Complexity, Security and Civil Society in East Asia

Foreign Policies and the Korean Peninsula

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Chapter 4

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4. Urban Security and Complexity in Northeast Asia

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Introduction

Irreversible and rampant globalization has transformed every aspect of the economic, social, cultural, legal, political, military, and environmental spheres of daily life. "In this respect," writes David Held,

> [G]lobalization is akin to a process of 'structuration' in so far as it is a product of both the individual actions of, and the cumulative interactions between, countless agencies and institutions across the globe… But it is also a highly stratified structure since globalization is profoundly uneven… Globalization is best understood as a multifaceted or differentiated social phenomenon. It cannot be conceived as a singular condition but instead refers to patterns of growing global interconnectedness within all the key domains of social activity… Under conditions of globalization, 'local,' 'national' or even 'continental' political, social and economic space is re-formed such that it is no longer necessarily coterminous with established legal and territorial boundaries.[1]

Due to globalization, we face not only local and national problems, but also manifold global problems like climate change, biodiversity and

1 Held, D., *Global Transformations: Politics, Economics and Culture* (Redwood City: Stanford University Press, 1999).

 http://dx.doi.org/10.11647/OBP.0059.04

ecosystem loss, fisheries depletion, deforestation, water deficits, maritime safety and pollution, global financial crises, illegal drugs and trafficking, the digital divide, terrorism, the international migration of laborers, the inappropriate regulation of international investment, the lack of reliable and safe biotechnology, and so forth.[2]

The most significant characteristic of a global problem is that it is very complex. Cities have become complex systems by virtue of their intersection with multiple global problems. In complex systems, there are more agents, more interactions, more decentralized decision-making, more feedback loops, and more unpredictable outcomes than in a simple system.[3] Beset by global problems, the security of cities is threatened from many different directions at the same time. As a result, cities face new vulnerabilities and uncertainties as globalization proceeds apace. Conversely, by exploiting their increasing interdependence, cities can learn from each other and contribute to creating cross-city solutions to these common problems via complex, networked, and shared strategies.

The spatial inflection of globalization is vast and drives rapid urbanization across the globe. According to the UN Department of Economic and Social Affairs (UN DESA) *World Urbanization Prospects* report in 2010,[4] almost two thirds of humanity already live or soon will live in urban areas. "Between 2009 and 2050," states the report, "the world population is expected to increase by 2.3 billion, passing from 6.8 billion to 9.1 billion. At the same time, the population living in urban areas is projected to gain 2.9 billion, passing from 3.4 billion in 2009 to 6.3 billion in 2050."[5]

Even more striking is the rise of "mega-cities" (those with more than 8 million) and "hyper-cities" (those with over 20 million inhabitants).[6] During the period from 1950-1975, only three cities (Tokyo, New York, and Mexico City) had more than 10 million inhabitants. From 2009-2025, however, twenty-nine cities are expected to have more than 10 million inhabitants. Tokyo, for example, will have 37 million inhabitants in 2025.[7]

2 Rischard, J.F. (2002).

3 Harrison, N.E., *Complexity in World Politics: Concepts and Methods of a New Paradigm* (New York: State University of New York Press, 2006).

4 United Nations, Department of Economic and Social Affairs, Population Division, *World Urbanization Prospects, the 2009 Revision* (New York: United Nations, 2010).

5 Ibid., p. 1.

6 Davis, M., *Planet of Slums* (London: Vigo, 2006).

7 United Nations, Department of Economic and Social Affairs, Population Division (2010).

The burgeoning of megacities has two distinct characteristics. First, this unprecedented urbanization increases inequality within and between cities with different sizes and economic functions. Although most of the population will still live in smaller cities in an urbanized world in 2015, "there is little or no planning to accommodate these people or provide them with services" due to the dominant demand of the megacities.[8] That is, megacities will gain the benefits of globalized investment, trade, and financing while the costs arising from the growth of urban populations will remain concentrated in small and medium-sized cities.[9] And with the dominance of neoliberal capitalism, the daily life of ordinary people will be affected profoundly by the continued existence of inequality of income and wealth between the relatively wealthy and the vastly poor. This dichotomy results in social conflict between and within cities.

Second, globalization also changes the relationship between cities and rural areas. Traditionally, we have conceptualized cities and the countryside at opposite ends of one spectrum. However, with the extension of megacities into rural areas, especially in China and Indonesia, cities and countryside have fused. As Michael Davis puts it, "In many cases, rural people no longer have to migrate to the city; it migrates to them."[10] Such rural-urban hybrid settlements are called "*desakotas*" (city villages). In this case, rural areas are urbanizing "not through rural depopulation to the cities with their subsequent outward growth, but through a process of spontaneous change in which a majority of the rural population are transforming their lifestyles and activities into urban pursuits *in situ*."[11]

Deepening disparity or inequality of cities and the rise of *desakota* settlements are emergent phenomena that reflect the bottom-up transformation of human settlement and land use by globalization. In the wake of this transformation, the provision of appropriate services to the increased population is under serious threat. In particular, the provision of infrastructure to provide important services like water, food, energy, and transport is critically important for urban security in each city. Because the provision and management of infrastructure entails the investment of capital, implementation of new technology, management of social conflict,

8 Davis, M. (2006), p. 7.
9 Ibid.
10 Ibid., p. 9.
11 Xie, Y., *et al.* (2005).

and solving of environmental problems, infrastructure becomes highly politicized.[12] Superimposed on this political economy are other challenges such as climate change, resource constraints, violence and conflicts, economic depression, non-state terrorism, and so forth. Sustainable provision and good governance of "smart critical infrastructure" has become, therefore, the central concern for creating secure and sustainable cities. Conversely, without provision of proper critical infrastructure and its good governance, urbanization in an era of globalization leads to more, not less, insecurity and vulnerability, thereby undermining the provision of human security in various forms — the very essence of city formation. Thus, Martin Coward juxtaposes urbanization and security as reciprocal dynamics. He suggested that the security agenda is urbanized and that urbanity is securitized. He calls this antithesis the "urbanization of security."[13] Security in this sense has many dimensions. Some dimensions are contradictory and many are intricately connected to external, often global forces unamenable to local control.

The "urbanization of security" and "politicization of urban infrastructure" leaves urban infrastructure managers with multiple dilemmas. Key questions to answer include the following:

- Who is responsible for sustaining and reproducing the critical infrastructures of cities facing multiple threats like climate change, resources constraints, violence, terrorism, and other insecurities?
- How are they held responsible?
- Is critical urban infrastructure resilient to those threats?
- Which urban form is more resilient to those threats? Closed, separated cities or networked, open, agglomerated cities?

In this chapter, we examine how globalization affects cities in Northeast Asia. We begin by noting the different historical origins of urban form and land use, which in turn affect a city's relative vulnerability to a variety of global threats. We note how the evolution of land use and urban form varies greatly due to local, historical, and contemporary factors, but we also observe how the evolution of urban corridors and *in-situ* urbanization

12 Hodson, M. and Marvin, S., "'Urban Ecological Security': A New Urban Paradigm?," *International Journal of Urban and Regional Research*, 33 (1) (2009), doi: http://dx.doi.org/10.1111/j.1468-2427.2009.00832.x

13 Coward, M., "Network-Centric Violence, Critical Infrastructure and the Urbanization of Security," *Security Dialogue*, 40(4-5) (2009), doi: http://dx.doi.org/10.1177/0967010609342879.

of "rural" settlements in a globalized economy may surpass the capacities of traditional urban authorities and stimulate new forms of networked, cross-border governance. Next, we investigate how cities in the region adapt to energy insecurities. We note how local urban form and density are major drivers of multiple dimensions of energy insecurity that arise from exogenous factors associated with the potential failure of global energy markets and the vulnerability of cities to energy-driven climate impacts—especially thermal stress and heat islands in major cities.

In the next section, we identify the already visible impacts of global climate change on cities in Northeast Asia, including its amplification of the already noted effects of land use on energy insecurity, as well as those of floods, storm surges, and the increasing frequency and intensity of storms on cities.

In the final section, we observe that traditional forms of international cooperation executed by central governments are slow, bureaucratic, and often result in little change. We argue that city-city linkages are far more likely to create solutions commensurate with these rapidly evolving, linked problems. Moreover, we suggest that such a networked approach will create extra-city, networked forms of resilience, thereby preparing cities to respond to the shared shocks that may arise as climate change reaches various tipping points or to bottom-up, game-changing dynamics such as non-state threats to urban security. This inter-city approach, supplemented by agile civil society networks able to span borders and fill structural holes between different cities, and between cities and central authorities, increases social complexity to match the increasing complexity of the problems that beset cities.

In this respect, we suggest that civil society organizations working closely with city governments are seeds dropped into an already super-saturated solution. Although they are small, they lead to the rapid precipitation of crystals and to a new, emergent pattern of decentralized, networked governance that supplements and supersedes, but in no way substitutes for, the role of states in the region.

Multiple Threats to Cities in Northeast Asia

We will now apply these arguments and questions to cities in Northeast Asia. Northeast Asian countries have some common features. Except for Japan, they all experienced post-colonial, nation-state-led urbanization.

In Seoul, Tokyo, and Shanghai, cities relied on a "growth-only-oriented" urban policy. Central states designated specific cities to pursue this growth strategy. Additionally, for some cities in South Korea and Japan, North Korea poses a concrete military and economic threat due to its ability to deliver an artillery or rocket attack, implicating these cities in an inter-Korean war. Thus, cities in this area also live in a potential warzone that poses additional risks in common.

