

Inclusivity and Sustainability:

Placing People at the Heart of Urbanization

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U rbanization: The Most Powerful Force for Economic Growth

In 2010, for the first time in world history, more than 50 percent of the global population lived in cities. By 2050, this number is expected to reach 75 percent. In China alone, 300 million people – almost the entire population of the United States – will move to a city in the next 15 years. By the time China’s level of urbanization reaches that of developed countries, the country will have approximately *one billion* urban residents, noted Premier Li Keqiang in March 2013. And, Premier Li added, because urbanization and industrialization are the main indicators of modernization, “this path is indeed unavoidable; we have no other choice.”

In the last generation, China has become the global face of one of the most extraordinary transformations in human history. The country’s efforts to urbanize have lifted millions of citizens out of poverty, spurred trillions of dollars of investment, created a rising middle class, and begun to unlock the country’s domestic demand. In the past 20 years, 8.5 percent of China’s GDP has been invested in infrastructure, including some 70 new airports, 43,000 kilometers of new expressways, and 22,000 kilometers of additional rail by 2015. “The huge potential that urbanization presents,” Premier Li added, “is the most powerful and lasting internal driving force for economic growth in this country.”

However, the challenge remaining before China is formidable. The country must build the rough equivalent of all of the cities and towns in the United States in less than two decades. The

cost of this development is estimated to be \$160 trillion, more than 10 times America’s Gross Domestic Product. What the United States did with 160 million people in the 1950s, China is now doing with more than a billion. While faced with many obstacles, China’s development path presents a historic opportunity to advance the well-being of its citizens while preserving the country’s rich traditions and celebrated culture.

The Current Challenge: Sustainable Growth with Quality of Life

Modernization has not come without cost to China despite concerted efforts to channel growth and forge a sustainable future. While the government has invested in solar, wind, oil, natural gas and hydro power generation; greenhouse gas emissions remain a challenge. This has led to high air pollution that affects parts of the country. Losses attributed to health issues, crop degradation, wastewater clean-up and pollution-related accidents were calculated in 2010 at 3.5 percent of GDP. Of course, this is not China’s problem alone; cities occupy 2% of the planet and are the main source of global economic growth and productivity, but account for 60 to 80 percent of energy consumption and 75 percent of carbon dioxide emissions. China’s success in developing the model for a smart and sustainable city matters to the well-being of the entire world.

A particularly promising area of improvement is new urban construction. Buildings currently account for 33% of China’s total energy consumption, and the government plans to add more than 1 billion square meters of green

building floor area by 2015. In a September 2013 research paper presented to the 8th Annual Meeting of the Chongqing Mayor's International Economic Advisory Council, "Demonstrating Global Leadership: Chongqing & the Symbiotic City," United Technologies Corporation laid out a series of best practices designed to maintain a balanced and sustainable urban environment, even as growth accelerates:

1. Recognize sustainability as an investment with an attractive return. Green building is accelerating around the world, with nearly a third of respondents in 62 countries indicating that greater than 60 percent of their design portfolio is associated with green building activity. One example of a marquee project in China, Carrier's recent Shanghai International Finance Center HVAC upgrade, led not only to a 40% improvement in chiller plant efficiency but returned annual savings of US\$1.2 million dollars.

2. Set explicit "green goals" to drive behavioral change and technological adoption. China's 12th Five Year Plan (2011-2015) included targets to cut energy and carbon intensity by 16% and 17%, respectively, by the end of 2015; and to boost the proportion of non-fossil fuels in primary energy consumption to 11.4%. The plan also featured a number of building efficiency policies and targets, including retrofitting existing buildings, installing smart meters in homes, and strengthening building codes and appliance efficiency standards. The country has an impressive record of continually raising expectations around environmental goals in ways that leverage innovation and design,

and which adopt best practices from around the globe.

