's Climate Change Agreement targets for the building sector. In the US, a Mayors' Climate Protection Agreement (MCPA) was set up in 2005, and today nearly 300 mayors representing more than 49 million Americans in 44 states and Washington, D.C. have signed the MCPA. The agreement urges the federal and state governments to meet or exceed the target of reducing greenhouse gas emissions to seven percent below 1990 levels by 2012. For the building sector, the MCPA encourages local governments to purchase only ENERGY STAR efficient equipment and appliances for city use, and promotes sustainable building practices incorporated in the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) program or a similar green building program (ICLEI 2009).

Efficient building technologies, particularly building-integrated renewable technologies, can also be promoted through technology dissemination targets or goals, as in the California Solar Initiative (CSI), which set a target of installing 3,000 MW of solar photovoltaic (PV) capacity by 2018 and includes \$2.9 billion in economic incentives for building owners and homeowners to install solar PV systems (Go Solar California 2010). CSI also promotes the use of solar thermal systems and advanced metering in solar applications. Technology dissemination goals are often used in conjunction with fiscal policies, incentives and state and citywide energy-efficiency and emissions-reduction targets.

Recommendation 2: Issue more stringent local building codes

Building energy codes are intended to reduce the energy load of buildings and, importantly, can help overcome substantial market barriers to energy efficiency in new buildings, such as objections to increased costs or technical know how. But codes are only effective when coupled with consistent code review, regular updates and effective enforcement to ensure full compliance. China has a strong set of codes, but a less effective enforcement process.

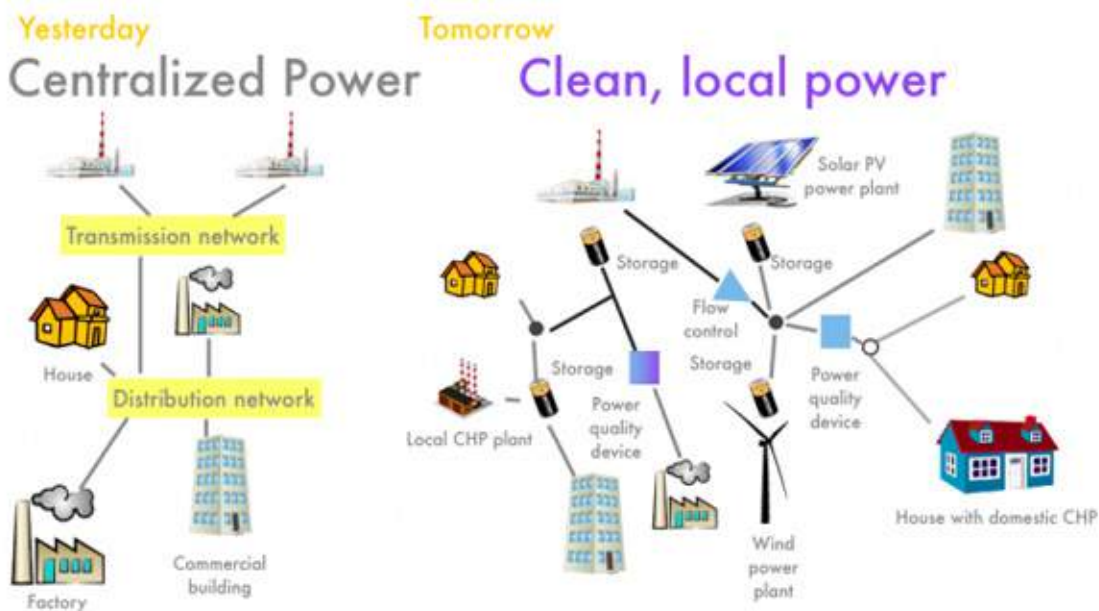
Energy codes are typically developed at the national level, adopted at the state level and implemented and enforced by local governments. However, stringent regional building energy codes have been developed and adopted, for example in the U.S. state of California and in major Chinese municipalities. We understand that Pinggu adopts Beijing building codes, which is a strong example and foundation. However, to really distinguish the District, the Pinggu government could consider a number of specific actions to improve upon that foundation:

- Enforce building energy standards before the nationwide standards effective date;
- Require additional energy conservation measures; and/or,

- Set building energy standards that are more stringent than national requirements, making local buildings more efficient than required by national building energy-efficiency standards.

Recommendation 3: Develop financial incentives for distributed generation in buildings

Distributed generation is a particularly viable option for adoption on a broad scale in Pinggu. Distributed generation, also known as on-site generation or decentralized generation, refers to the generation of electricity from sources near the point of consumption, in contrast to centralized generation sources such as large utility-owned power plants. Clean distributed generators installed by residential and commercial buildings can supply electricity alone (via renewable generation or electricity), or heat or steam (via small combined heat and power [CHP] arrangements).



fresh-energy.org

Distributed generation reduces the amount of energy lost when power is transmitted over large distances and reduces the size and number of power lines that must be constructed. In addition, combined heat and power is more energy efficient than generating electricity and thermal energy separately because in a CHP system, heat that would normally be wasted in conventional power generation is recovered to meet heating demand. With distributed generation systems, property owners generate their own power and are also connected into the national grid. Owners use their self-generated power, but if they generate more power than needed, the excess may be supplied to the grid through an import/export meter; a credit is given to the owners by the state for the power that is supplied.

The Pinggu government could consider promoting the installation of distributed generation in new or existing buildings by providing financial incentives such as preferential loans, rebates, subsidies, or grants to building developers or owners. These financial incentives, which have been used in several countries with great success, offset part of the higher up-front cost of installing distributed generation. Since 2007, 609 federal, state, and utility rebate programs and 53 grant programs were offered for distributed generation in buildings in the U.S. There are also U.S. federal tax credits for CHP investments. California's Self-Generation Incentive Program provides incentives to customers who produce electricity from a variety of sources, including CHP. Incentive payments range from US\$0.50/W (3.2 RMB/W) to US\$2.25/W (14.2 RMB/W), depending on the type of system. In addition to providing subsidies for households, Japan has increased national solar photovoltaic (PV) subsidies for schools, hospitals, and railways stations from 33 to 50 percent. Ireland, Germany, and Luxembourg provide subsidies or grants for installation of solar water heaters and solar space heaters in residential, public, and commercial buildings. Eskom, a South African utility company, recently started a solar hot water subsidy program that provides US\$200-350 (1262-2209 RMB) per household and indicated a payback period of five to eight years.

Recommendation 4: Conduct energy audits / assessments

Conducting citywide and sector wide energy audits or assessments would lay the foundation for energy saving and emission reduction. Energy audits of an industrial enterprise involve collecting data on the major energy-consuming processes and equipment in a plant as well as documenting specific technologies used in the production process, and identifying opportunities for energy efficiency improvement throughout the plant, typically presented in a written report. Standardized tools, informational materials and other energy-efficiency products are often provided during the audit. Some audit programs, like the U.S. Department of Energy's Energy Savings Assessments program, provide a directory or network of accredited auditors.

Energy audits or assessments are sometimes coupled with benchmarking, as a way to quickly identify the energy-savings potentials before conducting a full energy assessment. To incentivize use of energy audits or assessments as well as the adoption of recommended energy efficiency technologies and measures, fiscal incentives, such as fiscal rewards, energy efficiency loans and funds, or tax relief can be provided.

Other policies, such as a national/sub-national energy or CO₂ taxes or differential electricity pricing could also incentivize industrial plants to achieve higher savings through conducting energy audits and implementing the recommended energy-saving measures.

Recommendation 5: Set energy management standards

Energy management standards are used to institutionalize continuous improvement in energy efficiency within industrial facilities. These standards are typically based on the "plan-do-check-act" approach with the goal of providing guidance to industrial facility

managers on how to structure their operations in a manner that continually identifies, adopts and documents energy-efficiency opportunities.

Energy management standards have been adopted in China, Denmark, Ireland, Japan, South Korea, the Netherlands, Sweden, Thailand, and the United States. While most of these standards include key elements such as establishing a management-appointed energy coordinator and developing an energy management plan, they are not uniform in their adoption of elements, such as external validation or certification of claimed energy savings or the intervals for re-evaluating performance targets (Price and McKane, 2009). To provide standardized guidance for energy management systems, the International Standardization Organization (ISO) initiated the “ISO 50001: Energy management systems – Requirements with guidance for use” in 2008. This standard was published in 2011 (Piñero, 2009) and aims to:

- Assist organizations in making better use of their existing energy-consuming assets
- Offer guidance on benchmarking, measuring, documenting, and reporting energy intensity improvements and their projected impact on reductions in GHG emissions
- Create transparency and facilitate communication on the management of energy resources
- Promote energy management best practices and reinforce good energy management behaviors
- Assist facilities in evaluating and prioritizing the implementation of new energy-efficient technologies
- Provide a framework for promoting energy efficiency throughout the supply chain
- Facilitate energy management improvements in the context of GHG emission reduction projects
- Allow integration with other organization management systems (environment, health and safety)

Energy management standards are also coupled with energy manager training, as energy managers play a critical role in implementing energy management standards and integrating energy management practices into daily operations.

Recommendation 6: Introduce industrial energy efficiency loans and innovative funds

Energy efficiency loans are subsidized by public funding and are offered at interest rates lower than the market rate for investments in industrial energy efficient technologies and equipment. Like subsidies, the goal of subsidized loans is to promote energy efficiency measures until they achieve a certain market acceptance level and can be funded on their own.

Innovative funds that are aimed at increasing the involvement of banks and private capital in energy efficiency investments are also being used in some countries. Innovative funds include equity participation through:

- **ESCOs:** Private companies that provide project identification, engineering, design, installation, ongoing servicing and maintenance, monitoring and verification of savings, and financing of energy and energy efficiency projects. As a part of a private fund geared towards energy efficiency, the ESCO's role is to help acquire and manage projects within the fund.
- **Guarantee funds:** A guarantee is made to the banks granting loans in the medium and long term. Guarantee funds for energy efficiency can be offered in addition to national funds in order to cover credit risks associated with financing energy efficiency. France, Hungary and Brazil have all established guarantee funds for energy efficiency.
- **Revolving funds:** The repayment of the loan is recycled back into the fund to support new projects. These funds generally require public or national intervention to support them, either through subsidized interest rates (low or zero) or by subsidized principal investment. They can be implemented at the local or national level and can be applied to any sector (Price et al., 2008).
- **Industrial energy efficiency loans and innovative funds:** Provided to assist local governments to promote energy efficiency by conducting energy-efficiency activities and investing in energy-efficiency projects. To achieve higher energy savings, this policy can be used in combination with conducting energy audits, implementing industrial energy plans, meeting stretch targets, enforcing the minimum energy performance standards, and investing in low-carbon industrial parks as well as fuel-switching projects. For example, Pinggu could issue such support to lower level government, such as townships and villages.

Recommendation 7: Implement fuel-switching

Auto manufacturing, food manufacturing and food processing are the main industries in Pinggu. Many industrial applications or processes can use different fuels to produce steam or process heat. However, in reality the choice is often limited by the cost, availability and environmental regulations related to the various fuel options. According to the Intergovernmental Panel on Climate Change's *Third Assessment Report*, the potential to reduce carbon intensity in an industry through fuel switching is estimated in the range of 10 to 20 percent (IPCC, 2007).

One option for industries is to switch to lower carbon intensity fossil fuels, such as by replacing coal with natural gas. Industries are increasingly turning to the use of wastes or waste materials in fuel switching projects. For example, a variety of industries are using methane from landfills as a boiler fuel (US EPA, 2005). Waste materials, such as tires, plastics, used oils and solvents, and sewage sludge are being used in a growing number of industries. Rather than landfill or incinerating the wastes without heat recovery, the use of wastes or waste materials can provide energy and climate benefits from a life cycle

perspective. Plastics have been used in the steel industry as alternative fuel (Ziebek and Stanek, 2001), with net emissions reduction of 0.6 MtCO₂-eq/yr in Japan (Okazaki et al., 2004). Wastes have also been used as an alternative fuel in the cement industry. Heidelberg Cement (2006) reported using 78 percent waste materials (tires, animal meal and grease, and sewage sludge) as fuel for one of its cement kilns. Non-fossil fuels have also been used as alternative fuels in the cement industry. For example, Indian cement companies are using agricultural wastes and sewage (Jain, 2005). Studies estimated that fuel switching in the cement industry has a potential of reducing global CO₂ emissions by 12 percent by 2020 (Humphreys and Mahasenan, 2002).

However, limitations of fuel switching still exist, such as the availability of alternative fuels and the need for careful control of airborne toxic materials from certain wastes or waste materials (IEA, 2006). Yet, fuel-switching could play an important role in achieving the targets of low-carbon industrial parks. Fuel-switching projects will be more attractive financially to investors and industrial companies, if fiscal incentives are provided, such as, tax relief, or under an energy or CO₂ tax.

Recommendation 8: Integrate transportation planning

Saving energy and carbon in the transportation sector requires *integrated transportation planning*: coordinated land-use policies and prioritized funding for low-carbon transportation modes and infrastructure.²

Integrated transport planning for low-carbon development has the goal of enhancing a community's accessibility to resources and services with: (1) low-VMT transport: transport options that reduce the Vehicle Miles Traveled per person and in total; and, (2) low-carbon transport modes, from non-motorized transport to efficient, clean-powered vehicles.

Cities around the world, from Portland to New York to Buenos Aires and Guangzhou, have utilized a hierarchy of transportation modes to lower carbon in their transportation sectors (ITDP 2012). In order of importance, the low-carbon transportation modes are (Portland 2009):

1. Pedestrian Streets/Footpaths
2. Bicycles
3. Public Transit (Rail, Subway, And Buses)
4. Freight and Commercial Vehicles
5. High-Occupancy Passenger Vehicles
6. Single-Occupancy Vehicles.

² In general terms, integrated transportation planning provides an overall framework for a holistic planning approach to resolving emerging transport issues at regional, sub-regional and local levels (Western Australian Planning Commission, 2012).

Non-motorized transportation is a central component of low-carbon, integrated transport planning. Walking and cycling can be promoted as important elements of urban transport development through planning, target setting and infrastructure development. Policies that can help promote the shift towards non-motorized transport include improving access, convenience, and safety of cycling and pedestrian activity. At the same time, integrated transport planning also promotes utilization of existing infrastructure and services (i.e. coordination of infrastructure and development), while focusing on both access and mobility.