However, Northeast Asian cities also differ from each other in many ways. Some are on socialist paths of urbanization; others are completely capitalist in nature. The cities have different locations in the global network of cities, and they are positioned differently in the topology of global cities. In fact, it is easy to get lost in the diverse characteristics of cities in each country. In each country, there is a hierarchy of urban scale. In addressing the challenges posed by globalization, we must specify what type of cities we are dealing with: small- and medium-scale cities, large cities, metropolises, megalopolises, urban corridors, and so on. Here, we focus on world cities like Tokyo, Beijing, and Seoul. Smaller cities can be included for discussion, however, provided we recognize how the specificity of the issue varies as a function of scale. As we shall see, smaller cities are often more agile and more creative than mega-cities in adopting new strategies to respond to the pressures of globalization and globalized threats. In Table 4.1, we present a taxonomy of the multiple threats faced by world cities in Northeast Asia in four dimensions: political, social, environmental, and economic.

Table 4.1: Multiple threats to Cities in Northeast Asia

Political aspect	**Social aspect**	**Environmental aspect**	**Economic aspect**
DPRK threat of attack	Demographic instability	Natural /artificial disaster	Unsustainable supply chain
Dependency upon central government	Migration/ immigration (households)	Climate change related disaster	Japanese recession
City-rural relations	Limited professional opportunities	Food dependency on imports	Market investment trend
Non-state terrorism	Asymmetry of population structure	Water from long distance	Construction-biased economy
Territorial disputes	Aging city	Concentration of risky facilities	Shortage of jobs

Urbanization of Northeast Asian Cities

In this chapter, we will not attend to all of these dimensions —many more could have been included in Table 4.1. Rather, we will begin with an overview of the urban form and land use of major cities in South Korea, Japan, and China. We will identify some of the drivers that explain their different vulnerabilities to global threats and their strategies in response to these threats.

Urbanization of Seoul

The urbanization of South Korea can be characterized as "compressed urbanization," meaning that all the steps and cycles of modernization, the transformation of social life, occurred in a short time.[14] The urbanization was relatively smooth and successful, although there social conflicts arose as a result of redevelopment and providing houses. As the locational inertia of traditional cities has affected the urbanization process, most large cities in South Korea were built on the sites of older big cities.[15] In particular, Seoul, the capital of the Chosun dynasty (1492-1910), accumulated advantages such as physical infrastructure, economic and social/cultural capital, educational opportunities, human resources, social services, networking, and so forth. Therefore, concentration on the Seoul Metropolitan Area (hereafter SMA) is the single most noticeable feature of urbanization in South Korea. The capital region population increased from 21 percent of the national population in 1960 to 48 percent in 2005. In 1960, there were only two million-sized cities in South Korea, but by 2003, there were eight. Overall, the urbanization rate increased from 37 percent in 1960 to 90 percent in 2000. Today, therefore, most South Koreans live in urban areas. We list the socio-spatial characteristics of the South Korean urbanization process in Table 4.2.

The government used many policies during the 1990s to cope with the problems of population concentration in SMA, such as land shortages for housing and the skyrocketing price of housing for the middle class. The regulation of the floor area ratio, for example, was reduced by up to 400 percent, enabling the construction of high-rise buildings and five

14 Cho, M., "Trends and Prospects of Urbanization in Korea: Reflections on Korean Cities" (Korean Language), *Economy and Society*, 30(29) (2003).
15 Ibid., p. 27.

new satellite cities near Seoul. The "joint redevelopment method" for the provision of high-rise apartments was adopted, and the restructuring or remodeling of dilapidated houses and the building of multi-owner or multi-family houses was promoted.

Table 4.2: Urbanization and Socialization of South Korea

Period	Mid 50s-early 60s	Mid 60s-mid 70s	Late 70s-late 80s	Early 90s-present
Steps of urbanization	Leaping stage	Growing stage	Accelerating stage	Maturing stage
Mode of urbanization	Selective urbanization	Concentrating urbanization	Regional urbanization	Dispersed and metropolitan urbanization
Pattern of social change	• High mobility • Leaving rural community • State-led economic develop-ment • Military dictator-ship	• Settling in urban area • Urban slums and apartments • Informal sectors and conglomeration • Export and heavy indus-try oriented industrialization • Authoritative regime	• Expansion of urban employment • Expansion of urban culture • Urban middle class • Domination of conglomeration • New industrialization • Democratization	• Urban generation • Intensive consumption • Liberalization • Economic crisis • Knowledge/ venture capital • Segregation of employment and class relation • Vitalization of civic politics

Source: Adapted from Cho, M., "Trends and Prospects of Urbanization in Korea: Reflections on Korean Cities" (Korean language), *Economy and Society*, 30(29) 2003.

Of these, the "joint redevelopment method" for the provision of housing was uniquely South Korean. In projects designated for "joint redevelopment," owners of land or houses within the designated area for redevelopment could establish a "house redevelopment union" and pursue redevelopment by financial support from private construction companies. In most cases, high-rise apartments replaced dilapidated houses, and the number of houses exceeded that of union members. Then they sold the surplus house stocks (including their own new houses) on the open housing market, earning windfall profits in the rapidly growing South Korean real estate market at that time. The only role of public agencies was to set the spatial boundary for redevelopment. In fact, joint redevelopment was sort of a win-win game for stakeholders — but not for tenants. Typically, the tenants of dilapidated houses were evicted violently without proper compensation before enactment of the "law of protection of housing tenants" in 2001.

Private construction companies that exploited public sector support, which provided legal and institutional means to privatize a public asset, led this process of urbanization. Thus, the urbanization process was commercialized and houses were only provided that could be sold privately for profit. In this system, the public sector did not provide housing for low-income populations who could not compete in the private real estate market. Thus the human right to shelter, a meaningful housing-welfare system, and the basic dignity of the poor were neglected. During this period of South Korean urbanization, only money mattered, not people. As a result, high-rise apartments dominate the urban landscape of South Korea.

This development pathway was heavily biased by commercial interests and deepened the vulnerability of cities. Land used for agriculture had low market returns and was transformed into commercial land for housing, paved roads, and industry. According to the 2009 survey, total agricultural land amounted to 1.8 million hectares[16] — a 1.3 percent drop from 2008. As a result, rice paddy fields fell by 3.4 percent (36 thousand hectares) over the same period. As rice is a domestically produced staple crop for Koreans (unlike other food crops), the food security of cities is thus being steadily reduced from year to year.

To serve the residence of apartment dominant cities, roads were constructed. In 2008, the roads of South Korea totalled 104,236 km, of which 79 percent paved. In the case of metropolitan cities, 99 percent of roads were paved.[17] The increase in paved roads was expected to improve the speed of traffic, but it turned out to have the opposite result: heavy traffic jams followed the surge in private cars. Also, paved roads decreased the number of permeable surfaces and open spaces. In particular, developed hillsides do not hold water well. Urban development relying solely on drainage systems cannot solve the problem of draining away heavy rainfall, nor the problem of landslides. Consequently, Seoul is vulnerable to flooding. On

16 Statistics Korea, *Survey on Agricultural Land* (Daejeon: Statistics Korea, 2009).

17 Ministry of Land, Transportation and Maritime Affairs, *Report on Status of Roads* (Seoul: Korean Ministry of Land, Transportation and Maritime Affairs, 2009).

July 27, 2011, for example, an unimaginable disaster occurred in downtown Seoul after unexpected heavy rain.

In addition to these escalating vulnerabilities that stemmed from the redevelopment strategy, citizens were obliged to depend heavily on fossil fuels. According to Gupta, South Korea is the second most vulnerable among twenty-six net oil importing countries in 2004.[18] Gupta's oil vulnerability index shows a country's relative sensitivity to the international oil market, with a higher index implying higher vulnerability. The index is based on various indicators like the ratio of value of oil imports to gross domestic product (GDP), oil consumption per unit of GDP, GDP per capita and oil share in total energy supply, the ratio of domestic reserves to oil consumption, exposure to geopolitical oil market concentration risks as measured by net oil import dependence, diversification of supply sources, political risk in oil-supplying countries, and market liquidity.[19]

Urbanization of Tokyo

Tokyo presents a different story to Seoul. As the capital of the Tokugawa Shogunate, established in 1603, Tokyo was named *wad Edo*. Edo became Japan's political center with a population surge in the early 18th century. It quickly developed into a metropolis of more than a million people. In 1868, after the collapse of the Shogunate, the city came under the control of the Meiji government and was renamed Tokyo. In the Taisho period, the influx of people to Tokyo went further and the population reached approximately 3.5 million by the beginning of the 20th century. Most of the city was destroyed, however, by the Great Kanto Earthquake in 1923. Toward the end of World War II, moreover, Tokyo was again destroyed by massive air raids. Most areas were totally ruined.

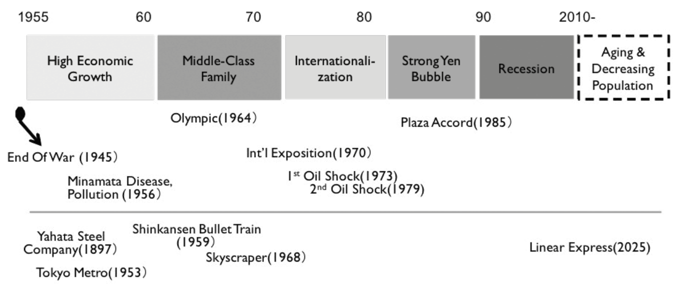
The urbanization of Tokyo underwent massive societal change after World War II, as shown in Figure 4.1. In 1897, Japan already had a highly-skilled labor force employed by the Yawata Iron & Steel Works. In the second half of the 20th century, essential public technologies such as the Shinkansen railway network (1959) and the Kasumigaseki skyscraper (1968) symbolized the development of cities through robust economic growth. Post-war reconstruction was virtually complete by the Tokyo Olympics in

18 Gupta, E., "Oil Vulnerability Index of Oil-Importing Countries," *Energy Policy*, 36(3) (2008), doi: http://dx.doi.org/10.1016/j.enpol.2007.11.011.