3. Recognize efficient mobility and transportation as an essential feature of the sustainable city. Rapid urbanization requires substantial innovation in moving people safely and efficiently, especially in urban communities and transportation hubs, and as the population ages. China's "vertical challenge" is also global; today, elevators move the equivalent of the world's entire population every 72 hours, while the global elevator and escalator market totaled \$62 billion in 2012.

China is responding with energy and enthusiasm to the need for sustainable growth. Dr. Qiu Baoxing, the Vice Minister for Ministry of Housing and Urban-Rural Development, said recently that green building construction in China has surged from only 10 projects in 2008 to 389 in 2012.

A New Challenge: Putting People First

Premier Li summarized the puzzle faced by China's need to rapidly urbanize when he said, "It's no good to be poor in a beautiful environment, nor is it any good to be well off and live with the consequences of environmental degradation. We need to develop new thinking on development."

Increasingly, this new thinking has focused on the Chinese people themselves and the essential role they can play in supporting healthy growth and sustainability. Again, the challenge faced by China is daunting; a country of 9.6

million square kilometers is home to dozens of diverse groups, and across this vast landscape, the bedrock of Chinese culture has long been its village life. Urbanization has taken a huge toll on this great national treasure; in 2000, China had 3.7 million villages and in 2010 just 2.6 million, a loss of 300 villages per day. When residents move to cities they can lose their sense of community, traditions and history. One example is Nanxian, a famous center of woodblock printing outside of Tianjin, which has lost 36 villages in the last few years. With artisan knowledge no longer concentrated in a single region, it is unclear if Nanxian's tradition of woodblock printing will be transmitted to a new generation.

Chinese leaders recognize these challenges and appreciate keenly the need to build a new model for urbanization that encompasses rapid growth, sustainability, social equity, maintaining a link between people and land, and preserving tradition and culture. Culture is especially precious; one government project has identified about 9,700 examples of "intangible cultural heritage" around the country, from songs and dances to martial arts. As one administrator observed, "It would be a great pity if they are lost just as our country is on the road to prosperity."

Premier Li has laid out China's 21st century challenge in all its complexity: Industrialization and urbanization are the key to modernization and therefore unavoidable, but they must be sustainable, and now, China "must adhere to the principle of putting people first."

Developing a New Model: People-Centered and Place-Centered

This extraordinary challenge was taken up in May 2013 at the UNESCO International Congress in Hangzhou, resulting in the *Hangzhou Declaration*, which sought to place culture at the heart of sustainable development policies. The Declaration defined human progress broadly, emphasizing "harmony among peoples and between humans and nature, equity, dignity, well-being and sustainability." Culture, it said, was a source of creativity, knowledge, energy, innovation and renewal. The Declaration recommended a people-centered and place-centered approach to development and sustainability.

Among its key conclusions, the *Declaration* recognized that "one size does not fit all and that different cultural perspectives will result in different paths to development." Specific recommendations included the safeguarding of historic urban and rural areas along with their traditional knowledge and practices. This might influence urban and architectural design, including patterns of production and consumption. The traditional knowledge and skills of indigenous peoples should be overlaid on science and technology to optimize solutions.

The *Declaration* recognized then when people are uprooted from their villages, even if it improves their standard of living, protecting and nurturing culture and traditions in their new location can provide a sense of normalcy, a confidence in the future, and the ability to weather hard times. Insuring the representation

and participation of a city's disadvantaged groups also preserves the social fabric, improves economic returns and increases a city's competitiveness. In a very real sense, culture can make a community "sustainable" along with its environment. Vice Minister Qiu Baoxing has helped define this model of "new-type" urbanization by stressing the move from large, centralized infrastructure to smaller, scattered, high-density hubs that create healthy "microcirculation," and that make intelligent use of open space by greater reliance on underground development.