We understand that Pinggu is already undertaking initiatives to reduce vehicle use (vehicle mass traveled) through a plan for bike paths in the downtown area as well as new paths along the riverfront. Both plans are a very strong start and will clearly bring more livability to the District. These projects should be considered as part of the whole transportation design, however, and integrated into the entire transportation planning process as much as possible.

In addition to helping lower VMT and transport-related carbon emissions, integrated transport planning can also help establish an interconnected infrastructure for different transportation modes that improves the quality of community mobility. Other low-carbon transportation strategies—vehicle technology, fuel standards, and incentives to influence traveler behavior—follow from integrated transportation planning urban form and infrastructure choices.

Recommendation 9: Adopt a mixed-use urban form

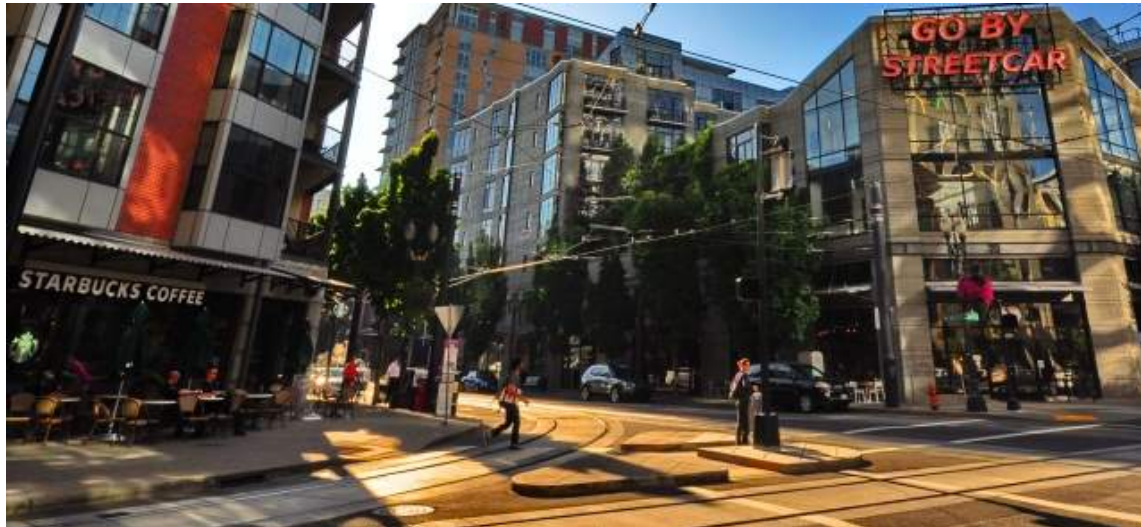


Source: http://www.boora.com/projects/mixed-use/north_pearl_district_master_plan/

An urban form that promotes mixed-use zoning in land-use planning can greatly reduce the need for motorized transport, thereby saving energy and carbon. Locating multiple urban facilities in close proximity, such as food markets, restaurants, shops, and service businesses, schools and parks, is referred to as a “20-minute neighborhood” (Portland 2009). In Portland, the creation of the Pearl

District, the premier example of the 20-minute neighborhood has been an economic and environmental success. Once a primarily industrial and warehousing district, the Pearl

District was transformed into a vibrant, mixed-use neighborhood that includes residential, commercial, and institutional uses. The addition of a street car, 11 bus lines, bicycle lanes, and pedestrian walkways has led to \$3.5 billion in private investment.



Portland's Pearl District, portlandoregon.gov

Another example of mixed-use urban form and land-use planning in practice is the UK's plan for urban development, which follows a "Proximity Principle" that advocates higher density, self-sustainability, and walkable communities (Buchan 2008). The ease of interaction with local businesses and residents can enhance the quality of life and economic viability of a city (CMAP 2012).

Land use patterns—urban form—greatly influence traffic patterns and volumes. When development is spread out (low density) and separated (isolated land uses), the number of trips made and the length of trips are higher than when development is more compact and different uses are intertwined. As a city grows, the physical scope of work, commercial, and residential spaces can increase the travel distance for urban residents. Spatial design in land-use planning can help reduce transport demand by emphasizing high density, mixed use communities to help foster shorter auto trips, greater biking and pedestrian activity and use of public transit. In addition, urban form and urban design can also help reduce vehicle traffic by enhancing the comfort, speed, cost, convenience, attractiveness, and safety of walking, biking and transit services.

Recommendation 10: Develop an integrated solid waste management plan

Integrated Solid Waste Management (ISWM) Plan is a comprehensive waste prevention, recycling, composting, and disposal plan. An effective waste management system considers how to prevent, recycle, and manage solid waste in ways that most effectively protect human health and the environment. ISWM involves evaluating local needs and conditions,

and then selecting and combining the most appropriate waste management activities for those conditions. The major ISWM activities are waste prevention, recycling and composting and combustion and disposal in properly designed, constructed, and managed landfills.

One area that we believe Pinggu could be a leader in is the launch of an initiative to promote building retrofitting and remodeling versus new construction. In the U.S., 40 percent of the landfills are comprised of building and construction materials. Reducing the waste from building construction by encouraging less demolition of existing buildings and more renovation of existing buildings can save 285m tonnes of coal equivalent annually by 2050. It is common practice in China to strip apartments and offices back to the studs when the previous tenant vacates. Encouraging residents and building owners to simply remodel or redecorate could translate into significant sustainability gains and measurable cost reductions. This is an issue that the Paulson Institute's CEO Council for Sustainable Urbanization will take up in 2015.

AGRIBUSINESS

Pinggu's impressive agricultural sector has been an important factor in recent economic growth and represents an area of emphasis moving forward. The District's more than 20 different agricultural products, and in particular the peaches, have put Pinggu on the map for local Beijing residents while increasing income for its rural farmers. Pinggu's priority for agribusiness is to create an "eco-friendly agricultural system" that has the ability to keep Pinggu growing and demonstrate to other edge districts a replicable sustainable growth model. Pinggu's agribusiness is based on the traditional model of "plant-harvest-ship" produce to Beijing, which should continue but with the addition of more modern value-added techniques like Consumer Supported Agriculture programs, farmer's markets, processed products (i.e. peach jam) and co-marketing with ecotourism destinations in the District, so visitors will stay longer and spend more.



Of the numerous agriculture-related projects identified in Pinggu's three-year action plan, the Xibaidian village pilot project took center stage during the course of our meetings with Pinggu leadership in January. This pilot project is meant to accelerate the use of "circular agriculture" as a development model. Our understanding is that the purpose of circular agriculture for Pinggu is to accomplish the two-fold

task of sustainable agricultural development and growing the incomes of farmers.

Pinggu leadership expressed great interest in scaling the Xibaidian village pilot project across the district and asked for our recommendations. This section responds to that request in three parts. The first part addresses the question of how to scale the pilot project. The second part addresses a key risk to the profitability of the Xibaidian village concept, which is the potential erosion of the price premium for its organic products due to counterfeit brands. The third part provides a set of recommendations on what Pinggu can do in general to promote the health and sustainability of its agriculture. There might be a case for retaining an advisor to help design an overall strategy to scaling the village, including financing and branding efforts.

Recommendation 11: Scale Xibaidian Village

Xibaidian village is Pinggu's pilot village for circular agriculture and can become the proof-of-concept required for modern agricultural development in Pinggu. Pinggu leadership has expressed a strong desire to scale this pilot village across the district, and has indicated that funding is the main barrier holding them back. In order to secure financing for scaling the Xibaidian villages concept, we recommend Pinggu take the following steps.

11.1 Prove the commercial viability of the pilot project

Based on the limited data we received, it is unclear whether the Xibaidian pilot project is commercially viable. We recommend Pinggu leadership make readily available the information that proves the economic viability of the project. For many private investors, this means the project costs and benefits should indicate a positive risk-adjusted return on investment. There are three basic categories of information that must be collected.

The first category is increased revenue. The Xibaidian village revenues appear to be larger than they were before the pilot project, however we were unable to quantify the increase. Our understanding is that the current income of the Xibaidian village is 50,000 RMB (about US\$8,000) per year per farmer-mu from product sales, which fall into three categories: livestock, produce and organic fertilizer. Surplus methane also may be a source of income and this should be confirmed. For each income source, the yield (amount sold) as well as the price sold per unit for Xibaidian village before and after the pilot project should be available.

The second category is operating costs. The total operating costs of Xibaidian village appear to have changed in the following ways as the result of the pilot project: increased maintenance costs (for the bio-digester and wastewater treatment) and decreased overall costs due to lower (or no) import of fertilizer and coal. We recommend Pinggu confirm whether this is true and quantifying these and potentially other changes.

The third category is the upfront capital cost to implement the pilot project. The initial cost for the pilot project was 15,000 RMB per farmer-mu, to a large extent covered by government funding. We are currently not clear if this upfront capital includes the greenhouse, as well as the bio-digester and a wastewater treatment system, and potentially other costs.

After this information has been collected, it will be possible to evaluate the profitability of the pilot project (i.e. the upfront capital cost divided by the improved net operating margin of the village), which will inform any proposal for private funding.

11.2 Estimate large scale commercial viability

An estimate is needed of the large-scale commercial viability of the Xibaidian Village. Pinggu needs to collect evidence in order to create this estimate. We recommend evaluating the demand for organic produce and potential supply from Pinggu, analyzing the potential to maximize profitability by pursuing economies of scale, and understanding the risks of scaling.

Demand and supply

In order for the Xibaidian Village to scale, the first step will be confirming that the demand for high quality / organic produce in Beijing, Pinggu's target market, is larger than the potential supply. The demand for high quality / organic foods in China appears to be growing rapidly. As of 2010 only 3 percent of the total Chinese population bought organic

(over 8 billion RMB – or about US\$1.2 million – in sales in 2007³), a recent projection indicated annual organic consumption to increase by 30–50 percent over the next decade. Organic foods also currently enjoy a healthy price premium: as of 2011 the domestic price for organic food was usually 3–5 times higher than conventional food.⁴ These national trends should be confirmed for Beijing. In addition, the potential yield for each of Pinggu’s organic products should be calculated and compared to the current and potential size of Beijing demand for organics.

Maximize profitability through economies of scale

Scaling up the Xibaidian village will allow Pinggu to take advantage of the microeconomic benefits related to economies of scale. This will enable Pinggu agribusiness to operate with lower operating costs, improve profit margins, and maintain competitive pricing. At scale, Pinggu agribusiness can pursue bulk buying and long-term contracts with grocery stores and transportation companies to keep operating costs low.

Manage and mitigate risk

Finally, the risks of scaling up a profitable pilot project should be well understood. We recommend Pinggu define and manage the following risks:

- *Execution Risk:* During the course of executing the scaling effort, Pinggu may experience higher capital costs than expected as well as a lack of stakeholder support. Higher capital costs may be attributed to variations in the villages that complicate the construction process, such as a remote or difficult-to-access location. It will be important to identify these “higher cost” villages up front. A lack of stakeholder support may also become an issue; for example, farmers may object to changes in their village. This can be managed by ensuring that farmers make an improved wage and through education on the positive environmental benefits for the village. Additionally, these execution risks can also be managed by implementing small-scale pilot programs in other villages. The “early-adopting” households or villages might be a practical approach to prove out the economics of scaling up circular agricultural practices.

³ Joshua E., Ryan R. Scott, Kristen Rasmussen, Wu Bugang, and Ursula Chen. *China - Organics Report*. Washington, D.C.: Office of Media Services, Bureau of Public Affairs, 1974. [Http://gain.fas.usda.gov/](http://gain.fas.usda.gov/). United States Department of Agriculture, 26 Oct. 2010. Web. 29 Jan. 2015. <[http://gain.fas.usda.gov/Recent percent20GAIN percent20Publications/Organics percent20Annual_Beijing_China percent20- percent20Peoples percent20Republic percent20of_10-14-2010.pdf](http://gain.fas.usda.gov/Recent%20GAIN%20Publications/Organics%20Annual_Beijing_China%20-%20Peoples%20Republic%20of_10-14-2010.pdf)>.

⁴ Pryor, Luke, Eric Reker, Hiromi Shimizu, and Cheryl Thayer. "Achieving Sustainable Growth in the Chinese Organic Industry." *Cornell International Institute for Food, Agriculture and Development* (n.d.): 3-4. [Http://ciifad.cornell.edu/](http://ciifad.cornell.edu/). Cornell University. Web. 29 Jan. 2015. <http://ciifad.cornell.edu/downloads/CS_China.pdf>.

- *Operation Risk:* After scaling up Xibaidian agricultural practices, Pinggu may experience lower than expected crop yields and higher than expected operational costs. Lower than expected crop yield may be caused by drought, flooding, disease, and other climate related events.⁵ It will be important that Pinggu identify potential causes of low crop yield and develop a contingency plan. For example, maintaining crop diversity can help stabilize income if one crop fails. Higher than expected maintenance costs of the bio-digester and wastewater treatment plant might also become an issue. This can be managed by ensuring that the bio-digesters and distributed wastewater treatment processes are designed and constructed to high standards by experienced teams.
- *Market Risk:* While establishing their organic business in Beijing, Pinggu may encounter organic price erosion as well as lower than expected income because of market competition. A large portion of the demand for organic produce in China is driven by the desire for safe food. Organic produce scandals where inorganic food was sold using organic labeling has decreased consumer confidence in organic produce.⁶ It is important that Pinggu maintain its brand reputation to avoid potential price erosion from decreased consumer confidence. Some actions that can be taken to maintain brand reputation are addressed in part three of this agribusiness section. Pinggu might also suffer lower than expected income because of market competition. We recommend undertaking a comprehensive study of market competitors so that they fully understand what opportunities exist in and beyond the Beijing organic market and what hurdles their competitors pose.

11.3 Identify and pursue financing solutions

A comprehensive financial strategy is needed to direct Pinggu's fundraising efforts. There are three possible sources of funding that we have identified that the Pinggu government can pursue.

Equity investment

Pinggu may be able to recruit external investors with existing businesses in or downstream from its circular agricultural system. These investors may be in the greenhouse construction business or organic agriculture. They may also be downstream, such as grocery stores. The investment could be foreign direct investment or originate from Chinese businesses. In each case, the investor would be able to contribute necessary expertise to the scaling plan in addition to the capital.

⁵ "Agriculture and Food Supply Impacts & Adaptation." EPA. Environmental Protection Agency, n.d. Web. 29 Jan. 2015. <<http://www.epa.gov/climatechange/impacts-adaptation/agriculture.html>>.