19 Ibid.

1964, and the city is now the paramount political and economic center of Japan, with a population of more than 10 million. Tokyo is still advancing, and, for a giant city, its public places are unusually safe and clean.

Figure 4.1: Post-WWII Transition in Japanese Society



Source: Minato, T., "Urban Security," presentation prepared for the Nautilus Institute workshop *Interconnected Global Problems in Northeast Asia*, Seoul, Korea, October 20, 2010.

Although Tokyo has led Japanese economic development, there are still unresolved issues. The areas of unused land around Tokyo Bay (nearly 900 ha) have been left vacant after factories were relocated, and many of these sites are contaminated and cannot be used easily. Redevelopment of these sites is also constrained by lack of accessible infrastructure and by contending stakeholders who block a public consensus for action.

In Japan, economic and political resources such as population and capital are over-concentrated in Tokyo. The transportation system, for example, followed a steady expansion to satisfy increasing demand. While some efficiency was achieved, there is a deadly commuter rush on workdays, in addition to pollution, garbage, and the omnipresent danger of the capital city being destroyed by earthquake and floods, or even terrorism and war. As a result, there is a need to take action on the over-concentration in Tokyo.

A blueprint of Tokyo in the future will be determined by socio-economic factors and by technological progress that may influence the basic structure of cities. Japan's aging population is an especially powerful driver of change. Aging leads to an increase in social welfare budgets and, at the same time, to falling personal savings. A decrease in the birthrate will lead to a smaller workforce, in turn dampening economic growth. Conversely, technological change is also a powerful driver and induces changes in lifestyle. Table 4.3 shows a projected image of urban life in Japan should economic development gradually deteriorate due to key causes such as the aging population.

Table 4.3: Boundary Image of Futuristic Cities in Japan

	Compact	**Pastoral**
Description	Homogeneous 'parasite' families moving in cities	Heterogeneous landscape (food, resorts, etc.)
Key drivers	Economic growth	Innovative technologies
Business	Ventures by elderly, women	Telecommuting work
	Conglomerate	P to P business
Transportation	Public and vertical	Personal and horizontal
	Automated commuter, walking	Hybrid-car, rapid train network
Welfare	Multifunctional services in one residence, intensive care	Self medical care, robots
		Remote education
Energy	Centralized, Building & Home Energy Management Systems	Distributed, de-commercialized, self-generation
	Micro, mobile electricity	
Security/safety	Centralized	Individual monitoring, tracing, alarm system
	Gated city	Open City

Source: Minato, T., "Urban Security," presentation prepared for the Nautilus Institute workshop *Interconnected Global Problems in Northeast Asia*, Seoul, Korea, October 20, 2010.

In Table 4.3, we refer to "compact" and "pastoral" models of future cities in Japan. By compact, we mean the maintenance of a smaller scale in every aspect of urban existence. The model of compacted urbanization also makes it easier to work close to home and vice versa. In compact cities, this integration of living spaces and workplaces will rest in the uniform control of information for the protection of safety and security as well as on a stock of new technologies to optimize production/usage of energy and food. In

Tokyo, for example, facilities such as shops and restaurants, called "Eki-naka," already exist inside railway stations and are developed in ways that meet the needs of communities. Some compacted towns such as Roppongi Hills have already been established in the midst of the Tokyo metropolis.

Compacted urbanization will have a significant impact on the sociology of housing and work. Aged parents, for example, may move to the city to live with their children, thereby creating a "reverse-parasite" living environment. In such urban habitats both women and the elderly may play important roles in business. Businesses that attract people with special skills and interests may also congregate in specialized, compact cities. The transportation range of people will also shrink, habitation styles will become vertical (that is, more residential skyscrapers), and energy efficiency will be achieved through highly automated, sensor-based Building and Energy Management Systems (BEMS) and Home Energy Management Systems (HEMS). In the realm of safety and security against crime and international terrorism, society will deploy a new suite of technologies, such as intelligent city gates and universal surveillance systems.

Pastoral cities lie at the opposite end of the spectrum of possible urban futures. Here, pastoral refers not to farms, but rather to the decentralized, combined urban-rural settlement or "rurbanization" that occurs when technological developments enable people to actualize their diverse values, and economic growth suffices to allow them to express their personal needs and desires in locational and lifestyle decisions. Such lifestyles may lead to communities that aspire to create democratic, autonomous societies in which human values and perceptions limit government control, and a set of diverse values are bonded into a networked, decentralized society.

In such societies, individual preferences would be respected and, therefore, diversification of lifestyles would occur. Furthermore, peer-to-peer businesses, working at home, and remote learning/remote medicine may become more viable through open network technologies. An increase in population distribution using high-speed transportation and eco-cars would require the deployment of energy-efficient technologies. Electronic authentication in online services, ciphering processes in mail circulation, embedded microchips in the medical treatment of the elderly, and practical use of traceability are all examples of technologies that realize pastoral societies. In addition, the social costs of food, medicine, or energy may increase in a decentralized society, which would then make it essential to implement innovative technologies such as nanotechnology and IC tags using radio frequency identification (RFID) technology to keep track of items to optimize the increase in social costs. Should compact or pastoral cities become widespread, society may shift from a growth-oriented economy to one based on steady-state energy and resource flows with minimum or zero pollution. As both types of ideal society require populations to devote increasing time to achieving energy efficiency and material flows, technology will be critical to making the transition from a mega-city such as Tokyo to a secure, sustainable city in the future.

In a decentralized social structure, decision-making processes in civil society-type social entities will become more important than they are today. For example, the realization of an "informed society" requires technological literacy so that people can discuss and select the most useful advanced technology as well as facilitate the introduction and diffusion of technology in concert with experts. For example, young people today exchange through social networks private, personal information that their parents could have never have imagined sharing in their youth, but this is not yet a virtual society in which the connection between people is very strong. On the other hand, the values and perspectives of people regarding information security are diverse. Information is free, and people are becoming increasingly indifferent about releasing previously private information. This involves risks and dangers for a society in which the private-public divide may become vague and chaotic and the "community" a group of anomic, unspecified, mostly unknown individuals except for their online identity.

In compact and pastoral cities, it seems likely that people will use energy ever more efficiently, and that cities will become even more integrated than they are today. This future portends much regulation, surveillance, and even heavy-handed urban security systems unless a strategy of extraordinary de-concentration occurs to increase local resilience in a network of coupled, diverse, urban systems. If enough people demand a decentralized lifestyle, whether in pastoral or compact cities, the provision of innovative technologies will be essential to monitor and track individuals in remote areas and have sensor-based services deliver to them wherever they may be — without reducing their autonomy from the state by virtue of the continuous surveillance inherent in many of these technologies.

Urbanization of China

Given its socialist history, post-revolutionary urbanization in China followed a very different trajectory to that of post-war capitalist societies like South Korea and Japan. In capitalist cities, the main impetuses of urban development are economic factors like capital investment, property ownership, and market structure. In China, however, political factors like the strategic considerations of central government, control over the migration of people from rural to urban areas, and the designation of specialized cities have played a significant role in the process of urbanization, at least before the economic reforms of 1978. After those reforms, the Chinese economy engaged with the global economy and marketized in a capitalist manner, albeit with Chinese characteristics. Thus, as in the capitalist cities of Seoul or Tokyo, Chinese urban development was greatly affected by the political and economic drivers of globalization in the last three decades.

The urbanization of China can be divided into two phases. The first phase lasted from the establishment of People's Republic of China in 1949 until 1977. The second phase dates from the economic reforms in 1978 to today. The rural-urban relationship has played an important role in the process of Chinese urban development. After 1949, the Chinese Communist Party (CCP) pursued a rural rather than urban-based strategy of rapid industrialization to support the basic needs of people. As George Lin states, "To achieve rapid industrialization, a large agricultural population was retained in the countryside for the production of food and other materials to support a small and privileged industrial workforce in the cities."[20] This strategy relied on the ideology of socialist egalitarianism to mobilize the population to implement this uniquely Chinese urban development path. China tried to eliminate the "big three differences" between industry and agriculture, the city and the countryside, mental labor and physical labor. Thus, as manifested in the "downward transfer" (*xia fang*) campaign (1957-1958), almost 2.3 million of urban cadres (university professors, intellectuals, white collar workers, factory hands and so forth) were sent to the countryside to receive re-education from the peasantry.[21] Concurrently, the central government strictly controlled the migration of people from rural to urban areas. Moreover, political considerations of national security led to an emphasis on increasing the prosperity of inland cities rather than

20 Lin, G.C.S., "The Growth and Structural Change of Chinese Cities: A Contextual and Geographic Analysis," *Cities*, 19(5) (2002), doi: http://dx.doi.org/10.1016/S0264-2751(02)00039-2

21 Ibid., p. 303.

eastern coastal cities that were vulnerable to external attack. Despite rapid industrialization, there were different stages of urban development: slow urbanization (1949-61), de-urbanization (1962-65), and under-urbanization (1966-77).[22] Notwithstanding the many problems associated with the Maoist ideology and the Cultural Revolution, Chinese cities overcame their previously crowded and poorly-serviced status and by the end of this first phase in 1977, as Youqin Huang puts it, "they were virtually free of many of the urban problems that were widespread and seemed unavoidable in other developing nations, such as high crime and unemployment rates, and acute inequality."[23]

After the economic reforms of 1978 and the adoption of an open door policy, the pattern and driving factors of urbanization changed dramatically. With the transition from a socialist planning and control system to a market-regulation regime, the fate of Chinese cities was redrawn. State control over city designation and the operation of market forces was relaxed, as was the role of ideology. The authorities began to recognize cities as growth generating machines. The central government set up the first four "Special Economic Zones" (SEZ) in 1979 and designated fourteen coastal cities as "open" in 1984.