Sociologists Daniel Bell and Avner de-Shalit, in *The Spirit of Cities*, point out that Chinese cities have carried out research to affirm their own "spirit" (or "jingshen") in order to foster a sense of community, civic responsibility, urban planning and cultural heritage. In the same way that New Yorkers emphasize individualism, Parisians their art and culture, and Montrealers their linguistic heritage, research shows that Beijing residents value patriotism, inclusiveness, creativity and virtue, while Hangzhou residents place a clear focus on the environment. A strong civic spirit can also promote the economy, Bell and de-Shalit indicate, as the city of Qufu has shown in its creation of a "Confucius cultural special zone" designed to preserve and honor the hometown of Confucius and its numerous historic temples and cemeteries, some of which are listed as UNESCO World Heritage Sites.

Best Practices: Culture as a Tool in Sustainability

The use of culture as an essential tool in sustainability is just taking root in China as a "new-type" of urban development. It asks difficult questions, such as how brand new urban residents can participate in sustainable economic growth while preserving their history and traditions. It seeks more human-scaled urban patterns, including the idea of mixed-use, high-density areas; smaller city blocks; fewer automobiles and more pedestrian traffic. It depends on adapting technology to optimize its use in specific locations to insure safe, secure and mobile communities. It may even look to tradition and history as sources of economic growth in the form of leisure and tourism. In many ways, this new focus on culture tries to transplant and cultivate the sense of community so vital to Chinese village life in a way that will strengthen the country's vibrant new cities.

United Technologies Corporation has wide-ranging experience in dealing with the topics of growth, sustainability, secure and mobile communities, and vibrant cities. Over a century ago, Willis Carrier launched modern air conditioning in a printing plant in New York City, improving overnight the sustainability of industrial processes and setting the stage for the future of comfort cooling. Shortly thereafter, Otis Elevator introduced the gearless traction elevator that would become the standard in the elevator industry, changing forever the world's skyline, and the speed and mobility with which people access the urban landscape. Edwards, Chubb, and Kidde, all important members in the

United Technologies family, are preeminent global brands, renowned for their deep experience in protecting people and property throughout the urban centers of the world.

With \$63 billion in revenue and a presence in more than 180 countries, United Technologies is today a Global 100 company and one of the largest suppliers to the buildings industry in the world. Its products include efficient heating and cooling systems, elevators that capture waste energy, access control systems to efficiently manage resources, and environmentally responsible fire suppression systems. The company has a long and successful history in working with the public and private sectors to improve the quality of life in cities around the globe.

Having done business in China for over a century, United Technologies offers three “best practices” in support of China’s “new-type” urbanization, which emphasizes a people-centered and place-centered approach to sustainable development.

1. Champion the creation of mixed-use, high-density communities and low carbon eco-cities.

Perhaps surprisingly, New York City has the smallest per-capita carbon footprint of any American community – just 7.1 metric tons of greenhouse gases per resident per year, compared with a national average of 24.5. (Manhattan alone has an even smaller footprint, about the same as Sweden’s per-capita.) The reason is population density. Reducing the

distance people need to travel for work and play reduces energy use and waste of all kind. In particular, New York City has the lowest automobile-to-resident ratio of anyplace in the United States: less than 25 percent of Manhattan residents own even one car.

Research on cities suggests that when an urban hub doubles its size, resource needs increase by only 85 percent – yet economic activity increases by 15 percent per capita. This “clustering effect” remains the same no matter the size of the city, physicist Geoffrey West has reported. Take a person and “just move them to a city that’s twice as big,” West adds, “then all of a sudden they’ll do 15 percent more of everything we can measure.”

Chengdu, China’s westernmost megacity, is building a prototype urban center designed for 80,000 residents, all of whom will live and work within a 15-minute walk from one another. It has ambitious sustainability goals to cut energy use by 48 percent compared to a similar-sized Chinese city. As important for sustainability, however, Chengdu’s Migrant Management Office has been given an explicit mandate to help its migrant population access educational, health and community resources.

There are currently 200 prefecture-level cities in China with plans to develop low carbon eco-cities, a concept that includes reduced emissions, environmental protection, and economic and social sustainability. This means an emphasis on tailored, high-density development that takes advantage of local

history, culture and natural resources. Some, like Chenggong, involve entirely new construction.