⁶ Inagaki, Kana. "McDonald's Japan Warns of Loss after Food Safety Scandal." *Financial Times*. N.p., 7 Oct. 2014. Web. 29 Jan. 2015. <<http://www.ft.com/intl/cms/s/0/57ba5308-4e04-11e4-bfda-00144feab7de.html#axzz3Q8hhLM3R>>.

Policy-directed funding

The second potential source of funding is policy-directed funding. There are several major banks in China that could potentially fund credit facility to Pinggu to support the scaling of its agribusiness. Pinggu should consider in what ways the scaling of the Xibaidian pilot project might align with Chinese governmental policies. For example, the QR labeling program may qualify for national government funding because it is addressing a national concern about food safety.

Government and mission-based lending

The third area where Pinggu can look for funding is from government loan programs that support rural development, as well as organizations with mission-based lending. Organizations exist that promote sustainable agricultural development. For example, the International Fund for Agricultural Development (IFAD) offers low interest rate or grants for projects that fit their organizational goals. In 2002, the IFAD supported a project that provided 23,000 bio-digester tanks for biogas production in the Guangxi province of China.⁷ We recommend that Pinggu conduct further research to determine if there are any organizations, similar to the IFAD that may help fund the scaling of the Xibaidian village.

Recommendation 12: Support brand health

In order to maximize the profitability of its organic agribusiness, Pinggu must ensure its brand is as strong as possible and delivers maximum value. If the brand erodes, price premiums and profitability erodes. During our visit to Xibaidian village we learned of an innovative approach to safeguarding the brand through QR code scanning. This approach that is currently being piloted may also be used to create additional value through establishing a closer connection with customers and supporting Pinggu eco-tourism. We recommend the following steps to support Pinggu brand health.

12.1 Safeguard the brand

Chronic fraudulent labeling coupled with well publicized food safety scandals in China have increased consumer concern about the quality and safety of the food they are purchasing. While this problem is a major hurdle for the advancement of the organic produce market in China, it has also created an opportunity for Pinggu to create a trusted brand that captures substantial market share.

Pinggu currently has a brand that it must safeguard, or it can create a new brand with safety measures introduced. For either option, there are two approaches to safeguarding that should be taken: internal and external.

⁷ "China Biogas Project Turns Waste into Energy." *Rural Poverty Portal*. International Fund for Agricultural Development, n.d. Web. 29 Jan. 2015.
<<http://www.ruralpovertyportal.org/country/voice/tags/china/biogas>>.

Internal protection

Pinggu needs to ensure that their products with the organic brand meet their organic standards. Supplying subpar produce will ruin public trust in Pinggu's brand. The examples of this are many, ranging from the powdered milk industry to the supply chain for McDonalds to the organic kale market.^{8 9 10}

Internal protection measures include the following:

- Limiting the brand to only Pinggu farmers, as it is more difficult to ensure quality from external parties;
- Voluntary third party oversight of Pinggu organic farming practices can be utilized to promote consumer confidence in their products;¹¹
- Training Pinggu farmers on organic farming best practices;
- Educating Pinggu farmers on the benefits of organic farming from sustainability, health, and financial perspectives; and,
- Promote transparency by publishing all quality assurance reports and providing tour opportunities of Pinggu farms, such as what is being done in Xibidaidian Village.

External protection

Because truly organic produce such as Pinggu's can sell at a much higher price, there is a strong incentive for counterfeit. If someone copies the Pinggu brand and starts selling unsafe products, the Pinggu brand reputation can be tarnished. To prevent this, Pinggu can scale up its QR labeling practices currently being tested in Xibaidian Village. QR labels make a brand much more difficult to copy.

⁸ Huang, Yanzhong. "The 2008 Milk Scandal Revisited." *Forbes*. Forbes Magazine, 16 July 2014. Web. 29 Jan. 2015. <<http://www.forbes.com/sites/yanzhonghuang/2014/07/16/the-2008-milk-scandal-revisited/>>.

⁹ Inagaki, Kana. "McDonald's Japan Warns of Loss after Food Safety Scandal." *Financial Times*. N.p., 7 Oct. 2014. Web. 29 Jan. 2015. <<http://www.ft.com/intl/cms/s/0/57ba5308-4e04-11e4-bfda-00144feab7de.html#axzz3Q8hhLM3R>>.

¹⁰ Wong, Stephanie. "Chinese Pay Double for Organic Kale After Food Scandals." *Bloomberg.com*. Bloomberg, 14 Mar. 2014. Web. 29 Jan. 2015. <<http://www.bloomberg.com/news/articles/2014-03-13/chinese-pay-double-for-organic-kale-after-food-scandals>>.

¹¹ Sharma, Lisa L., Stephen P. Teret, and Kelly D. Brownell. "The Food Industry and Self-Regulation: Standards to Promote Success and to Avoid Public Health Failures." *American Journal of Public Health*. American Public Health Association, Feb. 2010. Web. 29 Jan. 2015. <<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2804645/>>.

QR labeling trends

To date, successful QR labeling has been used for product authentication as well as marketing campaigns. Hewlett Packard pioneered the use of QR codes for product authentication.¹² To engage customers, Taco Bell provided access to exclusive sports videos when people scanned their QR codes. Turkish Airlines set up a scavenger hunt for QR codes during the London Olympics to promote brand awareness.

QR labeling programs have been hampered due to improper design, however. Poor designs include placing QR codes on billboards or television advertisements where it is difficult to scan, and in subways where there is no cellular service.¹³ There are many valuable lessons to learn, and it is worth the time to investigate elements of an effective QR code program.

New technology is being created that is less proven than QR codes but will be easier and more intuitive to use and should eventually make QR codes irrelevant. One example is Touchcode, a new technology that uses invisible electronic code printed on paper, cardboard, film or labels. Consumers can hold their phones over the product label to pull up videos, deals, articles or brand confirmation.¹⁴ Because the technology is invisible to the human eye it is extremely difficult to counterfeit, making this technology potentially useful for Pinggu's brand protection.¹⁵

Commercial viability

We would also recommend that Pinggu continue to explore and define the commercial viability of QR labeling. Brand safeguarding can avoid price premium erosion as well as reduced demand for Pinggu products due to counterfeit. In addition, as discussed in the following section, the benefits of QR labeling can extend beyond brand safeguarding when used to collect data that can optimize product delivery and marketing, and increase customer engagement.

¹² "Global Product Authentication Service." *Http://www8.hp.com/us*. Hewlett-Packard, n.d. Web. 29 Jan. 2015. <<http://www8.hp.com/us/en/software-solutions/product-authentication-anti-counterfeit-services/>>.

¹³ Schapsis, Claudio. "QR Codes Best Practices – Horror Stories from NY Subways." *Georillas*. Georillas Mobile Marketing, 30 July 2013. Web. 29 Jan. 2015. <<http://georillas.com/qr-codes-best-practices-horror-stories-from-ny-subways/>>.

¹⁴ Tofel, Kevin C. "Forget QR Codes: Your Touchscreen Can "read" This Ink." *Gigaom - Mobile*. Gigaom, 27 Mar. 2012. Web. 29 Jan. 2015. <<https://gigaom.com/2012/03/27/forget-qr-codes-your-touchscreen-can-read-this-ink/>>.

¹⁵ "Original Products, Which Can Identify Themselves?t+." *Touchcode: Brand Protection*. T+ink Touchcode, n.d. Web. 29 Jan. 2015. <<http://www.touchcode.de/case-studies/brand-protection.html>>.

The biggest expense of a QR labeling system is the QR scanners, which Pinggu does not need to buy: the customers' smart phones serve as the scanners. Other expenses include the technology for creating and affixing the labels to products and the consulting and planning required to link the QR code to the appropriate website or other digital information for the customer to receive.

There are a number of risks that Pinggu can manage and mitigate when designing a QR labeling program, including:

- While it takes more work than copying a brand label, QR codes can also be faked; Pinggu's labeling program should have the flexibility to adapt to new labeling technology, such as Touchcode, that make it even more difficult to fake
- Initial cost of developing a QR labeling program could vary depending on the sophistication of data transmission to and from the customer; Pinggu should carefully weigh the costs and benefits of this capability
- Customers may not be properly incentivized or even know how to scan the QR codes; marketing campaigns (such as those used by Taco Bell and Turkish Airlines noted above) may be required at least initially to promote the program
- A failed QR labeling program may tarnish brand reputation; the program should be tested in multiple stages before full roll-out

12.2 Further establish the brand via customer connection

In addition to ensuring brand security Pinggu can further develop brand loyalty by connecting consumers with farmers. We recommend pursuing an integrative approach to developing consumer connections pursuing both established methods of connecting with consumers such as consumer supported agriculture (CSAs) and also capitalizing on emerging trends in local food markets, such as QR labeling, farm to school programs, food hubs, and food e-Commerce.

QR code labeling

The QR labeling program provides Pinggu with an opportunity to engage with customers in a grocery store, as they have never done before. A member can scan a box of peaches and automatically receive information and photos of the exact Pinggu farm that produced it. This approach was recently taken by a McDonalds in Australia, which enabled customers to scan a QR code to track the origin of the lettuce and other ingredients in sandwiches.¹⁶ For Pinggu, the system would be much simpler but still very effective at building consumer trust.

¹⁶ O'Meara, Andree G. "How McDonald's Increased Brand Trust with Transparency, Authenticity." *Sustainability Matters*. The International News Media Association, 28 Oct. 2013. Web. 29 Jan. 2015. <<http://www.inma.org/blogs/sustainability-matters/post.cfm/how-mcdonald-s-increased-brand-trust-with-transparency-authenticity>>.

After customers scan the QR label, they can also be given the opportunity to sign up as a “Pinggu Member.” This membership community can receive discounts, offers, and other communications via email directly from Pinggu to help bolster the health of Pinggu’s brand. These offered discounts are effective in encouraging costumers to purchase specific brand products only if the discounts are customized for the consumer.¹⁷ By using the data collected on customers, Pinggu can offer consumers periodic discounts for their favorite products, which incentivizes the costumers to continue purchasing Pinggu products and further establishes brand loyalty.

Consumer Supported Agriculture

Pinggu farmers can also offer consumers the opportunity to engage in Community Supported Agriculture (CSA). CSA is a farming practice where shares of a crop are sold to subscribers in a community prior to the season’s beginning. During the season these subscribers then receive weekly deliveries of fresh produce and are offered opportunities to visit the farm to meet and even help the farmers harvest their crops. An estimated 6,000 CSAs are currently operating in the United States.¹⁸ In China, we understand that community supported agriculture is relatively new phenomenon. One of the first Chinese CSAs was started in 2008 just outside of Beijing and since then an estimated three-dozen more CSAs have begun operating in China.¹⁹ CSAs can be an excellent way to connect consumers with farmers, develop brand loyalty and provide farmers with an upfront source of income. However, CSAs are only effective if there is consumer interest in participating, and if the subscriber fee is low enough to encourage participation but still high enough to be worth while for the farmer.²⁰ Given Pinggu’s proximity to Beijing and other urban centers CSAs would likely be an effective way for Pinggu to connect with their customers.

Farm to Schools

Farm to school programs could offer Pinggu an opportunity to connect farmers with schools and expand brand loyalty. In a farm to school program, a farmer provides produce

¹⁷ "Six Myths About Customer Loyalty Programs." *Forbes*. Forbes Magazine, 2 Feb. 2014. Web. 05 Feb. 2015. <<http://www.forbes.com/sites/hbsworkingknowledge/2014/02/24/six-myths-about-customer-loyalty-programs/2/>>.

¹⁸ Ernst, Matt, and Tim Woods. "Community Supported Agriculture (CSA)." (n.d.): n. pag. University of Kentucky, Apr. 2013. Web. 5 Feb. 2015. <<http://www.uky.edu/Ag/CCD/marketing/csa.pdf>>.

¹⁹ Charles, Dan. "How Community Supported Agriculture Sprouted In China." National Public Radio, 24 Sept. 2011. Web. 5 Feb. 2015. <<http://www.npr.org/blogs/thesalt/2011/09/24/140670551/how-community-supported-agriculture-sprouted-in-china>>.

²⁰ Bruch, Megan L., and Matthew D. Ernst. "A Farmer’s Guide to Marketing through Community Supported Agriculture (CSAs)." *UT Extension* (n.d.): n. pag. University of Tennessee Institute of Agriculture, Dec. 2010. Web. 5 Feb. 2015. <<https://utextension.tennessee.edu/publications/documents/pb1797.pdf>>.

or other products directly to a local school. Farm to school programs are rapidly expanding in the United States. A study conducted by the U.S. Department of Agriculture found that 44 percent of schools surveyed participate in farm to school programs with an additional 13 percent planning on adopting farm to school programs in the future. This amounts to 40,000 schools serving over 23 million children and generating \$385 million (about 2.4 billion RMB) in revenue for farmers.²¹

Farmer's Markets and Food Hubs

In addition to QR labeling and farm to school programs, Pinggu should explore the possibility of farmer's markets and food hubs as potential ways to develop brand loyalty and trust. Farmer's markets are an established way of connecting farmers directly with consumers (see eco-tourism section for more on farmer's markets). Food hubs are a growing food trend that can supplement or substitute farmers markets. From 2007 to 2014, in the United States, there has been an approximately 300 percent increase in regional food hubs.²² Food hubs provide infrastructure for local farmers to reach a large network of potential local buyers. They can take on a variety of different structures, but generally they provide a weekly bundle of local food delivered to a local destination for a set price. Consumers appreciate food hubs because they preserve the transparency of farmer's markets while providing convenient one-stop shopping for locally sourced food.

E-Commerce

Food e-commerce is one of the most significant trends in the United States now, and could be another opportunity that Pinggu could leverage to increase brand recognition and loyalty. More consumers are using delivery services, such as Amazon and Instacart, for their nonperishable, packaged foods, and shopping local producers for fresh foods. Food e-commerce combines food hubs and CSAs with e-commerce. In this model, customers can go online and select the food they would like from a variety of local farms. Farmers then produce the desired amount of food and the food is delivered to local drop offs where consumers collect their purchases. Convenient for the customers, this form of locally sourced food shopping also provides consumers with the transparency that encourages brand loyalty and trust. This model also develops new sources of employment and is being compared to the popular Uber taxi service, which creates about 20,000 new jobs a month through their online car service platform. Further, profit margins for the farmers are higher with the e-commerce, CSA and food to school programs than with the farmer's markets. This approach will be particularly appealing to Beijing residents, but may require building out some infrastructure to support and facilitate villagers' access to the Internet.

²¹ "Farm to School Census." *Farm to School Census*. United States Department of Agriculture, n.d. Web. 24 Mar. 2015. <<http://www.fns.usda.gov/farmentoschool/census#/>>.