As a result of the new geographically-biased open door policy, SEZs and open coastal cities enjoyed more economic, social, political, and cultural benefits from globalization than inland cities, many of which remained closed to external markets. For example, most foreign investment was concentrated in SEZs and coastal cities.[24] They became the center of capital investment. According to George Lin,

> Because of their inherent advantages of agglomeration economies, these larger urban settlements received more than 60% of all fixed assets capital invested in cities in the 1990s. Moreover, the share of fixed assets capital invested in the extra-large cities was raised from 46.5% in 1990 to 52.5% in 1998…, suggesting that the extra large cities have clearly been chosen by the Chinese government as the center of fixed assets capital investment.[25]

22 Ibid., p. 305.

23 Huang, Y., "Urban Development in Contemporary China," in *China's Geography: Globalization and the Dynamics of Political Economic and Social Change*, ed. by Gregory Veeck, Clifton Pannell, Christopher J. Smith, and Youqin Huang (Boulder: Roman & Littlefield Publishers 2006).

24 Fan, C.C., "Foreign Trade and Regional Development in China," *Geographical Analysis*, 24(3) (1992), doi: http://dx.doi.org/10.1111/j.1538-4632.1992.tb00264.x

25 Lin, G.C.S. (2002), p. 311.

This trend continues today. Unsurprisingly, the inland cities of China lag behind the coastal cities in terms of population and economic growth. Experts on Chinese urbanization predict the population of urban areas will reach 1.0-1.1 billion and the urbanization level will skyrocket to 75 percent by 2050. In addition, "there are likely to be 50 ultra-large cities with a population of more than 2 million, some 150 big cities, 500 medium sized cities, and 1,500 small cities."[26]

The vast social and economic disparity between cities and within cities, however, now prevents China from becoming a prosperous society. According to the World Bank, 91 percent of the poor are from rural areas and 50 percent of them are from western provinces. Moreover, "the urban underclass is concentrated in second-tier cities. The four largest mega provincial cities (Beijing, Shanghai, Chongqing and Tianjin) have the lowest urban disadvantaged rate of around 1 percent. More than 80 percent of the urban underclass live in prefectural or lower-level cities."[27] This disparity is likely to deepen under current conditions of globalized growth in the aftermath of the global financial crisis.

Urban Insecurity in Northeast Asia

In Asia, many major cities are located in coastal zones. This means that they may face similar types and levels of impact from climate change, earthquakes, and tsunamis, as well as from other global threats to all open cities, such as pandemics and food insecurity. Here, we highlight the risks arising from the ultimate global threat: rapid climate change driven by anthropogenic causes.

Many major coastal cities may face existential threats within the next twenty years due to the increased frequency and intensity of storms and surges as well as to relative and absolute sea-level rise associated with climate change.[28] According to the Japanese Ministry of the Environment,[29] 93 percent of the seashore will disappear in Japan if the sea level rises by 1

26 Yeh, A.G.O. and Xu, J., "China's Post-Reform Urbanization: Trends and Policies," in *IIED-UNFPA Research on Population and Urbanization Issues* (London, 2009).

27 Lall, S. and Wang, H.G., "China Urbanization Review: Balancing Urban Transformation and Spatial Inclusion. An Eye on East Asia and Pacific" (The World Bank, 2011).

28 Gray, D., "Keeping Its Head above Water," *Associated Press*, 27 October 2007, http://v1.theglobeandmail.com/servlet/Page/document/hubsv3/Travel/travelPages?activities=floods; Margolis, J., "Sinking Bangkok," *PRI's The World*, 2007

29 Ministry of the Environment, 地球温暖化の日本への影響 (Tokyo: Japan Ministry of the Environment, 2001).

meter, and the expansion of levees from 2.8 to 3.5 meters would be necessary to protect the inland. Another simulation shows the inundated area would increase by approximately 50 percent in Tokyo and Osaka Bays if the mean sea level were to rise by 60 centimeters.[30] According to the Japanese Ministry of Land, Infrastructure, Transport, and Tourism,[31] the inundated area would reach a maximum 25,000 ha under the worst scenario. The situation is the same as in other mega-cities located near the sea.

In big cities like Tokyo, climate-induced sea-level rise intersects with the threat of tsunamis. In the 2011 earthquake in eastern Japan, for example, the number of dead and injured exceeded 20,000, and many people went missing. In some areas, massive fires broke out after the tsunami, and whole cities were burned if they had not already been washed away or irradiated by the Fukushima reactor catastrophe. The damage included more than 1.2 million destroyed and damaged buildings, and more than 400,000 people were evacuated.[32] Power and water systems were devastated, cutting off millions of households. The tsunami was 40 meters high in some places and resulted in catastrophic damage to the coastal areas of Tohoku facing the Pacific Ocean.

In addition to the tsunami damage in 2011, various lifeline networks were also shredded by liquefaction, ground subsidence, and dam failure. Five stations in the Tohoku Shinkansen were affected, and the Sendai airport runways were submerged. In many industries, factory operations stopped and the international supply chain was interrupted. These events caused procurement problems outside Japan in the automobile industry, among others. According government estimates, property and livelihood damage may reach up to 25 trillion yen, excluding the Fukushima nuclear power plant accident.[33]

Since South Korea is a peninsula, its coastal cities are also vulnerable to sea level rise from climate change as well as watershed saturation and flash flooding. An estimate of the number of people and places that

30 Ministry of Land, Infrastructure, Transport and Tourism, *Climate Change Adaptation Strategies to Cope with Water-Related Disasters Due to Global Warming (Policy Report)* (Tokyo: Japan Ministry of Land, Infrastructure, Transport, and Tourism, 2008).

31 Ibid.

32 Vervaeck, A. and Daniell, J., "Japan – 366 Days after the Quake… 19000 Lives Lost, 1.2 Million Buildings Damaged, $574 Billion," *Earthquake-Report*, 12 March 2012, http://earthquake-report.com/2012/03/10/japan-366-days-after-the-quake-19000-lives-lost-1-2-million-buildings-damaged-574-billion/

33 Nakamichi, T. and Ito, T., "Tokyo Estimates Disaster Costs of Almost $200 Billion," *Wall Street Journal*, 24 March 2011, http://online.wsj.com/news/articles/SB10001424052748704050204576217852022676740

may be affected by sea level rise in South Korea is projected in Table 4.4. Major ports in South Korea have already registered a measureable sea level rise.

Table 4.4: Population and Area affected by Observes Sea Level Rise at Korean Ports (cm/y)

Population and area affected by sea level rise			
Sea level rise	**Potential population affected**	**Potential area affected**	**Reference**
0.5m	278,745	856.13 Km^2	1.4 x the size of Seoul
1m	312,855	984.30 Km^2	1.6 x the size of Seoul
Observed Sea Level Rise at Korean Ports (cm/y)			
Port			**Level**
Sokcho			0.2
Mukho			0.06
Ulreungdo			0.2
Busan			0.2
Yeosu			0.2
Jeju			0.5
Seogwypo			0.6
Mokpo			0.08
Gunsan			0.1

Source: Korea Economic Institute, *Economic Analysis on Climate Change in South Korea* (2009), p. 166.

In many ways, China is even more vulnerable to climate change than cities in South Korea or Japan due to inherent risks associated with its climatic zones, susceptibility to severe natural disasters, huge population, vulnerable ecosystems, coal-dominated energy mix, and relatively low level of per capita income, etc.[34] The impacts of climate change on its coastal cities deserve particular attention. According to the National Development and Reform Commission, "Firstly, the sea level along the Chinese coast will continue to rise. Secondly, the frequency

34 National Development and Reform Commission, *China's National Climate Change Programme* (Beijing: China's National Development and Reform Commission, 2007).

of typhoon and storm surge will increase, aggravating the hazards induced by coastal erosion. Thirdly, some typical marine ecosystems, including coastal wetlands, mangroves, and coral reefs will be further damaged."[35]

In Japan, four major typhoons have struck Tokyo since World War II: Typhoon Kathleen (1947), Typhoon Kitty (1949), Typhoon Kanogawa (1958), and Typhoon Eleven (1993). Recently, there has been frequent torrential rain in urban areas and serious urban flooding. In addition to the traditional water damage, cities experienced a new form of fatality due to people being trapped and drowned by rapid, widespread basement flooding in 1999. Because of this trend, the Tokyo Metropolitan Government has continued to develop flood control facilities.

In the case of South Korea, casualties from natural disasters have decreased between 2001 and 2011, but in monetary terms the damage has increased, as Table 4.5 shows.

Table 4.5: Impact of Natural Disasters in South Korea, 2001-2011

Year	**2001**	**2011**
Dead and missing	42	24
Refugees	338	-
Flooded houses	0	14,855
Cost of damage (1,000KRW)		
Total	24,883,087	31,319,101
Building	3,402,000	9,286,200
Vessels	0	-
Farming land	117,529	23,931
Public facilities	21,219,205	21,928,860
Other	144,353	80,110

Source: Seoul Statistics, http://stat.seoul.go.kr/jsp3/

In 2010, super-Typhoon Gonpas hit South Korea. On September 21, a month's worth of rain fell on Seoul in three hours. The Cheong-Gye-Cheon stream and public space, a famous achievement of the ex-mayor

35 Ibid., p. 18.

of Seoul and later president of South Korea, Lee Myung-bak, was flooded along with Gwang-Hwa-Moon Square, a symbolic site, and much of southern Seoul.[36] Today, South Korea can expect to be hit by two to three typhoons a year,[37] and the intensity of these storms may increase with further climate change.