Others like Huainan, involve “eco-remodeling.” Huainan has adopted the integrated philosophy of “industry promoting agriculture, city helping town, town helping village and city-town interacting with each other.” Its development activities range from the recovery and revitalization of wasteland from abandoned coal mines, to high-tech coal mine gas utilization, to attracting new, clean industries like pharmaceuticals, to protecting and leveraging its historic sites. This includes preserving the place of the famous Feishui Battle fought in 383AD, and serving as host to the popular Chinese Bean-Curd Cultural Festival – both of which have contributed to rapidly rising tourism revenue. Huainan includes many stakeholders in its planning, including residents. One observer noted, “People’s habits, behavior and life style choices have a deep impact on eco-city development.” A critical area of focus for the city is social equality.

Another eco-city that protects its cultural heritage to economic advantage is Nanning, the capital of Guangxi Zhuang autonomous region. Activity is centered in the Wuxiang New District and involves some 175 square kilometers including residential, administrative, infrastructure, amusement and recreation areas. In 2012 there were 154 projects underway as well as efforts to green the city through adoption of a large-scale tree-planting campaign. Carefully preserved cultural areas include

Qingxiu Mountain and Yangmei Ancient Town, featuring architecture from China’s dynastic past.

In a similar effort to promote green development, Laiyuan county government is strengthening its local economy through tourism, featuring scenic locations like Mount Baishishan, part of the Fangshan Global Geopark. This has created opportunities for villagers to provide room and meals to tourists, and ties the future of the 270,000 residents of Laiyuan county to sustainable assets “that will not dry up like other resources, such as minerals.”

Efforts to preserve tradition and history are also underway in some of the oldest, largest and densest of Chinese cities. In Dashilan, a district located south of Beijing’s Tian’anmen Square, local government has chosen to renovate the historic “hutongs,” or alley ways, rather than razing and replacing them with new houses and shops that only imitate ancient traditions. “The point here is the desire to preserve the old neighborhood and its human vitality, while driving it into modernity.” The “new” hutongs will feature design studios, art galleries, shops (and not just souvenir shops, but those serving residents), restaurants and inns – a high-density, mixed use that honors the past.

Finally, the Sino-Singapore Tianjin Eco-City, while still in its early phases, is designed to be a replicable, scalable model for sustainable development in China. The city, being built to accommodate 350,000 residents by 2020, features subsidized public housing designed to enable people of all incomes to live near and

interact with one another. All buildings in the city will meet international standards for green construction. Tianjin has focused on public transit to meet the needs of the elderly and mobility-impaired. This eco-city design also respects local history, preserving the 1,000-year-old Ji Canal and two existing villages, which will be conserved through adaptive reuse or partial rebuilding.

Of course, the high-density growth envisioned for China's eco-cities and so essential to building a strong sense of community presents its own set of challenges. Moving people comfortably and safely in urban environments requires careful planning and often advanced technologies. United Technologies has encouraged Chinese leaders to "recognize efficient mobility and transportation as an essential feature of the sustainable city." As the emphasis on horizontal travel shifts from automobiles to mass transit, the need for vertical transport to move people in and out of residence, work and transportation hubs in high-density, mixed-use areas becomes essential to quality of life. And this is true from the youngest and healthiest citizens to the poorest and least mobile. For example, the Chinese government is committed to enhancing social equality by building 36 million social housing apartments for low-income families by 2015. Through an intensive development effort, Otis became the first company to offer a flagship product in this important market. Green and affordable, the Gen2 Core™ unit features ReGen™ Drives, which can reduce energy use by up to 75% versus conventional machines. This innovative

technology was delivered by the company's Chongqing plant in 2012 and has already been adopted by resettlement and social housing projects in Nantong, Tianjin and Changchun.

In general, the pressure on high-density transportation nodes – the "handshakes" of a modern urban transportation system – will increase, just as the pressure on sustainable development has grown in the last decade. Already 64% of all travel kilometers made are urban, and travel in urban areas is expected to triple by 2050. In addition, the median age of China is forecast to grow from 34.6 in 2010 to 46.3 in 2050, a "12-year" demographic trend across 1.4 billion people which urban planners must address with effective vertical solutions.