²² Narula, Svati K. "Beyond Farmers Markets: The Future of Local Food in America." *Quartz*. Quartz, 11 Mar. 2015. Web. 24 Mar. 2015. <<http://qz.com/354925/beyond-farmers-markets-the-future-of-local-food-in-america/>>.

12.3 Co-brand with eco-tourism

As part of its efforts to connect with customers, Pinggu can provide information that supports eco-tourism. For example, in addition to receiving information on where the peach was grown, a customer can also receive notice that the Peach Festival is coming soon. In addition, the “Pinggu Membership” program suggested above can help deliver eco-tourism marketing and offer incentives to attract organic customers to Pinggu’s tourist destinations. Beijing residents who have grown to rely on Pinggu produce should be a target audience for eco-tourism, as they may be most receptive to its dimensions of pleasure, well-being and education.

Recommendation 13: Support agricultural health

Healthy soil is the basis of productive agriculture and is a key challenge that Pinggu expressed to us in our follow-up questionnaire. Pollution, climate change and mismanagement are primary causes of soil degradation in China, according to our research. The application of high concentrations of synthetic fertilizer attempts to combat this problem through infusing nutrients, but is often ineffective and causes a series of unintended consequences.²³ We recommend the following regenerative soil management practices to improve the ability of soil to naturally produce and store nutrients, and support Pinggu’s agricultural health:

- 13.1 Develop an organic waste collection, compost, and application service
- 13.2 Plant cover crops on annual fields and ground cover on perennial fields

The purpose of these steps is to increase the percentage of organic matter in the soil, which is a good indicator of soil health. Organic (carbon-containing) matter enables soil to store water and nutrients and creates a soil structure in which plants can more readily access oxygen and dissolved nutrients.

Organic matter is also critical in creating resilient soils that can withstand droughts and floods. For every percentage increase in organic matter, soil can absorb and retain an

²³ Figures from the Chinese Academy of Agricultural Science show that nitrogen fertilizer use exceeds the internationally accepted limit of 225 kg per hectare in at least half of China’s agricultural regions. Much of the fertilizer applied to China’s fields is never absorbed due to soil degradation. Up to 70 percent of the nitrogen used in Chinese agriculture runs off as waste at great cost to the farmer, and resulting in downstream pollution and water contamination. A study of agriculture in Henan found that crops absorbed only 33 percent of the three million tons of fertilizer applied in the province. Meng, Yeng. “The damaging truth about Chinese fertilizer and pesticide use.” China Dialogue, 2012. Accessed January 31, 2015
<https://www.chinadialogue.net/article/show/single/en/5153-The-damaging-truth-about-Chinese-fertiliser-and-pesticide-use>

additional 75,700 liters of water per acre.²⁴ Floods in the United States in 2011 cost farmers \$10.8 billion in crop damage, while drought in 2012 cost farmers \$17.3 billion. Soils with high volumes of organic matter that can retain more water are resilient and can endure seasonal variations, allowing farms to remain productive during extreme weather cycles.

Healthy soils are full of living organisms, both visible and invisible to the naked eye. A few grams of healthy soil can contain billions of beneficial microbes.²⁵ An acre of living soil can contain 400 kilograms of earthworms, 1100 kilograms of fungi, 680 kilograms of arthropods and algae.²⁶ Soil organisms create nutrients and make them available to plants, reducing or eliminating the need for artificial fertilizers. Amending soil with organic matter creates an environment in which soil biota can thrive.

13.1 Develop an organic waste, collection compost and application service

One proven method for increasing the percentage of organic matter in soil is through the application of compost. Composting can be replicated and accelerated by diverting organic waste streams from the landfill to composting sites. The application of compost to soil has been proven to durably increase yields.

In one study, the Marin Carbon Project, based in California, added a half-inch of compost to 1,500 square meters of farmland. Three years later the results from a one-time application of compost supported 25–40 percent increase in plant growth compared to land that had not received compost amendments.²⁷ The results show that a single application of compost creates long-term benefit by activating key soil microbes that continue to produce beneficial nutrients well beyond a single growing season. The increase in crop yields and the decreased need for synthetic fertilizers support greater margins for farmers.

Another study in central California compared the use of organic compost and synthetic fertilizers in peach orchards. The study found that orchards amended with organic compost were more resilient to disease. In particular, cases of brown rot disease were significantly reduced in trees treated with organic compost. The study also surveyed consumer demand and found, “consumers would prefer to purchase a product fertilized

²⁴ Brown, Gabe. “The Real Dirt: Regenerating Soil Quality to Sustain Life.” OnEarth, 2013. Accessed January 31, 2015 <http://archive.onearth.org/articles/2013/08/this-north-dakota-rancher-turned-barren-range-into-a-fertile-farm>

²⁵ Grubinger, Vern. “Soil Microbiology: A Primer.” Accessed January 31, 2015. <http://www.uvm.edu/vtvegandberry/factsheets/SoilMicrobes.html>

²⁶ Pimentel, David et al. 1995. Environmental and economic cost of soil erosion and conservation benefits. *Science*. Vol. 267, No. 24. P. 1117-1122.

²⁷ Rebecca Ryals, Michael Kaiser, Margaret S. Torn, Asmeret Asefaw Berhe, and Whendee L. Silver, "Impacts of organic matter amendments on carbon and nitrogen dynamics in grassland soils," *Soil Biology and Biochemistry* 68 (2014): 52-61.

with natural materials, such as green material compost, rather than with synthetic fertilizer materials such as ammonium nitrate.”²⁸ Therefore, this can be a strong selling point.

Communities around the world are developing municipal composting programs that divert organic waste to composting facilities that would otherwise be sent to landfills. San Francisco is a good model of capturing mass amounts of food scraps and other compostables (nearly 700 tons per day) that are converted to high value compost at two regional composting facilities. The compost is sold into the agriculture market, certified for organic use, and has been applied with great benefits to farmers, especially orchards, vineyards, and produce growers.

A growing number of cities, including New York and Providence in Rhode Island, offer pick up services or drop off facilities for food waste and compost, which make up an estimated 14 percent of total waste in the United States. CompostNow, a program in the state of North Carolina distributes compost bins to households in seven cities and collects them weekly, replacing full bins with clean, empty bins. The waste is professionally composted and distributed to farms and gardens across the state. Food waste collection systems that are designed to collect organic matter close to the point of generation have had the highest success rates (i.e. covered buckets inside the kitchen). Some communities have curbside collection programs for covered buckets as frequently as three times a week.

13.2 Plant cover crops on annual fields and ground cover on perennial fields

Planting cover crops between growing seasons is a regenerative practice that can significantly improve soil health and fertility. Cover crops are typically secondary crops (rather than the primary crop) grown in fields that would typically lay fallow between seasons. Cover crops produce multiple benefits to farmers, including:

- Reduction of erosion from wind and water
- A natural source of nutrient fixation (nitrogen and others)
- Increase of organic matter content in soil
- Soil moisture retention
- Increased yields
- Additional revenue streams from the sale of cover crops

According to one study conducted by the USDA, farmers who planted corn in a field following a cover crop had a 3.1 percent increase in yield compared to side-by-side fields with no cover crops. Likewise, soybean yields increased 4.3 percent following cover crops. The most common cover crops are legumes (including fava, clover, vetch, and winter pea) and cereals (including winter wheat, cereal rye, and triticale). According to Barry Fisher, a

²⁸ "Compost Demonstration Project, Fresno County: A Comparative Analysis of Soil Amendments Used in Peach Production." *CalRecycle Publication Detail*. N.p., 15 Apr. 1997. Web. Feb. 2015. <<http://www.calrecycle.ca.gov/Publications/Detail.aspx?PublicationID=484>>.

soil scientist with the USDA, “By using practices like cover crops that enhance soil health, there will be more soil organic matter development and higher production potential. That results in a higher return on investment and true economic growth.”²⁹

In addition to cover crops, ground covers can be used with similar effect in orchards and vineyards. Ground covers beneath orchards, vineyards and other perennials have many of the same benefits of cover crops, providing a durable source of nutrition, erosion control, and moisture retention.

²⁹ Taylor, Ciji. “Cover Crops Provide Multiple Benefits, Higher Yields.” Accessed January 31, 2015. <http://blogs.usda.gov/2015/01/21/cover-crops-provide-multiple-benefits-higher-yields/>

ECO-TOURISM

In its purest form, eco-tourism involves visiting natural areas, whether in wild, remote mountains, pastoral countryside, or urban fringe green environments, without damaging the natural or cultural resources of the site. In a nation with as rich and ancient of a culture as China and as fragile an environment, there are few places that do not possess inherent cultural values that also must be conserved from adverse impacts from excess visitation. With a wide variety of natural, cultural and recreational features, Pinggu is no exception.

Eco-tourism principles also include recognition that such tourism activities should also provide benefits to the local economy and the well being of local residents. These are precisely the goals that Pinggu is seeking to accomplish with its eco-tourism strategy. From our meetings, we learned that the predominantly agricultural Pinggu District has set ambitious goals to grow its economy through optimizing eco- and agri-tourism. And, we know that there is a strong desire to ensure that growth does not impact its traditional agricultural base.

Pinggu officials used the eco-tourism label to encompass agri-, eco-, cultural/historic, and recreation tourism. Therefore, this section takes up all four aspects of the tourism market to provide a more comprehensive look at tourism, but given that these elements will all have sustainable aspects, we have placed them all under the eco-tourism umbrella.

Pinggu's Attractions

We were able to visit many of Pinggu's major outdoor attractions and destinations with a tourism focus - Jinhai Lake Recreation Theme Park (with its Bihai Hillside Resort), Yuyang



Yaji Mountain Temple, beijingshikers.com

Mountain International Ski Resort, Yaji Mountain Taoist Health-Preservation Theme Park; and Qin Long Mountain Temple. Our delegation was unable to visit some of the other well known sites, such as the Jingdong Grand Karst Cavern, the Jing Dong Grand Canyon, Mt. Shi Lin and its waterfalls, and Tian Yuan Mountain, all of which are located in the mountains

of the undeveloped Eco-Tour Zone. But it is clear that these attractions could serve as the highlights of a yet-to-be-developed trail system for Pinggu.

In addition, a beautiful, well-landscaped new urban park, River Forest Park in downtown Pinggu, offers all of the benefits of a relaxing outdoor setting in close proximity to all of the services of the city. There is plenty of evidence that such urban green spaces provide a strong economic impact in a city. For example, in San Francisco, they estimate that their parks and green spaces generate US\$1 billion a year for the city. So it is well worth the effort to publicize urban parks.

Pinggu tourism staff also previewed for us plans to build an extraordinary new development near Pinggu City in the Industry Zone to be called “Creative Industry Valley’s Music Experience Theme Park,” that will feature year-round music performance spaces, both indoor and outdoor, and an existing Music History Museum. This new development would significantly expand upon the District’s existing successful music instrument factory, including its Violin Culture Experience Hall, where handmade violins, violas, cellos, and bass instruments are produced in remarkable volume and quality.

Recommendation 14: Coordinate the marketing strategy

Based solely on our meetings and on-site visits and discussions with Pinggu District officials, it appears that the single most important element of a comprehensive tourism program that is under-resourced in Pinggu is marketing and advertising. For example, Pinggu officials indicated that the District web site currently provides some basic traveler information, but it is rudimentary, and not as user-friendly as is necessary. Further, it seems that each tourist attraction is responsible for their marketing. In order to optimize visitation, our recommendation is to develop a joint marketing or coordination of tourism development strategies that include a comprehensive website and marketing materials. An “every attraction for itself” marketing approach is not effective; however, development and launch of the SEED brand could link together all of the various elements of the tourism market and serve as an umbrella brand.

14.1 Foster private sector marketing

Marketing and advertising functions for tourism throughout the world are normally carried out by the private tourism business sector, in close coordination with both public agencies and/or private companies that actually manage and operate attractions and destinations. In some countries where tourism attractions are underdeveloped, it is often the case that government agencies will initially take the lead role in the early stages of marketing and advertising, but this is not normally a field in which government is experienced or specially trained to perform effectively.

For the long term development of the tourism market, we recommend that Pinggu seek to foster establishment in the private sector of a “chamber of commerce,” “convention and visitors bureau (CVB),” or “destination marketing organization (DMO).” While we did not go into these functions in any detail during our meetings in Pinggu, we believe that these types of organizations are particular effective in marketing and staffing marketing efforts on behalf of local governments.

One of the first tasks for this group should be to develop or refine a comprehensive traveler information and reservation resource – or a revamped Visitor Center – online and via a phone center. This resource would include a regularly updated list and detailed description of all attractions and destinations in the District, opening and closing dates, special events, harvest seasons by product type, lodging and food service availability and reservations, and how to order or purchase maps. This could be known as the Pinggu SEED Center.

14.2 Leverage proven marketing techniques to develop a visitor database

An effective marketing technique, and one especially applicable to Pinggu District given the surge in development and opening of attractions that is under way at present, is to promote a regular array of “new” attractions, events, programs, activities, lodges, restaurants, etc. to entice the customer base. Curiosity is a powerful inducement to stimulate visitation. This approach is especially effective with customers who are already familiar, or think they are, with the offerings in Pinggu, such as Beijing residents who come to Pinggu for the annual Peach Blossom Festival.

We recommend building a database of visitors to Pinggu, if this has not already been done, perhaps by collecting contact information from local hotels and lodges. And then regularly update the database with “What’s New in Pinggu,” special events, and other key announcements to encourage return visits. This may be an effective way to market community based agriculture initiatives described above.

Recommendation 15: Develop year-round opportunities for agri-tourism

Pinggu District’s most immediate opportunity for economic expansion of tourism is its current agricultural base. We recommend focusing on maximizing the number of days in the growing season when there are opportunities for tourists to experience the farm environment, gain knowledge of farming practices, and pick their own produce for purchase (at a discount compared to the price they would pay for the same product in Beijing).

15.1 Expand beyond peaches

There are two keys to success with this approach. First, broaden beyond the peach market to other produce-specific markets to attract additional visitors by more widely advertising the diverse variety of farm products grown in Pinggu. Given the differing maturation times of various fruits and vegetables grown in Pinggu, this strategy can greatly increase the number of days for agri-tourism. And second, the Peach Blossom Festival is a major success in attracting tourists, but it is not sufficient by itself to optimize the agri-tourism potential of the District. Additional events, focused on different products, can expand tourism and spread visitation across a greater portion of the year bringing the same people back more often, and attracting new visitors.