China, too, is vulnerable to climate change. In 2010, almost 210 million people in China were affected by flood and drought. Overall, more than 3,000 people died, and the economic damage totaled around 3,745 million Yuan. The floods damaged 3,751 reservoirs (of which 57 were large and middle-sized reservoirs, while 3,694 were small-sized reservoirs) and 81,824 dykes extending over 19,146 km, with associated economic losses of about 692 million Yuan.[38] Climate-induced out-migration in China may increase the number of unregistered, "floating" urban migrants, many of who will be homeless. One careful examination of this prospect found that natural disasters of the type associated with climate change not only increase the total number of migrants to cities, but also expand the number of low-skilled workers in the cities and swell the ranks of the urban poor in China.[39] Thus, climate change would amplify the already anticipated doubling of China's urban population by 2030. The increased share of this population constituted by the labor force — due to internal migration of younger workers, leaving rural areas with older and under-skilled workers — will likely constrain the transition to a service economy.[40] Unsurprisingly, China's cities are highly exposed to climate impacts. Of its estimated urban population of 0.4 billion people, about 130 million live in coastal cities.[41] One study found that six of the top twenty most at-risk cities in the world are in China (see Table 4.6).

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36 Kim, J.E., *et al.*, "Disaster Management of Local Government: Comparison between the UK and South Korea" in *Korea Association of Public Administration 2012 Summer Conference* (Korea Association of Public Administration, 2012).

37 City Safety Agency of Seoul, *Report of Disasters in Seoul 2010* (Seoul: City Safety Agency of Seoul, 2011).

38 Ministry of Water Resources, *Bulletin of Flood and Drought Disasters in China* (Beijing: China Ministry of Water Resources, 2010).

39 Deng, Q., "Natural Disasters, Migration and Urban Insecurity in China" in *Interconnection Among Global Problems in Northeast Asia Workshop* (Paju: Nautilus Institute, 2009).

40 Cao, G.Y., *et al.*, "Urban Growth in China: Past, Prospect, and Its Impacts," *Population and Environment*, 33(2-3) (2012), doi: http://dx.doi.org/10.1007/s11111-011-0140-6

41 Prasad, N., *et al.*, *Climate Resilient Cities: A Primer on Reducing Vulnerabilities to Disasters* (Washington, DC: The World Bank, 2009).

Table 4.6: City Vulnerability to Climate Impacts, China

Qingdao	Highest proportional increase in population at risk from climate change extremes, estimated 2070 population at risk: 1.9 million; assets: $601.6 billion.
Ningbo	Highest proportional increase in assets at risk from climate change extremes, estimated 2070 population at risk: 3.3 million; assets: $1.1 trillion.
Hong Kong	With 450 miles of coastline and 19 sq. mi of water in its territory, an estimated 687,000 people and $1.2 trillion in assets by 2070 are at risk.
Tianjin	Exposed to dangers from severe flooding, putting at risk an estimated 3.8 million people and $1.2 trillion in assets by 2070.
Shanghai	Heavy storms in 1997 flooded over 170 roads and cost Shanghai millions in economic losses. The city established flood security measures in the last decade. Estimated 2070 population at risk: 5.5 million; assets: $1.8 trillion.
Guangzhou	Over $500 million in damages due to recent "meteorologically unusual," heavily damaging storms exposed this wealthy city's vulnerability to climate extremes. Estimated 2070 population at risk: 10.3 million; assets: $3.4 trillion.

Source: R. J. Nicholls, S. Hanson, C. Herweijer, N. Patmore, S. Hallegatte, J. Corfee-Morlot, J. Château, R. Muir-Wood, "Ranking Port Cities with High Exposure and Vulnerability to Climate Extremes: Exposure Estimates," OECD Environment Working Paper No. 1, OECD (2008), http://www.aia.org/aiaucmp/groups/aia/documents/pdf/aias076737.pdf

The fact that so many Chinese cities are at "high risk" may affect international investment in manufacturing, especially water-intensive industries, which already face water stress in China.[42] This incidence of climate disaster in vulnerable regions of China is a challenge to local, city, and provincial governments. In 2007, following central government direction, local governments established "leading groups" with the responsibility of developing mitigation and adaptation plans to build resilience capacity, not because of climate concerns per se, but because of the close linkage of climate action with energy efficiency, a key indicator of economic competitiveness.[43]

42 *Climate Change and Environmental Risk Atlas 2013* (Bath: Verisk Maplecroft, 2013), http://maplecroft.com/about/news/ccvi_2013.html

43 Ye Qi, *et al.*, "Translating a Global Issue into Local Priority: China's Local Government Response to Climate Change," *The Journal of Environment & Development*, 17(4) (2008), doi: http://dx.doi.org/10.1177/1070496508326123.

Urban and Climate-Induced Heat Stress

Another urban problem associated with extreme weather conditions and climate change is the heat island: a phenomenon whereby average and peak temperatures in urban areas are higher than in non-urbanized areas due to energy use, changes in albedo, etc. According to the Japan Meteorological Agency, the annual average temperature in Tokyo rose 3 degrees Centigrade over the last century, which is 1 degree higher than in medium-size cities. The proportion of days spent in temperatures rising above 35 degrees Centigrade and nights not falling below 25 degrees Centigrade has also increased since 1970. Recently, the heat island has been correlated with heat stroke and even death, particularly among small children and the elderly. In July 2011, approximately 1,500 people affected by heat were transported to medical facilities.[44] Consequently, the Tokyo metropolitan government office issued new guidelines to implement green infrastructure and so reduce the heat island.[45]

With rapid urbanization, Seoul also exhibits a heat island. From 1971 to 2007, the frequency of daily maximum temperatures above 30 degrees Centigrade increased in Seoul. In 1994, for example, there were 56 days above 30 degrees, while in 1997 there were 61.[46]

Like Tokyo and Seoul, Chinese cities endure thermal stress in heat islands. An early review of three decades of paired rural and urban climate stations showed the average heat island effect was 0.23 degrees Centigrade over the period 1953-1973, and that the heat island effect had increased by about 0.1 degrees Centigrade. Trends in the heat island effect could be correlated with the level of urbanization and industrial activity before 1966 and after 1977, that is, with the rise and fall of the Cultural Revolution in China.[47]

A more recent study of Shanghai showed summer mortality rates in and around Shanghai have increased. Scientists directly attribute these deaths to exposure to extreme thermal conditions due to the heat island effect.

44 Ryall, J., "Japan Struggles to Cope with Heatwave, with 26 Dead of Heatstroke," The Telegraph, 18 July 2011, http://www.telegraph.co.uk/news/worldnews/asia/japan/8645326/Japan-struggles-to-cope-with-heatwave-with-26-dead-of-heatstroke.html

45 Guidelines for Heat Island Control Measures (Tokyo: Tokyo Metropolitan Government, 2005).

46 Korea Environment Institute, *Research on Policies for Mitigating Heat Island Phenomenon to Adapt to Climate Change in Urban Area* (Seoul: Korea Environment Institute, 2009).

47 Wang, W.-C., *et al.*, "Urban Heat Islands in China," *Geophysical Research Letters*, 17 (13) (1990), doi: http://dx.doi.org/10.1029/GL017i013p02377.

Jianguo Tan and his colleagues found the average mid-summer maximum temperature in the urban center is rising at about 0.07 degrees Centigrade per year, with the maximum extreme temperature rising by 0.09 degrees Centigrade per year. The number of hot days (above 35 degrees Centigrade) is also increasing in Shanghai by 0.6 days per year (0.3-0.4 days per year in suburban areas with no increase in ex-urban areas).[48] The heat island effect in Shanghai is most intense during the daytime and reached an average 0.9 degrees Centigrade differential temperature between urban center and exurban areas, with the range amounting to a 0.5-2 difference in degrees during the midday period.[49]

The heat island effect has caused a measurable increase in deaths in Shanghai's central region, especially during the 1998 and 2003 heat waves. In 1998, for example, excess mortality among city dwellers was 27.3/100,000 residents versus 7/100,000 in exurban areas.[50] Researchers concluded that this heating effect was mostly local in nature, and not the result of a larger, regional warming pattern. Their investigation did not examine concurrent determinants of mortality such as air pollution (itself caused in part by heat), cloud cover, humidity, or social variables that affect mortality under conditions of heat stress. Nonetheless, there seems little doubt that cities in China that lack effective offsetting green strategies to reduce the heat island effect increase the vulnerability of their residents to thermal stress, sometimes to the point of death.[51] This conclusion applies not only to eastern coastal cities in the tropics or sub-tropics but also to northeastern cities such as Harbin, which researchers have shown to be similarly vulnerable to such climate effects as the heat island.[52]

Energy and Urban Security

Japan is one of the biggest energy consumers in the world. Since 1973, it has tried to diversify its energy supplies among hydroelectric, natural gas, coal, petroleum, and nuclear sources. The major driver of this diversification

48 Tan, J., *et al.*, "The Urban Heat Island and Its Impact on Heat Waves and Human Health in Shanghai," *International Journal of Biometeorology*, 54 (1) (2010), doi: http://dx.doi.org/10.1007/s00484-009-0256-x

49 Ibid., p. 77.

50 Ibid., p. 80.

51 Ibid., p. 78.

52 Zhang, L., *et al.*, "Analyzing and Forecasting Climate Change in Harbin City, Northeast China," *Chinese Geographical Science*, 21 (1) (2011), doi: http://dx.doi.org/10.1007/s11769-011-0441-9

was two oil supply cutoff shocks in the 1970s. Overall, Japanese energy self-sufficiency today is about 20 percent, falling to 4 percent if nuclear power is excluded (Japan relies on imported uranium). The country's secondary energy production is heavily reliant on imports. Natural gas is the major source of energy, supplying nearly 50 percent of primary energy. Before the Fukushima-driven nuclear shutdowns, nuclear accounted for about 25 percent. Japan's energy efficiency is very high, about twice that of the United States and eight times higher than in China and India.