Sustainability, mobility, quality of life and culture: While eco-cities are still in their infancy, their potential impact is nothing short of spectacular. If China is successful in creating high-density, mixed-use, sustainable cities with vibrant communities, it is estimated that as much as 800 million tons of carbon dioxide can be prevented by 2030 – more than that emitted by Germany in 2011.

2. There is no substitute for green building, an indispensable part of supporting healthy community in China's "new-type" urbanization.

In May 2013, United Technologies published a study in collaboration with the Rhodium Group analyzing the impact of a 30% improvement in U.S. building efficiency by 2030. This improvement, possible *with existing technology*

and design practices, would generate \$65 billion annually in savings, net of investment costs, for American households, businesses and governments and offered an IRR of 28.6% over a 10-year period. “Globally,” the Rhodium report concluded – and particularly important to China – “improving building efficiency in rapidly urbanizing emerging economies could create a \$1.8 trillion market for energy-efficient building design and technology.”

Building owners around the globe are realizing the economic value in green buildings, with nearly half saying that going green can boost a building’s value by more than 6 percent, and 16% saying the value premium is more than 10 percent. An Otis customer in Guangzhou recently constructed one of the greenest skyscrapers in the world with zero-impact on the environment. It features wind turbines embedded in the building, solar power, and energy/efficient air conditioning and elevators. Estimates are that such energy-efficient technology will reduce the costs to power the building by at least 50% relative to structures of comparable size. Construction costs for the skyscraper exceeded those to build a less energy-efficient structure, but projections indicate a five-year payback through reduced energy consumption and the absence of conventional oversized equipment that provides property owners additional square footage to let. Green investments upfront are proving to provide an attractive return over the entire life of a building.

This all bodes well for China’s cities, which have abundant existing building stock ripe for green investments, and where massive future outlays on infrastructure projects are forecast. Through education and example, China can help lead this green revolution, providing attractive returns for its building owners, enhanced quality of life for its residents, and helping to create a true symbiotic city, one green building at a time.

Inherent in this best practice is the creation of not just green buildings, but of green districts that optimize resource consumption at scale. For example, the city of Copenhagen has invested substantially in green infrastructure and is now ranked the most sustainable city in Europe. Features include centralized heating systems by district, and a world-class infrastructure for non-automobile transportation. All residents live within a quarter mile of public transportation. The city features 241 miles of cycling routes. Copenhagen is also piloting carbon-neutral neighborhoods with energy-efficient residential and commercial buildings, sustainable energy networks, and low-emission transportation systems.

Another different but useful example of high-density hubs dependent on sustainability, mobility and security – from which China’s emerging eco-cities might draw an abundance of valuable lessons – are global, international airports. United Technologies’ Carrier is supplying HVAC systems for the new Midfield Concourse development at Hong Kong International Airport (HKIA), with sister company Chubb also providing advanced video security

and access control. In 2013, HKIA became the first airport in Asia-Pacific to be awarded an Airport Carbon Accreditation “Optimization” certificate for its management and reduction of carbon emissions, achieving a carbon intensity reduction of nearly 14% over the past two years.

Premier Li has cautioned his countrymen in the past that “environmental problems are generated during the process of development, and thus should be solved during development.” China’s “new-type” urbanization is taking this lesson to heart, focused from the start on green building and sustainable solutions.

3. Encourage China to continually test and adopt best practices from sustainable, culturally vibrant cities around the world.

China has already shown great skill in adopting best practices in its high-growth urban hubs, often bypassing outdated ideas and technologies. Some of these best-of-class cities embrace smart technologies and the use of data to promote sustainability, reduce cost and support quality of life and community. Others hold themselves to targets that specifically promote community and culture. Still others develop powerful public-private partnerships.