15.2 Establish a permanent farmer's market

Another opportunity to develop year round tourism is to set up a permanent farmer's market. Roadside farm stands for direct produce sales to visitors are a common practice in farm country, but can put a burden on short-handed farmers to staff these outlets sufficiently. The launch of a cooperative, year-round Farm Market at a centralized location in the District, where many (or all) products of the region can be sold, should be advertised on a well-publicized schedule.

Beyond fresh produce sales, having a centralized farmer's market operating year-round would further incentivize development of a variety of value-added products that can be sold year-round (or at least in a three-season market), such as canned or preserved fruits, dried fruits, pickled or other cured vegetables, and even a variety of locally made handicraft products. These types of markets become strong tourist attractions. Pike Place market in Seattle, Reading Terminal market in Philadelphia and markets throughout Europe have become major tourist draws while still being used by local residents for their fresh produce and artisanal products.

These markets can be strong revenue generators for the city. In Portland, farmer's markets are a key ingredient in the city's renowned food culture. Enthusiasm for fresh and local food has sparked the growth of Portland farmers markets from one small market in 1991 to 14 markets and \$11.2 million in sales for the 2007 market season. A recent report, *Growing Portland's Farmers Markets/Direct-Market Economic Analysis*, details a \$17 million regional economic impact and estimates that farmers markets account for three percent of annual countywide consumer purchases of fruit and vegetables.³⁰

15.3 Promote educational opportunities

Agri-tourism also offers educational opportunities to city dwellers. Increasingly, urban populations, especially younger generations, lack first-hand awareness of where food comes from, how it is produced, how agriculture can affect climate change, and all of the work that goes into it. Agri-tours can be developed to bring city-based tourists out to the farm for a day of hands-on learning opportunities; school groups can come on packaged tours provided by either commercial tour operators or their school systems.

In fact, many of these programs for youth are seen as a way to combat the growing child obesity epidemic. The more children become interested in fresh, healthy food, the more they seek it out. Further, we have found that educating children is one of the most effective ways to raise awareness on any given issue, such as the importance of seeking out organic produce and eating fresh. Children are effective at convincing parents and grandparents about the importance of an issue. In the US, it was child awareness campaigns that lead to universal adoption of seat belt laws and the widespread adoption of recycling programs. They are very effective little marketers.

³⁰ See <https://www.portlandoregon.gov/bps/49940> for more details on the findings of the study.

Recommendation 16: Protect cultural heritage and promote historic tourism

Cultural and historic sites for tourism were not featured during our visit, with the exception of the Yaji Mountain Taoist Health-Preservation Theme Park; however, there are numerous cultural and historic sites throughout the District that could feature prominently in future travel and tourism plans for Pinggu development. Among the cultural sites in the *Pinggu Tourism Guide* are the Xuanyuan Tomb, the Wenfeng Pagoda, Immortals Cave, and at least seven “Folk Culture Villages” and two “Folk Tourism Villages” (the difference, if any, between Folk Culture and Folk Tourism Villages is unclear and unstated.)

Such cultural and historic sites could become a major attraction to all age ranges. Older travelers are most interested in the nostalgic aspects of history and culture, and prefer packaged, all-inclusive tours in groups. And younger travelers can be engaged through planned field trips for school groups to learn about their culture which are a prominent aspect of tourism around the world and could become a major factor in Pinggu tourism in the future, given the millions of school-age children in the region.

16.1 Explore securing UNESCO World Heritage status

We also recommend that Pinggu explore how to participate in China’s creative and effective program to protect its cultural heritage as a means to promote tourism. In recent years, the Chinese government has sought UNESCO World Heritage designations for its historic sites and geographies. This designation serves a dual purpose: protect and promote the unique culture of these ancient landmarks, and encourage tourism to generate revenue. World Bank and International Monetary Fund (IMF) researchers have proven a positive correlation between a World Heritage designation and tourism growth, with a resulting increase in long-term GDP growth. Tracking figures over a 22-year period, the IMF determined that tourism generated by World Heritage status increases growth per capita by 10.4 percent.

Chinese cities have been pursuing this World Heritage designation. And, the results speak for themselves. After receiving a World Heritage designation, the historic site of Lijiang, in rural Yunnan Province, now hosts over 11 million visitors annually. The ancient village of Kaiping saw their tourism rise from 100,000 to a staggering two million visitors a year, with revenues of \$7.8 million annually, after their inscription to the list in 2007. For rural areas with little industry, cultural tourism has become an economic windfall. Pinggu should consider if their sites might meet the requirements and apply for these unique designations. There are many organizations that are well positioned to support Pinggu’s efforts in this regard. The Paulson Institute would be pleased to provide recommendations.

Recommendation 17: Expand and improve the recreational trail system

Outdoor recreation, especially walking, hiking and biking, is the least well-developed tourism attraction for Pinggu District at present, but is a critical element to bring on line. The Tourism Commission Director for the District, Chen Menghui, informed our group that

this is currently a major area of focus for her having learned of the major economic benefits during her recent participation in the World Leisure Conference in Mobile, Alabama.

17.1 Produce a series of maps

The first – and most important step – is to develop a series of maps for the trail system. Based on our discussions, it appears that numerous trails are under construction in various areas of the District, but especially focused in the Eco-Tour District. In order to promote tourism on the trails and for the trail system to function effectively, they will need to be shown on maps. Once developed, such trail maps and any accompanying trail guidebook must be updated regularly as new sections of trail are built and opened to the public.

Pinggu should also prepare a comprehensive map of the entire District Trail System. At the scale of the District, this map should show all trail routes that are currently open for recreation, perhaps color-coded to differentiate modes of trail use (i.e., hiking versus biking if these are separated uses on different trails), and include identification of all access points and trailhead parking, as well as nearby service amenities such as food, water, overnight lodging, and gasoline stations. At this map scale, it is not desirable to include terrain contours that would indicate degree of difficulty for users, but a difficulty rating scheme can be easily developed and shown on the map in a range of colors keyed to degree of difficulty. This district-wide map should become the primary marketing tool used to attract recreational tourism visitors. The back side of this map would normally include descriptive and education information about the District and its major tourism attractions, key telephone numbers and street addresses for tourist facilities, which will have the added purpose of encouraging advance reservations, especially for services that will be purchased by visitors to the District, such as overnight accommodations.

Further, separate maps for each major trail or trail segment should be prepared at a larger scale which can serve trail users when actually traveling on the trail routes. These hiker/biker maps would normally include terrain contour lines indicating slopes, stream crossings, and segment distances, access and egress points, and any amenities in the immediate vicinity of each segment.

Recommendation 18: Establish world-class attraction management processes

With a wide variety of existing and planned attractions, we recommend that Pinggu allocate sufficient time, staffing and funds for the management and operations of each attraction. Whether attractions are operated by public agencies or private businesses, critical staff functions on-site should include resource protection and direct management, road, trail, and other facility maintenance, law enforcement, and visitor education and interpretation. Coordination of these critical functions and carrying them out routinely will determine the long-term sustainability of Pinggu’s attractions for tourism.

In our meetings, the Pinggu government reinforced that development of these various types of tourism must be undertaken in a manner that assures the long-term conservation and quality care of the sites for a “Beautiful Pinggu,” it will be imperative that Pinggu

District staff, and that of each individual destination/attraction, are well trained in management and operation of these places to accommodate the intended increased in visitation without allowing resource damage or a diminished quality to the visitor experience. There are numerous groups that provide this consulting and have extensive experience in this sector.

Recommendation 19: Spread out special events and encourage longer stays

Pinggu should strive for a balance between special events aimed at attracting large visitor audiences for typically short visits, and a steady flow of regular tourism spread throughout the year. Such a balance will provide the best flow of revenue and help to assure minimal damage to the attractions.

At present, the largest single annual event is the Peach Blossom Festival, which attracts thousands of visitors in the spring. We were told that Pinggu officials seek to showcase other attractions for visitors at the same time. However, our recommendation would be to develop other events for different times of the year, such as music festivals or a strawberry festival, and market them during the Peach Festival. While not likely to be as big as the Peach Festival, at least at first, over time these additional events will greatly assist in stabilizing the tourism economy throughout the year.

Pinggu should also market to encourage longer stays in the District. For example, Yuyang Ski Resort is a winter attraction, which is a time when visitation to other attractions is reduced. This is an opportunity for Pinggu to launch a marketing campaign aimed at skiers to encourage a longer stay in the District by informing them about other attractions, such as the Violin Culture Experience Hall given that skiers are generally a younger group, which is also attracted to music. This facility can also serve as an alternative attraction for skiers when the weather at the Yuyang Mountain is not optimum. When the Music Valley Theme Park is built and operating, this venue will be a great means to induce visitors to extend winter visits.

Recommendation 20: Package the Pinggu experience

A typical marketing strategy that works for multiple attractions, and that encourages longer stays (and thus greater spending) is offering “package deals” or advance tickets for multiple attractions on the same day or weekend at a lower price than if the tickets for each were purchased separately and on site. Such advance sales, even with discounted prices, are to the advantage of the attraction’s operators, which can better plan and staff up when they have a more accurate estimation of attendance at a given time. Likewise, a discounted multi-day package for the same facility can be a strong inducement for a visitor to extend his stay in the District.

Another effective Pinggu Experience package would be to combine advance sale of tickets for attractions, overnight lodging and meals, again at a discounted price from the cost if each of these were purchased separately and on site. Just as with marketing special events,

having a fully implemented marketing strategy and partner organization in place that manages the package deal offers is essential.

Recommendation 21: Improve transportation to the district and in the district

Transportation facilities and travel information are critical to success in tourism development and promotion. While Pinggu District is merely 45 kilometers from downtown Beijing, travel from the inner city to this outer district can require two hours, given the heavy traffic on the available roads. Such logistical impediments can be a strong disincentive to one-day travel from the center city, though likely less so for visitors to Pinggu who plan a weekend excursion or longer in the District.

At present, most visitors to Pinggu are required to drive private cars to reach the area. But, as Beijing continues to grow and traffic worsens, this single means of access could become a serious limiting factor in expansion of tourism plans for Pinggu. For the future, rail access to Pinggu would be ideal. While we understand this is somewhat out of Pinggu's jurisdiction, improving transportation to the District would be an important way the Beijing government could support Pinggu's efforts. Pinggu could then focus on improving the local circulator bus service in the District, which would not only reduce travel time around the District, but would support reduced air pollution goals in the important Jing-Jin-Ji (JJJ) region.

In the interim, Pinggu could incentivize private tour operators in Beijing to develop a selection of package tours to Pinggu, both day-trips and weekend excursions. Such tour packages would logically include attractions, meal tickets, and overnight room reservations for groups staying more than one day.

Given how widely separated some of the attractions in Pinggu are, the District should also consider modifying the routes and schedules of its existing commuter bus service to facilitate visitor circulation especially on weekends, when locals are less likely to be riding. Given that most lodging and food service is located downtown while the attractions are spread around the District, it would make good business sense for the District to encourage visitor parking in the City and use of a convenient and regular bus service that follows a circuit route or routes among various attractions and back to the city in the evenings.

For hikers and bikers, it is particularly important to have a convenient bus service with regular stops at a variety of trailheads, so that continuous through-travel, rather than backtracking on the same trail section. Such a service would make hiking and biking in the District far more attractive than otherwise, enabling more rapid growth of the recreational tourism sector.

WATER CONSERVATION

Pinggu's 12th Five Year Plan sets forth the plan to strengthen water system treatment by focusing on restoring the Juhe and Ruhe surface rivers and soil-water erosion management. Further, the Binhe Forest Park is scheduled for expansion with 10,000 mu (1 mu = 0.1647 acres) set aside to build a recreational space. There are several wetland parks slated for construction as well as a new water system surrounding the Pinggu New Town.

“Twelfth-Five-Year Plan” of Pinggu District (2011-2015)



19 River Map of New Town

The following recommendations are intended to be a holistic approach to supporting Pinggu's goals for the water system while reinforcing the overall SEED plan.

Recommendation 22: Strengthen the protection of wetlands and surface water

Wetlands are considered the “kidneys” of the earth playing an important part in all aspects of water conservation: controlling runoff, storing floodwater for use against a drought, reversing pollution, sequestering carbon, releasing oxygen, regulating climate, controlling soil erosion, and beautifying the environment. The northern wetland park, in the Binhe Forest Park, is currently under construction and will be the first wetland park in Pinggu District. And, the treatment of Xiaoxinzhai Stone River, Ruhe River and Juhe River are well underway. In order to better the eco-environment of Pinggu District, improve the eco-conserving capacity and resolve the acute problems resulting from the contradiction between the supply and demand of water resources, we recommend that Pinggu redouble efforts to rehabilitate and protect the wetlands. There are several important steps for the effective protection of wetlands and surface water resources.

22.1 Improve the eco-conserving capacity by restoring wetlands and recharging groundwater

The headstreams of the main rivers running along the Pinggu New Town are mostly in mountainous areas and upstream from rural areas. In recent years, a focus on the management of small catchments and soil-water erosion has achieved measurable and impressive results. From 2001 to 2014, we understand that 403 km² or 80.3 percent of

small catchments have been cleaned and restored. Pinggu leads all Beijing Districts on this important metric. We recommend furthering this work and expanding treatment of soil-water erosion coupled with the construction of ecologic and clean small catchments to improve the rate of erosion treatment. Additionally, headstreams should be cleared through rigid sewage discharge controls.

We further recommend building the new Hexi Sewage Treatment Plant to increase the overall sewage treatment capacity, the production of recycled water in the New Town area and the water supply for landscape, particularly to service the 10,000 *Mu* (~667 hectares) Riverside Forest Park and the northern wetland.

We understand that 50 percent of the reclaimed water from the New Town township sewage treatment plants meeting certain standard will be used for the restoration of rivers and wetlands around Pinggu New Town. And, in the 13th Five Year Plan, efforts will be made to build several wetland parks around the New Town using reclaimed water, rainfall and floodwaters. These actions combined with the recommendations above will have an important impact on the whole eco-system leading to increased air humidity, improved air quality and recharged groundwater.

Recommendation 23: Expand construction of the urban water system

The main challenge facing the Juhe River Wetland restoration is a lack of water. The Juhe River is an ephemeral stream; some of its reaches suffer serious leakage. To harness the Juhe, we recommend maintaining the natural twisting river course, restoring the natural properties of the river, avoiding hardening the riverbank, and



[Juhe Restoration Project](#); Photo taken by [Hong Jianming](#) on January 13, 2015

restoring natural vegetation and artificial indigenous plantings. In tandem, we recommend strengthening controls on basin water pollution, specifically by preventing sewage from discharging into the river course. Reclaimed water, rainfall and floodwaters should be used for recharging the river and integrating measures for ecological water to bring sufficient water to the city and improve the water quality.