Tokyo is a major energy-consuming entity in its own right. Electricity in the Kanto area (Tokyo and the surrounding seven prefectures) is supplied mostly by thermal and nuclear power plants. The Tokyo Electric Power Company (TEPCO) has a virtual monopoly within its service region. Before the March 2011 Fukushima catastrophe, total power generation capacity was about 9 gigawatts from hydroelectric plants, 38 gigawatts from thermal (oil and coal) power plants, and 17 gigawatts from nuclear power plants. The capacity of the renewable electricity supply was roughly 0.01 gigawatts.

Electricity supply is characterized by daily fluctuations in demand and by seasonal peaks. In Japan, this peak usually occurs in summer due to air conditioning loads. To meet this demand profile, the utility allocates base-load demand to nuclear generators, most of the rest to thermal power, and matches peak demand from stored hydropower. Until 2011, nuclear power played a critical role in energy policy. After the Fukushima nuclear disaster, however, the regional power grid suffered irreversible damage. TEPCO relied on nuclear power plants for about 20 percent of its power. The impacts of the loss of nuclear supply were severe in the Tokyo metropolitan area. After the accident, renewable energies such as photovoltaic cells received more attention. Renewables are insufficient to meet the gap, however, and are expensive to boot. Therefore, the transition from nuclear to renewables may not be easy in the short run, and largely voluntary energy conservation has filled the gap in Tokyo.

Japan grew rapidly after 1950 and energy consumption grew with the economy. In the 1970s, Japan's economy was hit by the oil shocks. Economic growth also slowed. Since the 1980s, energy demand has increased due to lifestyle changes based on comfort, convenience, and increased automobile ownership. Today, energy use by the commercial and transport sectors have doubled relative to four decades ago, while industrial energy use has remained the same.

Air conditioning, refrigeration, lighting, and TVs account for more than 60 percent of household energy use, the growth of which has been driven by increased floor space, office automation equipment, and larger appliances. In the transportation sector, the shift to individual passenger automobiles caused most of the increased energy consumption. Energy consumption in this sector dependents on oil more than in the industrial sector. Undoubtedly, alternative energy conversion technologies must be a critical driver of future energy use.[53] To improve energy efficiency and reduce greenhouse gas emissions, the Ministry of Economy, Trade and Industry has produced the Technology Strategy Map of critical technologies.[54] Those include natural gas thermal power, coal thermal power, carbon capture and sequestration, innovative solar power, advanced nuclear power, and superconductivity in the energy sector; fuel cell automobiles, plug-in hybrid cars, and biomass fuel in the transportation sector; material processing technologies and innovative steel in the manufacturing industry sector; energy conservation in houses and buildings, lighting, decentralized fuel cells, heat pumps, information devices/systems, energy management systems in homes and commercial and industrial buildings of all kinds; and electricity storage, power electronics, and hydrogen production/storage as common technologies.

Like Tokyo, Seoul is also a major energy consumer. The service sector dominates electricity use in Seoul (60 percent) followed by residential use (28 percent), industrial (10 percent), and public use (8 percent).[55] Unlike in China, where industry still dominates urban energy, Seoul's industrial energy use remains small. And whereas many Chinese households today are powered by coal — even in Beijing — 90 percent of households in Seoul use natural gas. Overall, Seoul energy use is fuelled mostly by oil (37 percent), liquid natural gas (33 percent), and electricity (26 percent), as shown in Table 4.7. Although Seoul accounts for nearly a quarter of the population of South Korea, it uses only about 8 percent of the total energy consumed (in 2010), mostly because industrial energy use is so small in Seoul relative to other cities based around heavy and energy-intensive industry, as shown in Table 4.8.

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53 *Research Organization for Information Science & Technology* (Tokyo: Research Organization for Information Science & Technology), http://www.rist.or.jp/ehome.html

54 Ministry of Economy, Trade and Industry, *Innovative Energy Technology Plan* (Tokyo: Japan Ministry of Economy, Trade and Industry, 2007).

55 Ministry of Knowledge and Economy and Korea Energy Economics Institute, *Yearbook of Energy Statistics* (Tokyo: Japan Ministry of Knowledge and Economy and Korea Energy Economics Institute, 2011).

Table 4.7: Seoul, Final Energy Consumption By Source Unit: 1,000toe

Total Seoul	Coal	Petroleum	Town gas	Electricity	Heat	Renew-ables
15,717	117	5,800	5,127	4,067	510	97
100%	0.70%	37%	32.60%	25.90%	3.20%	0.60%
Total national						
193,832	27,968	100,381	21,081	37,338	1,718	5,346
100%	14%	52%	11%	19%	1%	3%
Seoul as fraction of total national						
8.10%	0.40%	5.80%	24.30%	10.90%	29.70%	1.80%

Source: Ministry of Knowledge Economy, Korean Energy Economics Institute, *Yearbook of Regional Statistics* (Seul, 2011).

Table 4.8: Seoul, Final Energy Consumption By Sector Unit: 1,000toe

Total Seoul	Industry	Transportation	Residential/ commercial	Public
15,717	1.023	4,846	9,153	696
100%	7%	31%	58%	4%
Total national				
193,832	115,155	36,938	37,256	4,483
100%	59%	19%	19%	2%
Seoul as fraction of total national				
8%	1%	13%	25%	16%

Source: Ministry of Knowledge Economy, Korean Energy Economics Institute, *Yearbook of Regional Statistics* (Seul, 2011).

As in South Korea and Japan, cities in China play a major role in national energy use. Wenji Zhou and his colleagues have described how residential households, transportation, and the building materials industry propel most of China's urban energy use.[56] The main determinants of these drivers are (a) shifts in industrial structure that change the energy intensity of key inputs into urban construction, such as cement, glass, aluminum, and steel; (b) net effects of increasing income on household energy use via the

56 Zhou, W., *et al.*, "Energy Consumption Patterns in the Process of China's Urbanization," *Population and Environment*, 33(2-3) (2012), doi: http://dx.doi.org/10.1007/s11111-011-0133-5

acquisition of more end-use equipment, as opposed to increasing the unit efficiency of such equipment over time, as well as the substitution of cleaner, more efficient fuels such as natural gas for dirty coal in household cooking and heating; and (c) shifts in transport and mobility, especially from public transport to cars, and from inefficient older vehicles to more efficient newer vehicles that offset efficiency-driven reductions with increased absolute usage provided by the more efficient vehicles.[57] These three drivers — household equipment, transport mode, and building materials — account for about 20 percent of overall urban energy use in China. Within that 20 percent, residential use is declining relative to transport and building energy use. The other 80 percent comes from urban industrial energy use.[58]

The International Energy Agency notes that urban energy use in China is controlled more by the central government and national policies than it is by cities or provincial policies. Nonetheless, Chinese cities still influence local energy usage because they often own much of the public infrastructure and energy utilities. Overall, the Agency estimates that China's cities account for about 75 percent of total primary energy demand (2006), forecast to increase to 83 percent by 2030. "On average," the Agency states, "each urban citizen in China consumes 2.6 Mtoe (million tonnes of oil), compared with 1.4 Mtoe nationally, reflecting higher urban incomes." About 87 percent of this usage is still fuelled by coal although natural gas has been substituted for much coal in the mega-cities.[59]

Cities in China are charged with implementing energy and emissions reductions. Investment competition between cities drives them to address strong local concerns about air pollution and reliable energy supplies. To this end, cities focus on increasing natural gas and limiting coal use in residential and commercial sectors, building knowledge-based industry, increasing energy efficiency, and improving mass transit.[60]

In addition to increasing energy efficiency, China has promulgated the concept of a "circular economy" based on a zero-emissions recycling and efficient resource-use system, formally bringing it into law in 2009.[61] In this concept, the waste of high-grade heat is treated as a resource in a

57 Ibid., p. 202.
58 Ibid.
59 International Energy Agency, *World Energy Outlook 2008* (Paris: International Energy Agency, 2008). http://www.worldenergyoutlook.org/media/weowebsite/2008-1994/weo2008.pdf
60 Ibid., p. 193.
61 Zhou, W., *et al.* (2012), p. 217.

cascade of co-located end-users. Coupled industrial waste heat flows allow wastes from one factory (carbon dioxide, for example) to be used in the production of industrial chemicals in another factory. This model will take enormous effort to adopt throughout China, not just in the mega-cities. The "coal cities" of northeastern China, for example, were built around coal mining and manifest very poor integration of urban form and function. The energy transition implied by a circular economy and by increasing material and energy efficiency highlights the economic vulnerability and lack of resilience of such cities to economic losses and climate impacts at the same time.[62]

Finally, energy use in Chinese cities is very uneven. On average, the relative urban energy use per capita in China is small. But in the really big cities like Beijing, Shanghai, and Tianjin, it is huge and exceeds that of Tokyo, London, or New York. Shobhakar Dhakal, an energy researcher based at the Global Carbon Project who investigated China's urban energy use with the International Energy Agency, recommends that China's mega-cities look to the Tokyo model for excellent public transportation and mixed land uses.[63]

Complex, Networked Urban Security

In an era of globalization and complex global problems, no city is an island. No city can solve its problems alone. Cities must cooperate to prosper and subordinate globalization to local goals rather than allow their infrastructure to be fragmented and identity to be dissolved by new interdependencies. Above all, cities need to collaborate to create and share solutions to complex global problems, some of which must be implemented jointly.