Nearby, the urban hub in Songdo, adjacent to Seoul in South Korea, was designed from the start with smart technology in mind. Still in its infancy, Songdo uses sensors to monitor energy use and traffic flow, even alerting riders to their bus arrival time. The city offers charging stations for electric cars and a water-recycling system that prevents clean water from being used to

flush office toilets. All kitchen waste is sucked directly from individual kitchens through an underground network of tunnels to waste processing centers – and some of this waste will eventually be used to produce energy. To promote community and culture, Songdo is designed around a central park that allows every resident to walk to work.

Rio de Janeiro is working to include smart city elements in its growth. In a project coordinated with UNICEF, teenagers take aerial shots of their neighborhoods using digital cameras launched via kites. These pictures are then uploaded to a central database and used to identify breeding grounds for mosquitoes associated with dengue fever. City-wide cameras and a central operations center can also measure motor accidents and detect potential flooding, allowing government to move residents from harm’s way. The central operations center also hosts a platform that allows residents to interact directly with government. Rio’s attempt to use the highest-tech solutions to meet the most basic needs of the community, involving residents at all levels, is aligned with China’s new-type urbanization.

Best practices involve setting targets that relate not just to sustainability, but directly to community and quality of life. The green building initiative in New York City includes energy efficiency initiatives for public housing, smaller buildings, historic buildings and city government buildings, as well as improved regulations and compliance. Its goals are to improve air quality, increase water conservation and reduce waste.

But the city has also set targets for goals clearly focused on enhancing community, like the percent of new housing units within a half-mile of transit, and the percent of New Yorkers within a quarter mile of a park.

Finally, best practices are also being developed in the area of public-private partnerships (PPPs) designed to enrich community. The *Hangzhou Declaration* recommended that “the great and unexplored potential of public-private partnerships can provide alternative and sustainable models for cooperation in support of culture.” Rio has created a series of partnerships to redevelop its old port area and infrastructure, private investment that has freed up public funds to support essential services like schools. The city of Vancouver, Canada has \$3.5 billion worth of PPPs designed to improve transportation infrastructure.

United Technologies itself has worked for years with the American Architecture Foundation, a private organization designated by the Federal government to train U.S. mayors on sustainable city planning. United Technologies has also partnered for many years with China’s Ministry of Housing and Urban-rural Development and its Chinese Society for Urban Studies (CSUS), particularly in the establishment and support of the China Green Building Council. United Technologies Building & Industrial Systems has been singularly effective in partnering with other groups to drive thought leadership around sustainable energy.

Looking Ahead

Chinese leadership fully understands both the rewards and risks of rapid modernization. In response to growing awareness of environmental issues, the government shifted in 2005 from a “growth first” strategy to one of “sustainable development,” eventually creating the powerful eco-city program. People “want to live their lives in peace, with good work and a decent salary,” Premier Li said, “but also with a blue sky and clean rivers.”

Chinese leaders have recognized the importance of social equity, tradition, history and culture in building new communities that support truly sustainable cities. This new-type urbanization has begun to emerge in places like Tianjin and Chengdu, in megacities like Beijing, and in rural locations just beginning their development as urban hubs. A flexible range of ideas integrating people, landscape and architecture is at work. Many revolve around the concept of high-density, mixed-use development that is compact and walkable – a form of urbanization that uses advanced technologies to promote both sustainability and a sense of community. This mix of technology and tradition is especially inspiring; Nobel Prize-winning economist Joseph Stiglitz believes that “China’s urbanization and the United States’ high-tech development will be the two key phenomena that shape the world in the 21st century.”

The stakes are enormous. The Carnegie Endowment for International Peace has concluded that a country’s ability to manage its cities will determine its global competitiveness,

and some believe urbanization is the most important trend in China's long, rich history. As 300 million Chinese migrate to cities in the next two decades, China's new-type urbanization gives them the opportunity to maintain their quality of life while substantially raising their

standard of living – all while retaining their cultural spirit. “Culture forms the most stable, unchanging characteristic of a given setting,” one scholar has written, and is “an important factor in determining the process and content of sustainable cities.”