Finally, connecting the water system with wetland construction will result in scenic views of crisscrossing rivers, swamps and wetlands. Weeping willows will naturally grow along the riverside and reed cattails will line the banks and sway in the wind. Tourists and Pinggu residents alike will appreciate this improved natural scenery.

23.1 Enhance construction of rainfall and flood control installations

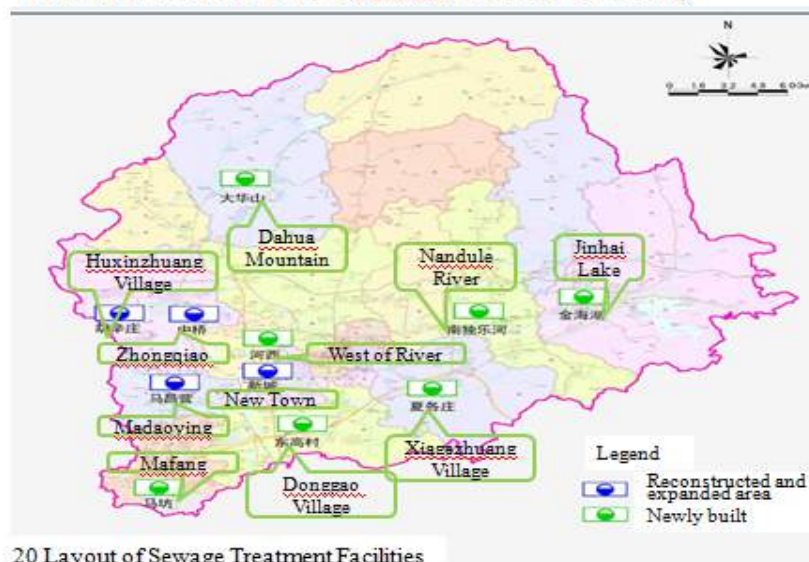
The multi-year average precipitation of Pinggu District is 614mm, and that is distributed unevenly throughout the year. The multi-year average precipitation during the flood season, which is from June to September, accounts for 82.7 percent of the annual rainfall concentrated in July (33.1 percent) and August (27.8 percent). The annual rainfall then is mainly floodwater resulting in a low rate of utilization.

In the 13th Five-Year Plan, we recommend ramping up the construction of rainfall and flood facilities to store more surface water for usage in improving the urban ecological environment and recharging groundwater. This is best accomplished through afforestation of the plains and converting wasteland and empty land—resulting from relocating villagers into towns—into ecological land. The resulting undulating urban green fields can provide citizens and tourists with leisure spots during the non-rainy season; and, during the rainy season can absorb enough floodwater to recharge the groundwater.

The rivers can also be recharged through ditches by opening simple flashboard riser water control structures. Rainfall and flood facilities can be installed upstream and in areas adjacent to the river. We also recommend linking rainfall and flood facilities with the construction of villages and new countryside by collecting and purifying rain, floodwaters and reclaimed water through artificial wetlands.

Recommendation 24: Implement natural sewage systems in rural areas

“Twelfth-Five-Year Plan” of Pinggu District (2011-2015)



20 Layout of Sewage Treatment Facilities

Pinggu’s 12th Five-Year Plan commits the District to the reconstruction and expansion of sewage treatment plants at the township level by 2015. The parameters for a sewage system in rural Pinggu are typical as those found throughout northern China: a small, dispersed population; a poor pipe network with extensive leakage and low ratios of sewage treatment; a low water quality and sewage rates; seasonally—and even

hourly—varying water quantity and quality; and, freezing winter temperatures, which pose a significant challenge to any sewage system.

Village streets in Pinggu are narrow inhibiting the space for a proper network of sewage pipes. And, the pipe network is the foundation of an effective system; it can comprise up to 80 percent of the investment in sewage treatment. However, lower levels of economic development in rural areas limit the choice of sewage treatment systems and technologies. Advanced technology is almost never an option due to high operating expenses and specialized training required for the staff.

For all these reasons, the selection of sewage treatment technology for rural areas must be cost efficient, easily serviced and simple to install. For rural Pinggu, viable options include natural treatment, biotreatment and ecological treatment. Widely used throughout the US³¹ and Japan³², these treatments are sustainable, and offer natural, low cost solutions for rural areas. Natural treatment systems include artificial wetlands, stabilization ponds and earth treatment system. Biotreatment includes biofilm processing and anaerobic treatment, among others. And, ecological treatment includes ecological clean-up beds and tower-type biological filter processes. These natural treatments are flexible enough to be integrated or used separately.

24.1 Artificial wetland technology

Already adopted in the Xibaidian village, we recommend scaling artificial wetlands throughout the New Town and Pinggu District. There are several compelling features to this process that make it a good fit for Pinggu:

- simple process
- low financial investment
- low operating costs
- simple technology
- simple management and maintenance

The water output is mainly used in irrigating farmland and landscaping. As is appropriate for northern China, the processing load can be reduced to 10m² per 1 ton of sewage.

Artificial wetlands employ a series of physical, chemical and biological reactions, such as adsorption filtration, precipitation, phytoextraction and microbial degradation, to effectively purify sewage. This treatment technique requires two elements: a pretreatment unit and the artificial wetland itself. The pretreatment unit is a subsurface constructed flow

³¹ The US government issued the *On-site Sewage Treatment Manual* in 2002 and the *Distributed Sewage Treatment System Management Handbook* in 2005.

³² For the Japanese government direction, please see *Rural Colony Drainage Work Design Guideline* and the *Rural Colony Drainage Work Construction Guideline*.

wetland using reeds, typically planted on a plastic membrane in colder climates to increase the ground temperature. The site should be mowed for the winter months to ensure proper functioning. The removal rate of BOD₅ COD_{cr} can exceed 80 percent, while that of P and N is 60 percent and 90 percent respectively. Most of the indexes reach the A standard of Grade I water.



Results of Xibaidian Artificial wetland treatment system in winter (left: reed in subsurface flow wetland, pond); Photo taken by Professor Hong Jianming on January 13, 2015

For your reference, the World Wide Fund for Nature (WWF), along with support from Coca-Cola Company and Coca-Cola Foundation, has a pilot project for constructed wetlands for wastewater treatment in rural areas on the Yangtze River. The project was developed as a result of the growing trend toward eco-tourism and homestays in the region generating additional wastewater. This project was a finalist for the PI and CCIEE Prize for Cities of the Future last year. There are also private sector firms leading the way on this issue, including Portland-based Biohabitats, which has completed projects around the world, including China.

24.2 Capillary tube soil infiltration (quick infiltration sewage treatment technology)

With the capillary tube soil infiltration technique is a highly efficient process in which quantitative rural sewage is discharged onto surface soil to penetrate the soil through physical, chemical and biological reactions like adsorption, filtration, precipitation, ion exchange, and microbial decomposition thus purifying the sewage. This technique is applicable to small- and medium-sized villages with highly permeable soil. It is a low cost and natural process particularly relevant where homes are dispersed.

The quick infiltration sewage treatment technology needs to recover its infiltration performance regularly, such as infiltrating soil layer cultivation. At present, Changping District has invested in and is operating the quick infiltration system technique with significant removal rates for key elements, including COD_{cr} (91.9 percent), BOD₅ (95.3 percent), SS (98 percent), TP (83.2 percent), and TN (69 percent).

24.3 Distributed sewage treatment technology with stabilization ponds

For rural areas with widely dispersed households, a digestion tank coupled with stabilization pond treatment is sufficient. Water output that reaches Grade II standard (GB18918—2002) can be used to irrigate farmland and local landscapes. Stabilization ponds are typically divided into three zones: 1. intensified filler; 2. aquatic plants; and, 3. surface flow wetland and water reuse.

24.4 Biological contact oxidation

This method is adaptable in terms of producing good water quality and volume without return-sludge flow. There are several features that make this method simple and easy to manage, including no sludge bulking, low sludge volume and easy precipitation. It is also easy to maintain as long as flies are kept away from the filter. This method is low cost and applicable to dispersed villages, particularly where a higher level of technology is needed because the water output is discharged into rivers and lakes.

24.5 Underground integration technology

This technology is particularly applicable to villages with insufficient land resources for the other methods and techniques. Operating underground, there is the added benefit of keeping water warmer during the winter. The primary components of an integration facility are a digestion tank and bar rack.

Recommendation 25: Ramp up protection of groundwater in Pinggu District

Pinggu's 12th Five Year Plan sets forth a “One City, Three Zones, and Ten Industrial Parks” development plan. The newly expanded Pinggu New Town and the Ten Industrial Parks are mainly located in rural-urban and village-town fringe zones; therefore, the original water systems are not adequate to support the development plans at this point. And, the quality of the water utility foundation works is lower than those in the urban area. The development of industry and improvement of living standards in Pinggu will result in constantly increasing water usage. Groundwater exploitation is also like to increase. Therefore, we recommend groundwater protection become a key focus area for Pinggu's water system plans.

25.1 Further reduce agricultural groundwater consumption

Although declining, agricultural water usage accounts for 52.3 percent of the overall water consumption in Pinggu—most of which is groundwater.³³ Pinggu is facing increasing agricultural water shortages due to limited existing water resources and the increasing consumption from industrialization and urbanization. And, agricultural water consumption efficiency is low due to extensive leakage and inefficient flood irrigation. Therefore, we recommend:

³³ Agricultural water consumption has declined from 69.9 million m³ in 2010 to 54.3 million m³ in 2012 and finally to 49.3 million m³ in 2014 marking a 30 percent decline each year measured.

1. Increasing the operating ratio of irrigation from 0.68 at present to 0.72 in 2015 through agricultural water saving measures, which has the potential save about 3 million m³ of water per year;
2. Integrating agricultural infrastructure adjustments with industrialization plans in agricultural regions to promote ecological water saving agriculture and construct comprehensive agricultural water saving zones;
3. Adopting the “one well, one meter, one household, one card, and one number” system for irrigation in order to collect the necessary information to manage irrigation zones precisely;
4. Adopting micro-irrigation water saving technology in water resource protection zones; and,
5. Maximizing reservoir, pit and rainfall and flood facilities to reach a rainfall utilization rate of 7.6 million m³ per year.

25.2 Further reduce GDP water consumption per RMB 10,000

The GDP water consumption per RMB 10,000 in Pinggu District has declined 58.8 percent from RMB 146.0 in 2010 to RMB 60.2 at present, yet there is still a large gap when compared with that of Beijing, which is at 20m³ per RMB 10,000. In the 13th Five Year Plan, Pinggu aims to develop into a modern and clean manufacturing logistics center. Therefore, the leadership should consider how to phase out industries that require high water consumption and contribute to water pollution. And, a strategy should be developed to attract and develop industries with high capacity and low water consumption, such as telecoms and device manufacturing.

25.3 Promote the use of water-saving tools and raise public awareness

More and more households are able to use tap water and flush toilets as the living standards of Pinggu increase. As a result, residential consumption increased 34.5 percent in just two years from 2010 to 2012. There was then another 53 percent increase from 2012 to 2014.³⁴ This represents 32.8 percent of the overall water consumption in Pinggu District, which is almost equal to the water consumption for agriculture.

According to recent surveys, the rate of water leakage in urban areas and towns is over 14 percent, and the utilization rate of water saving tools of residents in villages and towns is less than 70 percent. These factors will result in a rapid increase of residential water consumption. We estimate that if all Pinggu District residents use water saving tools and strictly conform to water saving standards, about 5 million m³ per year will be conserved.

To be successful in residential water conservation efforts, we also recommend launching a civic awareness campaign. For example, water used for washing vegetables and hands can be reused to flush the toilet. Pinggu could also consider a quota management system to introduce legal conservation requirements.

³⁴ Living water consumption increased from 15 million m³ in 2010 and 20.2 million m³ in 2012 or 34.5 percent, and then to 30.9 million m³ in 2014 or 53 percent.

There are many organizations doing excellent work promoting public awareness of water saving. Again, this is area where targeting children is very effective. The Paulson Institute has worked closely with an organization called Thirst, that teaches high school students about the importance of conserving water and teaches simple methods for conservation. They do eye-catching events by having children form water dragons on their playgrounds, and receive significant media attention. Sesame Workshop, the creator of the *Zhima Jie* television show, also teaches children about the importance of turning off the tap using their popular Muppet characters. And, The Nature Conservancy works with schools to plant rain gardens and do simple experiments demonstrating how to purify water.

CONCLUSION:

Tying Everything Together Through Branding

This report details more than 25 recommendations on how the Pinggu Government could take immediate and important steps to develop a model of sustainability for edge districts that could be replicated throughout China – and throughout the world. But it was the recommendation and creative vision of Pinggu’s Party Secretary, Zhang Jifu, that the model be branded. We see strong benefits to a branding initiative for both tourism marketing and scalability of the model. Therefore, we worked with Pinggu officials to develop the Sustainable Eco-Edge District (SEED) brand name and logo. As mentioned in the introduction, the SEED model would be comprised of implementing meaningful sustainability commitments at the political level coupled with the branding effort and a demonstration project, which will be the non-motorized transportation plan for Pinggu’s downtown, which is being developed by the Energy Foundation.

Branding Best Practices

There are two distinct audiences for the SEED brand: governments and tourists; and, two distinct goals for the brand: create a replicable model and grow tourism. The SEED brand’s strength is that it can speak to both audiences and support both goals. There is ample evidence that investing in branding campaigns, particularly targeting tourism, pays off economically in the long run. There is also ample evidence in China that piloting a new development model is a proven method for scaling that model; just look at the success of the eco-city or Central Business District.

But there are many important lessons learned in branding campaigns that should be heeded in order for the SEED brand to live up to its potential. The following is a brief summary of the top three international best practices in branding:

- **Actions matter more than logos:** While branding campaign can bring undeniable economic benefit if done well, it is estimated that about 86 percent of city branding initiatives fail.³⁵ The number one reason they fail is because the government’s actions do not support the brand philosophy. It is not enough to create a logo and declare your city, municipality or district as a leader in sustainability; the policies and plans must reflect that sustainability philosophy. In other words, sustainability must permeate every aspect of government planning and become a part of the localities’ DNA.
- **All stakeholders need to buy into the vision:** A key element of successful branding campaigns is making sure that all of your key stakeholders – local officials, investors and residents – buy into the overall vision and are “singing from the same music”. This requires a strategic educational outreach effort to the different constituencies to ensure that they understand the SEED model and its goals as well as know how to talk about it.