The traditional approach of inter-governmental cooperation to urban development is to promote *project-based cooperation*.[64] Each project, such as

62 Bo, L. and Lianjun, T., "Vulnerability and Sustainable Development Mode of Coal Cities in Northeast China," *Chinese Geographical Science*, 18(2) (2008), doi: http://dx.doi.org/10.1007/s11769-008-0119-0

63 Gaffney, O., "Tracking China's Urban Emissions," *Global Change Magazine*, 1 December 2009, http://www.igbp.net/news/opinion/opinion/trackingchinasurbanemissions.5.1b8ae20512db692f2a680003075.html

64 This section is based on Minato, T. and Sutheerawatthana, P., "Exploring Possible Cooperation for Climate Change Adaptation: How Civil Society Could Work with Government Strategies," in *Interconnections of Global Problems in East Asia: Climate Change Adaptation and its Complexity from the Perspective of Civil Society* (Paju: Nautilus Institute, 2009).

the construction of a water treatment plant, is treated and implemented separately, in part conforming to local needs and stakeholders and in part driven by the intentions of the project sponsors. This is typically how assistance agencies, such as the Japan International Cooperation Agency and Korea International Cooperation Agency, have operated. Sometimes, however, resources allocated to projects are hotly disputed, especially where there is a divergence between the goals set by central government agencies and the aspirations of locals who wish to exercise authority over the project or at least participate in its design and implementation. This has often occurred, for example, in "slum" renovation projects. Another approach, *the sectoral approach*, was recently promoted in the region in relation to greenhouse gas mitigation technologies. In this case, a coalition of global industrial corporations was promoted to develop and deploy technologies that could be used to tackle sector-specific problems. With this method, advanced technologies will be transferred or developed and owned jointly. The proprietary nature of corporate intellectual property embodied in such technologies, however, often reduces the incentives for technology sharing.

A *city-based approach* founded on alliances between cities demonstrates the possibility of powerful synergies in contrast to the traditional and corporate-coalition approaches to building capacity for urban security in the region. It may facilitate the dissemination of useful knowledge, enable technology transfer, facilitate sharing of resources, support capacity building, and permit new types of co-financing, etc. Because cities can act relatively independently from national-level policy, it can circumvent many political obstacles that otherwise block international cooperation. For example, the Clinton Climate Initiative applies a business-oriented approach by seeking economic opportunity in the urban response to climate change while nurturing the sharing of best-practice between forty of the world's largest cities.

Kitakyushu-Dalian cooperation exemplifies a city-based coalition approach. As one of Japan's four major industrial areas suffering from severe pollution caused by heavy and chemical industry, Kitakyushu was able to transform itself from a city with "a smoke-filled sky and the sea of death" to an "environmental city" with cutting edge technologies. Starting in the 1970s, it began to share this experience with other cities. In 1996, it initiated formal cooperation with Dalian, China. The local government played a significant role in obtaining funding from not only the central government, but also affiliated agencies such as the Japan International Cooperation Agency (JICA). It also organized the participation of private firms by addressing plausible technology transfers for the Dalian Environmental Model Zone Project. The project successfully created a master plan for environmental improvement, and Dalian became the first city in China to receive the "Global 500" awarded by the United Nations Environment Programme in 2001.[65]

The attempts made by Kitakyushu demonstrate that the city-based approach could help reinforce both intergovernmental environmental cooperation and market mechanisms relying on a production network of firms. Other than Dalian, Kitakyushu has cooperated to solve environmental problems with other cities in the East Asia region such as Incheon, Busan and Tianjing, Ho Chi Min, Cebu, and Surabaya.

The number of sister cities sharing environmental best practices has proliferated. Particularly in China, the State Environmental Protection Administration (SEPA) has encouraged local authorities to implement their own environmental policies through cooperation with cities in other countries.[66]

Scale in Social and Technological Solutions

Cities are under intense pressure to lessen the effects of natural disasters, especially those driven by climate change. In addition to institutional resilience, new technologies can reduce vulnerability to climate change impacts. One example is the Metropolitan Area Outer Underground Discharge Channel, a massive "underground river" in Tokyo. This artificial river, built 40 meters under the ground with a diameter of more than 10 meters, runs 30 kilometers under the Seven Ring Road from the Channel uptown into Tokyo Bay. The system prevents the overflow of four major waterways in Tokyo. When the swollen river exceeds capacity, the flood system functions as a reservoir, eventually draining the water into the sea.[67]

65 Council of Local Authorities for International Relations, *Local Authorities International Cooperation Network* (Council of Local Authorities for International Relations, 2003); Kitakyushu Office for International Environmental Cooperation, *Eco, Thereby Enhancing Global Partnership* (Kitakyushu: City of Kitakyushu, 2007)

66 Shin, S., "East Asian Environmental Co-Operation: Central Pessimism, Local Optimism," *Pacific Affairs*, 80 (1) (2007), doi: http://dx.doi.org/10.5509/20078019.

67 *The Metropolitan Area Underground Discharge Channel* (Tokyo: Japan Ministry of Land, Infrastructure, Transport and Tourism), http://www.ktr.mlit.go.jp/edogawa/gaikaku/

At the macro-scale, smart grids could make city-level energy much more secure. A smart grid uses information technology to radically change the way electricity is delivered. Smart grids monitor the flow of electricity to and from generators and consumers, use transmission lines to reduce power loss and accommodate intermittent and renewable power generators, enhance multi-layered network resilience, and facilitate demand-side management.[68]

In 2009, about $69 billion was spent globally on smart grids, of which about $21 billion was allocated to "Unified Smart Grid" implementation in the United States. Europe is developing a "SuperSmart" grid. Australia committed to a "Smart City, Smart Grid" in 2009,[69] and China has announced plans to create its own hybrid "Strengthened Smart Grid" by 2020.[70] Dozens of technological innovations in hardware and software are needed to achieve this shift from a unidirectional, centralized grid system to one that is omni-directional, decentralized, polycentric, and locally controlled.

In general, smart grid technology can be grouped into five key areas – integrated communications, sensing and measurement, advanced components, advanced control, and improved interfaces and decision support.[71] But most technologies enabling the smart grid are off-the-shelf. As envisioned, smart grids will develop incrementally and will not be transformational. In China, the initial emphasis on very high-voltage transmission lines — and the decision to delay the integration of renewable energy generation to a later stage — reinforces the traditional electric utility culture dominated by engineering values.

68 National Energy Technology Laboratory, *A Vision for the Modern Grid* (Pittsburgh: United States Department of Energy, Office of Electricity Delivery and Energy Reliability, 2007).

69 CTBR staff writer, "Australia's Rudd Government Invites Industry Bids to Transform Its Energy Grid through Smart Grid, Smart City Initiative," *Clean Technology Business Review*, 29 October 2009, http://www.cleantechnology-business-review.com/news/australias_rudd_government_invites_industry_bids_to_transform_its_energy_grid_through_smart_grid_smart_city_initiative_091029

70 Li, J., "From Strong to Smart: The Chinese Smart Grid and Its Relation with the Globe," *Asian Energy Platform News*, 2009, http://www.aepfm.org/ufiles/pdf/Smart%20Grid%20-%20AEPN%20Sept.pdf

71 National Energy Technology Laboratory, *A Compendium of Smart Grid Technologies* (Pittsburgh: United States Department of Energy, Office of Electricity Delivery and Energy Reliability, 2009).

To become transformative, the smart grid needs to be combined with new technologies for urban redesign, transportation systems, and different modes of power generation, distribution, and end use — all of which are driven by sustainability imperatives. Of these, the vision of electric and hybrid cars serving as generators when not re-charging or in use presents a possible combination that makes the smart grid and hyper-car, taken together in a fusion, truly transformative.[72]

For this to occur, hyper-cars need to move from concept to sales in large numbers, and smart grids will need to accommodate millions of new, small auto-generators feeding electrons back into the grid. The hyper-car entails shifting from fossil fuels or a centralized power supply stored in batteries to industrially-produced bio-fuels, as well as genetically enhanced plants with high-efficiency photosynthetic conversion of sunlight to biomass. Another concept is to convert underground coal or natural gas *in situ* into hydrogen, storing the carbon dioxide underground and using the hydrogen in fuel cell-powered hyper-vehicles.

Such a shift from centralized generation, whether of fossil fuels or renewable sources such as wind, to millions of small-scale generators that are also consuming machines would turn the smart grid upside-down and reap huge gains in energy efficiency, avoid billions of tonnes of greenhouse gas emissions, increase network resilience in the face of climate impacts on the power system, and yield massive economic savings.

To work, the system would need high bandwidth wireless monitoring and decision-support systems that could maintain tens of millions of parked auto-generators. It would also require the development of automatic power dispatch algorithms that reflect the interaction of driving patterns with power generation capacity. The fusion of the smart grid with hydrogen and bio-fueled hyper-cars is a possible transformative technology that could become the platform for a sustainable civilization. No less radical a technological shift will be needed to secure largely coal-powered cities in China in the face of dwindling oil supplies and accelerating climate impacts.

Of course, no one can predict exactly how such a transformative technological fusion will emerge. But let us assume something along these lines happens in the coming generations. What else is on the sustainability

72 Lovins, A., "Hypercars, Hydrogen, and Distributed Utilities: Disruptive Technologies and Gas-Industry Strategy," in *Operations & Marketing Conferences, American Gas Association* (Denver: Rocky Mountain Institute, 2000).

horizon that might complement the IT-enabled smart grid combined with the hyper-car?

At the other end of the scale, the East Japan Railway Company has reportedly installed an experimental "floor electricity generator" using the energy of the pressure and vibration of pedestrians at the Marunouchi North Ticket Gate in Tokyo station.[73] Such "micro-energy" may also be applicable in many public buildings as well as in private housing for keyless entry systems, battery-free remote control, and other monitoring systems such as automobile locks and ignition. Some hope that this type of electricity generation could provide auxiliary power during disaster emergencies.