³⁵ Samantha North, Why do most city branding campaigns fail? citymetric.com, August 21, 2014

- **Longevity:** Longevity is one of the most difficult elements to ensure, but one of the most important. For example, New York City has used the “I Heart NY” logo for more than 40 years; and, everyone around the world identifies the “I Heart” with New York City. While it is difficult to ensure that future political leadership will adopt the brand, creating a brand that stands the test of time, such as sustainability, will increase the odds that new political leadership may adopt the brand in part or in whole.



“Placemaking” Supports Branding

We have touched on the importance of sustainability in urban form and planning in this report, but these factors play a significant role in reinforcing a brand and attracting tourists. Known as “placemaking”, there is an emerging discipline that takes into account how public space is really used and maximizing its potential to attract people.³⁶ This concept incorporates principles from sustainable urban planning, such as more pedestrian streets, green spaces, bike paths, and mixed-use neighborhoods. These planning principles translate into improved environmental and economic performance for cities and attract more tourism—and repeat tourism. So while the brand may attract people to visit in the first place, a smart urban plan – or a city built for people – will actually keep them coming back. And, sustainable design can actually be a tourism marketing point.

Final Thoughts

There is oftentimes a perceived disconnect between sustainability and economic development. The perception is that it is expensive to adopt sustainable principles. It is expensive to mitigate climate change. But the evidence suggests otherwise so this perception is slowly changing.

On a corporate level, Dow Chemical talks about how the company invested \$1 billion into sustainability measures anticipating it would be a sunk cost. They ended up parlaying that investment into a \$6 billion profit. On a city level, the northwestern city of Portland, Oregon ranked 16th in the U.S. for GDP growth per capita over a period when they also lowered GHG emissions by 25 percent. And, on an economic level, Hank Paulson, Chairman of the Paulson Institute, partnered with former New York Mayor Michael Bloomberg and the Rhodium Group on an initiative called “Risky Business” that quantifies the economic risks to the United States posed by a changing climate. Mr. Paulson equates the failure to address climate change to the failure to address the issues leading to the economic downturn of 2008.³⁷ In China too, President Xi has declared war on pollution making environmental clean up a top priority. In doing so, he has considerably shifted expectations for the Chinese economy creating a “new normal” that prioritizing quality over quantity.

³⁶ <http://citybranding.typepad.com/city-branding/placemaking/>, December 15, 2015

³⁷ Henry M. Paulson, Jr. The Coming Climate Clash, New York Times, June 21, 2014.

It is against this backdrop that Pinggu embarks on this important initiative. Having the right vision is critical, now translating the vision into success will be the ultimate test. The Paulson Institute is pleased to be a part of this initiative and will be pleased to support Pinggu as it further develops its plans and programs.

APPENDIX I

SUMMARY OF RECOMMENDATIONS

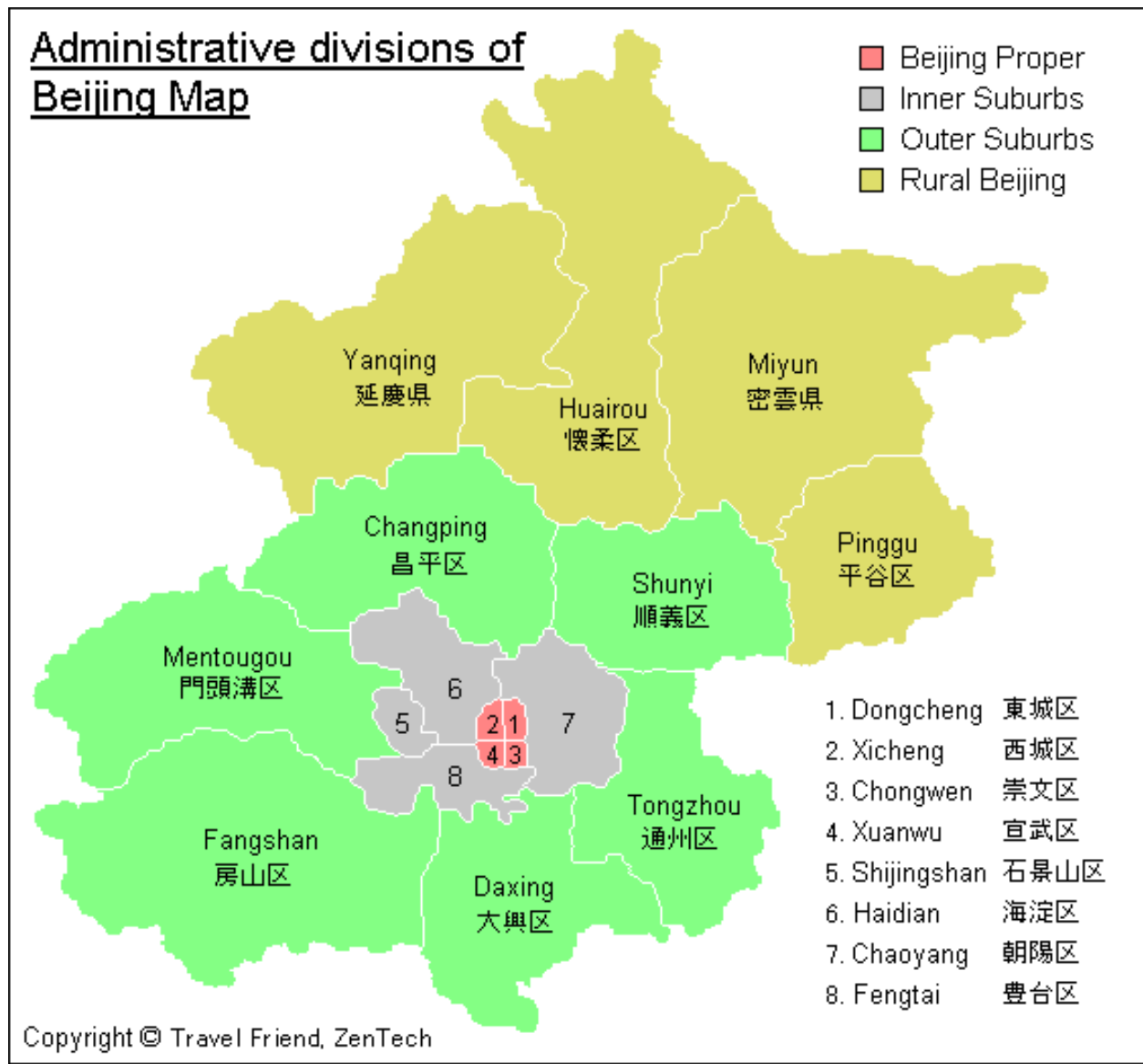
CATEGORY	#	RECOMMENDATION
ENERGY AND ENERGY EFFICIENCY	1	Set Targets for Efficiency and Renewables in Buildings
	2	Issue More Stringent Building Codes
	3	Develop Financial Incentives for Distributed Generation in Buildings
	4	Conduct energy Audits / Assessments
	5	Set Energy Management Standards
	6	Introduce Industrial Energy Efficiency Loans and Innovative Funds
	7	Implement Fuel-Switching
	8	Integrate Transportation Planning
	9	Adopt a Mixed-Use Urban Form
	10	Develop an Integrated Solid Waste Management Plan
AGRIBUSINESS	11	Scale Xibaidian Village
	11.1	Prove the commercial viability of the pilot project
	11.2	Identify and pursue financing solutions
	12	Support Brand Health
	12.1	Safeguard the Brand
	12.2	Further Establish the Brand via Customer Connection
	12.3	Co-brand with Eco-Tourism
	13	Support Agricultural Health
	13.1	Develop an organic waste collection, compost and application service
	13.2	Plant cover crops on annual fields and ground cover on perennial fields
ECO-TOURISM	14	Coordinate the Marketing Strategy
	14.1	Foster private sector marketing
	14.2	Leverage proven marketing techniques to develop a visitor database
	15	Develop Year Round Opportunities for Agri-tourism
	15.1	Expand beyond peaches
	15.2	Establish a permanent farmer's market
	15.3	Promote educational opportunities

	16	Protect Cultural Heritage and Promote Historic Tourism
	16.1	Explore securing UNESCO World Heritage status
	17	Expand and Improve the Recreational Trail System
	17.1	Produce a series of maps
	18	Establish World-Class Attraction Management Processes
	19	Spread Out Special Events and Encourage Longer Stays
	20	Package the Pinggu Experience
	21	Improve Transportation to the District and in the District
WATER CONSERVATION	22	Strengthen the Protection of Wetlands and Surface Water
	22.1	Improve the eco-conserving capacity by restoring wetland and recharging groundwater
	23	Expand Construction of the Urban Water System
	23.1	Enhance construction of rainfall and flood control installations
	24	Implement Natural Sewage Systems in Rural Areas
	24.1	Artificial wetland technology
	24.2	Capillary tube soil infiltration (quick infiltration sewage treatment technology)
	24.3	Distributed sewage treatment technology with stabilization ponds
	24.4	Biological contact oxidation
	24.5	Underground integration technology
	25	Ramp Up Protection of Groundwater in Pinggu District
	25.1	Further reduce agricultural groundwater consumption
	25.2	Further reduce GDP water consumption per RMB 10,000
	25.3	Promote the use of water-saving tools and raise public awareness
	25.4	Adopt rigid management on water resources, combine protection of groundwater with improvement of surface water quality.

APPENDIX II

PINGGU SNAPSHOT

Pinggu District, one of the 16 districts and counties of Beijing, is a predominantly rural District famous for its peaches and production of violins. It is located in the eastern edge of Beijing. Sitting at the juncture of Beijing, Tianjin and Hebei, it is 45 kilometers and 25 kilometers away from Beijing downtown and Beijing Capital International Airport respectively in the west and 110 kilometers and 130 kilometers away from Tianjin downtown and Tianjin New Harbor respectively in the south.



Geography & Population

Pinggu is 960 square kilometers with a permanent population of 420,000 inhabiting 16 townships, 2 sub-district offices, and 272 villages. The district is on a plain surrounded by mountains on three sides (north, south and east). It has a temperate monsoon climate with distinct seasons.

For planning and governance purposes, Pinggu District is divided into four zones: the Industrial Zone, the Urban Town, the Urban Expanding Area, and the Eco-Tour District. The Eco-Tour District is by far the largest portion of Pinggu comprising some two-thirds of the overall District.

Agriculture & Forestation

Pinggu District has nearly 50,000 acres in peach orchards, which represents its most significant product, although it has at least 26 other crops, including strawberries. The majority of farm products are shipped fresh into the Beijing market.

With the extensive peach orchards, Pinggu has a forest coverage ratio of 64.9 percent and a reforestation ratio of 69.8 percent.

APPENDIX III

APPLICABLE TECHNOLOGY FOR PINGGU'S LOW CARBON DEVELOPMENT

There are multiple key technologies in the industry, building, power, transport, water, and waste sectors. The following is a quick summary of technology that Pinggu can refer to improve its performance on low-carbon eco-city development.

Sector	Technology	Application	Cost	Mitigation potential
Industry	Energy monitoring and control systems	Demand forecasting, optimal plant operation, performance evaluation, investment planning, cost accounting, and energy benchmarking	Depends on the size of facility and the amount of sub-metering desired for individual processes and systems	Produces no direct energy savings but can be used as a benchmark tool
	Energy efficient motors	Centrifugal pumps, compressors, fan applications, materials processing (mills and machine tools), conveyors, and elevators	Typically cost 20 percent more than a conventional motor, but payback period can be as short as one year	2 - 8 percent
	Pump systems	Used widely across different industrial sectors	Purchase cost of a pump is only 5-10 percent of the total lifecycle cost of ownership and operation	20 percent on average
	Waste heat and water gas recovery	Applications abound in industry	In cement plants, a capital cost of such system ranges \$2-4 per annual ton of clinker capacity with operating costs of \$0.20-0.30 per ton of clinker	30 percent of the cement facility's energy needs
Building	Low U-value windows	Commercial new construction and major reconstruction with high window-to-wall area ratios that are fully conditioned and where the capital cost can be offset by the downsized HVAC equipment cost	A price premium of \$4 per square foot but prove to be cost effective in several climate zones on the basis of energy savings alone	20 - 40 percent reduction in heating and cooling
	Smart windows	Most applicable to new construction or major reconstruction projects, where the	For dimming controls, energy savings translated into payback periods of 1-10 years (ASHRAE 90.1-2001) and 2-18	20 percent reduction in cooling loads

		capital costs can be offset by decreased HVAC equipment costs	years (ASHRAE 90.1-2007) for installed costs in the \$5.40–43.00/m ² (\$0.50–4.00/ft ²) range; electrochromic window designs cost around \$100 per square foot in 2010	
	Cool roofs	In warm and hot climate regions that have long cooling seasons and short heating seasons	Asphalt shingle: \$2/ft ² ; built-up roof: \$2-\$4/ft ² ; clay tile: \$2-\$6/ft ² ; concrete tile: \$2-\$6/ft ² ; liquid applied coating: \$0-\$2/ft ² ; metal roof: \$2-\$4/ft ² ; modified bitumen: \$0-\$2/ft ² ; single-ply membrane: \$0-\$2/ft ² ; wood shake: \$0-\$2/ft ²	10 - 30 percent reduction in peak demand.
	Interior and exterior shading systems	New and retrofit construction	Cost data not available	Exterior shades: 53 - 67 percent energy savings in lighting; 79 - 94 percent savings in cooling loads
	Natural and hybrid ventilation	In locations with a moderate climate and clean outdoor air	Naturally ventilated buildings typically have lower capital costs for cooling and ventilation equipment, but some additional capital has to be spent on the facade and building fabric; capital costs for natural ventilation system elements, such as automated windows, can be comparable to air conditioning systems	Emission Reductions: Four of the six case study projects done in the UK saved between 24 - 71 percent of carbon emissions compared to the industry benchmark figures for an average air-conditioned building; cost savings are between 4,000 and 6,000 British Pounds a year
	Heat pump water heaters	Common in residential building, but increasingly common in commercial buildings	Slightly higher upfront cost but slightly lower operating costs	Up to 50 percent reduction in electricity use
	Advanced power strips	Kitchens, printer rooms, individual offices, and workstations in commercial buildings, and home entertainment or computer systems in residential buildings	Payback period less than 8 years in all applications	26 percent reduction in plug loads at workstations and about 50 percent in printer rooms and kitchens
	Lighting system improvements	Residential and commercial buildings	LEDs are more costly than CFLs; occupancy sensors have a payback period of half a year to several years	Large savings potential resulted from improved efficacy and longer bulb lifetimes
	Advanced metering infrastructure	Buildings that have the ability to control their HVAC, lighting, and other energy loads	Significantly higher upfront cost, including hardware and software purchases, labor expenses for meter installation, and consumer education	26 - 43 percent reduction in peak load from a pilot program
Power	Distributed	Commercial or large	Prices for an average system	Annual energy savings in cooling

	solar and Building Integrated PV (BIPV)	residential buildings	reach \$4.93/W with a payback time of 5-10 years	per unit conditioned roof area is 34.6 MJ/m ² (9.6 kWh/m ²) while in heating is 2.9 MJ/m ² (0.010 therm/m ²); annual prim energy savings in total source is 107.1 MJ/m ² (101 kBtu/m ²)
	Combined heat and power	Medium-sized commercial buildings (with peak electric loads ranging from 100 kW to 5 MW)	Gas turbines (5-40 MW): \$970/kW to \$1,300/kW; micro-turbines: \$2,400/kW to \$3,000/kW; natural gas spark-ignited engine gensets: \$1,100/kW to \$2,200/kW	In the case of New York City, estimated carbon savings is 2.3 Mt CO ₂ e for the building system and 5.0 Mt CO ₂ e for the microgrid scales respectively that use CHP
	Microgrids	Critical or controllable load source; Dispatchable generation (fuel cells or microturbines) or limited dispatchability generation (solar, wind) source	California's Santa Rita Jail microgrid project costs \$14 million (including a large-scale battery, new and legacy renewable energy sources and a fuel cell but excluding solar PV and energy efficiency measures); the cost of the battery was high and its purchase was only feasible with federal and state government grants; electrical storage costs still need to fall considerably to enable its widespread adoption	20 - 40 percent savings in heating and cooling
Transport	Electric vehicle	City bus, taxi, government official vehicle	Cost varies by modes over year, but could be comparable with conventional cars with government subsidy programs	A 2009 research of China's regional power grid using life-cycle-cost analysis shows that energy savings and CO ₂ emissions reduction varied between regions because of the share of coal-fired power in each region, but nationally, energy savings were 35.57 percent for pure battery electric vehicles (BEVs) and 17.78 percent for plug-in hybrid electric vehicles (PHEVs) and CO ₂ emissions reduction was 17.13 percent for BEVs and 8.56 percent for PHEVs
	Intelligent transportation system	Emergency vehicle notification systems, automatic road enforcement, variable speed limits, collision avoidance system and dynamic traffic light sequences	Capital cost of a transportation management center can range from \$1.8 million to \$11.0 million per facility, and its operations and maintenance cost can range from \$50,000 up to \$1.8 million per year	No single approach can be used to predict emission reductions contributed by ITS system, given it contains various applications
	Automatic bike rent/share system	Rapid growth seen worldwide	IA bike-share system includes capital costs (e.g. bike stations, bikes, permits, and design plans) and monthly operating cost. In North America, these costs can be partially covered from user fees, sponsorships,	The Capital Bikeshare program operated in Arlington County, Virginia estimates 1.6 million pounds of CO ₂ reduction in 2013 based on the number of miles traveled by users

			and advertising. A cost-benefit analysis for Capital Bikeshare program weighing both monetary and non-monetary costs and benefits projected a benefit-cost ratio of 1.72 over 20 years, using 7 percent discount rate	
	Smart parking system	Used in cities, universities for the garages, lots and street parking and transit	Initial capital cost for such a system typically is \$150 to \$250 per space and continuing operations and maintenance cost is \$40 to \$60 per space per year	A smart parking system in Ellicott City, MD reduced cruising time drivers spent looking for open spots by 21 percent; San Francisco's SF park, a smart parking project that adjusts parking prices according to local demand by pairing demand-responsive price management with smartphone application, reduced CO2 emissions and excess vehicle-miles traveled by 30 percent over a control area
	Rapid transit system	184 cities have built rapid transit systems as of 2012	Capital cost is high and often subsidized with soft loans and ancillary revenue	Success of bus rapid transit projects is typically measured by the increase of ridership; typical ridership gains range from 5 - 25 percent over previous local bus service on the corridor; the Los Angeles Metro Rapid reported an increase of 26,800 (42 percent) in weekday ridership on the on the Wilshire/Whittier corridor and 3,600 (27 percent) on the Ventura corridor; this was estimated to have reduced 9,188 metric tons of CO2 emissions -- 12,424 metric tons from mode shift, countered by an increase of 3,235 metric tons from additional transit service

Note: For a complete overview of each technology, please refer to the full report published by Lawrence Berkeley National Laboratory: Zhou Nan, He Gang, John Romankiewicz, David Fridley, and Cecilia Fino-Chen. (2015). *A Review of Commercially Available Technologies in Developing Low-carbon Eco-cities*.

APPENDIX IV

ABOUT THE AUTHORS

Michael Bendewald

Senior Associate, Rocky Mountain Institute

Michael Bendewald is a Senior Associate on Rocky Mountain Institute's Buildings Team. He leverages his practical understanding of energy efficient, smart, and healthy buildings to enhance real estate analysis and decision-making techniques. He currently leads the market delivery of the RMI practice guide on valuing energy efficiency and sustainability retrofits and supports RMI's Reinventing Fire program in China. As part of this effort, Michael develops strategic partnerships with trade associations, real estate product and service companies, and real estate owners and occupiers.

Cheng Maiyue

Managing Director, Rocky Mountain Institute

Maiyue Cheng brings 23 years of experience working on technology, investment and policy issues as well as innovation in growth models, smart cities, clean technology and education in mainland China, Hong Kong and the United States.

In his most recent role with RMI and Cisco, he is focused on low-carbon development, urban integrative design and IT applications for energy and efficiency. He has worked with leading Chinese cities, designing their development strategies, influencing policy-making and devising solutions to their infrastructure needs, often involving investment transactions in the billions of dollars. Earlier in his career he worked with the World Bank, Chinese SOEs, leading energy and telecom MNCs, and international management consultancies, with leadership roles in economic and financial analysis, business development, direct investment/private equity, and business strategy. Mr. Cheng participated in the research collaboration "Reinventing Fire – China (2050)" by RMI, ERI, LBNL and Energy Foundation China, as an initial step for a productive partnership between U.S. and China innovating for strategic policies and solutions for low-carbon development and green energy.

Mr. Cheng went to Fudan University, the Beijing Institute of International Relations and the Woodrow Wilson School at Princeton University. He has Bachelor's and Master's degrees in international relations, economics and public policy.

He Gang
Researcher on Energy and Climate Policy

Gang He is a graduate student researcher of China Energy Group, he is also a PhD candidate in the Energy and Resources Group at UC Berkeley. His work focuses on energy and climate change policy analysis, energy economics and energy modeling, low-carbon cities and low-carbon development, domestic coal and power sectors efficiency and emission mitigation. Prior to LBL, he has worked for Stanford University Program on Energy and Sustainable Development. He received an M.A. from Columbia University on Climate and Society and a B.S. from Peking University on Geography.

Hong Jianming
Professor, Capital Normal University

Hong Jianming serves as Professor in the College of Life Sciences at Capital Normal University. His research is focused on wetland ecological restoration technology and biodiversity conservation, and artificial wetlands water purification technology. He is also the Director of Beijing Environmental Education Research Center at Capital Normal University

Currently, he serves as a member of Wetland Ecological Professional Committee of Ecological Society of China / Member of the Popular Science Professional Committee, the National Wetlands Conservation Standardization Technical Committee, the Wetlands Conservation Engineering Projects Construction Standard Panel, and the National Wetlands Conservation Engineering Implementing Plan (13th Five Year Plan) Establishment Panel. He also serves as the Chief Professor of wetland restoration areas at the China State Forestry Bureau's Wetland Protection Management Center and as the Executive Deputy Director of Beijing Wetlands Research Center.

Professor Hong's work has been widely recognized by the Chinese government and international organizations. In 2003, his Wetland Protection Recommendation won commendation from the People's Government of Beijing Municipality and in 2012 won the Beijing Science and Technology Award for artificial wetland treatment technology for his rural domestic wastewater project. He won the Ford Auto Environmental Protection Award in 2006 for his wetland conservation and education project. And in 2007, he was awarded the Educational Innovation Model of Beijing City.

Professor Hong has undertaken and organized more than a dozen research projects throughout China, including in Inner Mongolia, Anhui, and Hebei provinces. He is widely recognized as one of China's leading authorities on wetland protection.

T. Destry Jarvis

President, Outdoor Recreation & Park Services, LLC

Destry Jarvis has spent the past 43 years working professionally in the parks, recreation, historic preservation, tourism, and youth engagement fields, in senior positions for both non-profit associations, the U.S. Department of the Interior, and as a for-profit consultant.

For the past twelve years, Mr. Jarvis has conducted high level consulting in policy and management of units of the national park system, cooperative land use planning at the local, state and federal levels, preservation of farmland and open spaces, public lands natural and cultural resources management, tourism marketing and policy, historic preservation, and recreation programs, carrying capacity determination, agri- and eco-tourism, appropriate development in public spaces, and concessions assessments.

Prior to his consulting business, Mr. Jarvis' professional positions included Executive Director, National Recreation & Park Association; Vice President, National Association of Service and Conservation Corps; Assistant Director, U.S. National Park Service; Senior Advisor to the Assistant Secretary, U.S. Department of the Interior; Executive Vice President, Student Conservation Association; and Vice President, National Parks Conservation Association. Mr. Jarvis served in the U.S. Army, including in Vietnam, with the rank of Captain.

Zhou Nan

Staff Scientist, Deputy Group Leader of the China Energy Group, Lawrence Berkeley National Laboratory

Nan Zhou is a Staff Scientist and the Deputy Group Leader of the China Energy Group of Lawrence Berkeley National Laboratory. In addition, since 2010 Dr. Zhou served as the Deputy Director of the U.S.-China Clean Energy Center-Building Energy Efficiency (CERCBE). In October 2012 she assumed the Director position for CERCBE. She has driven this program to meet challenging milestones while engaging with a complex joint U.S.-China stakeholder matrix and facilitated creation of a research program portfolio to focus on breakthrough energy efficiency building technologies. Nan Zhou has also co-initiated and is managing three major programs between LBNL and Chinese organizations: the LBNL-Shenzhen Institute for Buildings Research (IBR) Joint Program on Sustainable Communities, the LBNL Energy Efficiency Training Program for Chinese Industries, and the Tongji University-LBNL-University of California-Berkeley joint PostDoc Program. Dr. Zhou's research has focused on modeling and evaluating China's low-carbon development strategies, assessing building energy efficiency policies and technologies, and development and evaluation of China's appliance standards and labeling program. Additional work includes energy efficiency in industry; and assessments of energy efficiency policies.

Clay Stranger

Manager of the Office of the Chief Scientist, Rocky Mountain Institute

As Manager of the Office of the Chief Scientist at Rocky Mountain Institute, Clay oversees research, communications, and diverse engagements both within and outside RMI. Clay is also the founding Project Manager for Reinventing Fire: China, a partnership with the Chinese government to examine the maximum feasible share of renewables and energy efficiency in the Chinese economy through 2050. The project's aim is to develop a transparent, adjustable, and enduring model to inform China's energy future. Prior to joining RMI, Clay worked in viticulture, marketing, and social-business incubation. As a Wilderness Emergency Medical Technician, he has led expeditions in the Sierra Nevada, Himalaya, and Rocky Mountains.

Clay holds a BA in Ecology and Philosophy from the University of California, Santa Cruz, and an MBA from Bainbridge Graduate Institute.

Leigh Wedell

Chief Sustainability Officer, The Paulson Institute

Leigh Wedell, Chief Sustainability Officer at the Paulson Institute, has advised U.S. and Chinese companies on market access, profile raising and government relations for the past decade. She has worked with more than 40 companies from 20 business sectors. Previously, Wedell served as Managing Director for Albright Stonebridge Group, a consulting firm led by former Secretary of State Madeleine Albright and former National Security Advisor Sandy Berger, and Managing Director for MBP Consulting, a consulting practice of Mayer Brown, a top ten Chicago-based law firm. After leaving Stonebridge, she founded Wei Lei LLC, a strategic advisory firm.

Prior to her consulting work, Wedell was the Deputy Director of the Hong Kong-U.S. Business Council, a private-sector initiative administered by the U.S. Chamber of Commerce. In carrying out the U.S. Chamber's Asia trade agenda, she worked with U.S. Chamber member companies, state and local chambers of commerce, business coalitions, American Chambers of Commerce abroad, the U.S. government, and foreign governments. Wedell began her career at the International Republican Institute (IRI), a non-partisan, non-governmental organization dedicated to advancing democracy and the rule of law worldwide. She traveled extensively throughout China to implement programs relating to China's political and economic reform, including electoral reform at the village level.

Wedell received her Bachelor's Degree in Political Science and Master's Degree in International Relations and Asia Studies from Marquette University in Milwaukee, Wisconsin.

Yao Yuan**Visiting Faculty, Lawrence Berkeley National Laboratory**

Yao Yuan is a Visiting Faculty in the China Energy Group, Environmental Energy Technologies Division, of Lawrence Berkeley National Laboratory. He is the China Representative for the U.S.- China Clean Energy Research Center for Buildings Energy Efficiency (CERC-BEE) and the program manager for the LBNL-Shenzhen IBR Joint Research Center.

Dr. Yao's recent work includes managing government relations in China for CERC-BEE and coordinating between U.S. and Chinese researchers. Dr. Yao also manages the research progress of the LBNL-Shenzhen IBR Joint Research Center while exploring other research opportunities for the China Energy Group in China. Dr. Yao holds a PhD in Building Science from Tsinghua University. His PhD thesis was in the Indoor Air Quality area. He joined LBNL as an affiliate right after his graduation.

APPENDIX V

ABOUT THE PAULSON INSTITUTE

The Paulson Institute is an independent, non-partisan center located at the University of Chicago. Our work is grounded in the principle that today's most pressing economic and environmental challenges can be solved only if the United States and China work in complementary ways.

With offices in the United States and China, and partners around the globe, we take a “think and do” approach. Our mission is to advance global environmental protection and sustainable economic growth in the United States and China, while fostering broader understanding between the two countries.

The Institute was founded in 2011 by Henry M. Paulson, Jr., the 74th Secretary of the Treasury and former chief executive of Goldman Sachs, to promote economic growth and environmental preservation in both countries through programs, advocacy and research.