In addition to physical strategies or "hard adaptation," cities must also undertake "soft adaptation." Cities increasingly face "infrastructure congestion" or bottlenecks such as traffic jams. Japan, for example, loses more than 12 trillion yen per year due to traffic jams.[74] "Smart infrastructure" is a concept that applies not only to grids, as explained above, but also to transportation (to traffic light controls, for example), water, buildings, etc.[75] Using the full network capabilities of infrastructure, not just its stand-alone function, is critical to achieving urban sustainability as well as security. The two goals are served by creating adaptive networks to achieve efficiencies through substitution across infrastructure or by adding resilience, as in the case of cross-infrastructure cascading or concatenating failures. Seoul has begun to "smarten" its infrastructure and is moving quickly from phase 1 (application to specific services in a sector such as public transport system), to the phase 2 (vertical integration across services within a sector such as inter-modal transport information), and then onto phase 3 (horizontal integration across sectors).[76]

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73 Japan for Sustainability, "Walking on New Power-Generating Floor Creates Electricity," 22 March 2007, http://www.japanfs.org/en/pages/026618.html [accessed 22 July 2013]; Arai, M., "New Energy Systems in Railroads" in *Confederation of Asia-Pacific Chambers of Commerce and Industry* (East Japan Railway Company, 2009).

74 Nissan Motor Company, "Urban Mobility: Breaking the Chain of Urban Traffic Congestion," *Nissan Technology Magazine*, 19 July 2010, http://www.nissan-global.com/EN/TECHNOLOGY/MAGAZINE/report1.html

75 Lee, S.H., *et al.*, "Ubiquitous and Smart System Approaches to Infrastructure Planning: Learnings from Korea, Japan and Hong Kong," in *Sustainable Urban and Regional Infrastructure Development: Technologies, Applications and Management*, ed. by Yigitcanlar, T. (Hershey: IGI Global, Information Science Reference, 2010).

76 Hwang, J.S. and Choe, Y.H., *Smart Cities Seoul: A Case Study*, ITU-T Technology Watch Report (International Telecommunications Union, 2013).

Operational Strategies to Make Cities Secure

In Japan, governments have responded to threats to urban security such as climate change on an ad hoc, top-down basis, organization by organization. Central government tends to create catalogues of policies to be implemented in vertically-separated stovepipes by national ministries and agencies.

In contrast, cities tend to weave together their programs around local circumstances in a much more effective manner. In 2009, for example, the Tokyo Metropolitan Government initiated its "Tokyo in 10 Years" strategies. More than forty strategies were adopted to fulfill eight goals and objectives, including the development of a green city, infrastructure stock management, low-carbon society, disaster prevention, a new model for aged society, a creative city, the promotion of sport activities, and challenging society. As part of this plan, Tokyo also considered adaptive measures. Use of advanced technologies, personnel training, and promoting collaboration and solidarity among Asian cities were designated as important.

The March 2011 earthquake, tsunami, and Fukushima catastrophe revealed the underlying importance of local and urban resilience, and the fragility and brittleness of national and oligopolistic corporate responses. The national government proved slow and ineffective in its response while TEPCO, the main corporate organization responsible for the Fukushima plant, demonstrated not only its corruption, but also its incompetence in that it utterly failed to respond effectively.[77] This response deficit was filled mainly by the bottom-up actions of civil society,[78] including massive voluntary energy conservation,[79] combined with emergency capacities fielded autonomously by first-responder organizations and supplemented by the military.

Perhaps the most significant long-term impact of the disaster will be the direct challenge to the oligopolistic structure of the electric power industry in Japan. Led by cell phone entrepreneur Masayoshi Son, who laid out a

77 Onishi, N. and Belson, K., "Culture of Complicity Tied to Stricken Nuclear Plant," *New York Times*, 26 April 2011, http://www.nytimes.com/2011/04/27/world/asia/27collusion.html?_r=1&hp=&pagewanted=print

78 Ferris, E. and Solís, M., "Earthquake, Tsunami, Meltdown – the Triple Disaster's Impact on Japan, Impact on the World," *Up Front*, 11 March 2013, http://www.brookings.edu/blogs/up-front/posts/2013/03/11-japan-earthquake-ferris-solis

79 Inajima, T. and Okada, Y., "Japan to Have Surplus Power in Summer without Additional Nuclear," *Bloomberg*, 9 April 2013, http://www.bloomberg.com/news/2013-04-09/japan-to-have-surplus-power-in-summer-without-additional-nuclear.html

networked vision of renewable energy for a "solar belt" on the eastern coast of Japan that would render nuclear power unnecessary and obsolete, and in alliance with municipal governments across the country, a political struggle over nuclear power and electricity sector regulation has raged in Japan since the Fukushima event.[80] A number of tsunami-devastated towns are planning to resurrect themselves as altogether off-grid towns.[81]

After the disaster of 11 March 2011, consciousness of the danger of nuclear power plants increased greatly in the region. In spite of the Korean government's continuing commitment to constructing twenty-three more nuclear reactors by 2030 and to exporting eighty nuclear power plants abroad, civil society in South Korea has expressed alarm about this expansion. Small but significant operating errors and reactor accidents have occurred in dilapidated nuclear power plants in South Korea and almost three out of four plants are located near heavily populated urban areas. The Korean Green party was established on October 30, 2011, with non-nuclear power as its motto.

Perhaps the most significant example of the civil society reaction to the Fukushima catastrophe came from the local government. The new mayor of Seoul, Park Won Soon, a famous and leading NGO activist and lawyer, declared that by 2014 Seoul would eliminate the equivalent of one nuclear power plant through energy demand management and an energy saving movement.[82] The basic plan was for the 10 million citizens of Seoul to reduce their electricity consumption by 10 percent per year, rendering a nuclear power plant unnecessary. To achieve this goal, various policy tools were employed. These included the establishment of fuel-cell power plants, expansion of photovoltaic panels on the roofs of buildings (290MW), eco-mileage, a specialized school for climate change, energy retrofitting projects for buildings, total maximum energy consumption limits for buildings, changing low-efficient lighting bulbs into high-efficient LED bulbs, and

80 Masayoshi, S., *Creating a Solar Belt in East Japan: The Energy Future*, NAPSNet Policy Forum (Berkeley: Nautilus Institute, 2011); Kingston, J., *Ousting Kan Naoto: The Politics of Nuclear Crisis and Renewable Energy in Japan*, NAPSNet Policy Forum (Berkeley: Nautilus Institute, 2011); De Wit, A., *Japan's Nuclear Village Wages War on Renewable Energy and the Feed-in Tariff*, NAPSNet Policy Forum (Berkeley: Nautilus Institute, 2011).

81 Herman, S., "Japan Urged to Invite Foreign Expertise When Re-Building Tsunami Communities," *City Mayors Development*, 4 March 2012, http://www.citymayors.com/development/japan-post-tsunami.html

82 RTCC staff writer, "Mayor of Seoul Aims to 'Cancel out' a Nuclear Power Plant with Climate Action," *Responding to Climate Change*, 25 October 2012, http://www.rtcc.org/mayor-of-seoul-aims-to-cancel-out-a-nuclear-power-plant-with-climate-action/

so forth. Since Seoul consumes the electricity generated by seven nuclear power plants, this campaign had a significant impact on energy policy and also on the consciousness of ordinary people. As a result of this campaign, Seoul has set the goal of increasing its urban self-reliance in electricity generation from 3 percent in 2011 to 8 percent in 2014, and 20 percent in 2020.

This policy goal confronts many obstacles like low electricity tariffs, the indifference of many people to the danger of nuclear power plants, the pro-nuclear power plant policy of the central government, long-lasting economic depression, unfavorable circumstances for the anti-nuclear power movement, and so on. The campaign requires social consensus and strong support from civil society for its success.

Another post-Fukushima urban security project is the city farming project of Seoul, which began in the summer of 2012. Seoul's mayor outlined the "Ten commandments of city farming" on June 2, 2012. It gives residents guidelines on how to grow food in Seoul including advice on, for example, the provision of spare plots for city farming, education on city farming, community building through city farming, eco-friendly city farming, networking with professional farmers, establishing legal support for city farming, and so forth. Seoul established a 1-hectare model city farm on Nodle Island in the middle of the Han River. The Nodle farming plot consists of a citizen plot, a community plot, a paddy field, an indigenous seeds plot, and community facilities such as picnic tables, small pavilions, and chairs. The project offers environmental education programs like "farm school," "kids' farm class," and "paddy field school." The environmental education facilities use eco-toilets to recycle feces into fertilizer.

In China, the Sino-Singapore Tianjin Eco-City (SSTEC) project deserves scrutiny as an example of a city coping successfully with urban insecurity. SSTEC is located 45 kilometers east from the Tianjin city center and covers about 30 square kilometers of formerly contaminated land. The goal is to recover this area and create a sustainable city by 2020. The Tianjin eco-city is envisioned as a harmonious and sustainable community that would meet the needs of an urbanizing China. The term harmony is meant to include harmony among humans, harmony between social and economic activity, and harmony between humans and the environment. SSTEC will be a modern township where 350,000 residents can live, work, and play.

The vision of SSTEC is for an environmentally-friendly and resource-conservation city in China.[83]

SSTEC is an audacious Chinese experiment to explore alternative models for city development. The site lacks water due to low precipitation in Tianjin. There is also almost no arable land in the city. In the Tianjin eco-city, salt water will be desalinized into freshwater. Waste is to be managed in a comprehensive manner including reduction, reuse, and recycling. In other words, China is now trying to define and test a completely new model for city development in the face of an insufficient supply of water, food, and other environmental services.[84]

83 Lang, G. and Miao, B., "Food Security for China's Cities," *International Planning Studies*, 13 (1) (2013), doi: http://dx.doi.org/10.1080/13563475.2013.750940.

84 Ibid., p. 9.