# The Look, Feel, and Functionality of Sustainable Cities

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***"In living nature, the notion of unlimited sprawl seems to be adopted by organisms at the lower levels of evolution."***

—Paolo Soleri, architect and author of *Arcology: The City in the Image of Man, 1970*

Civilizations are becoming increasingly urban. Throughout the world, cities are spreading outward due to natural population growth, the influx of migrants, and the absorption of previously rural land. By the year 2005, more than 50% of the world's inhabitants are projected to live in urban areas. In less industrialized countries, the percentage of urban dwellers is projected to increase from 36% in 1993 to 50% in 2015.

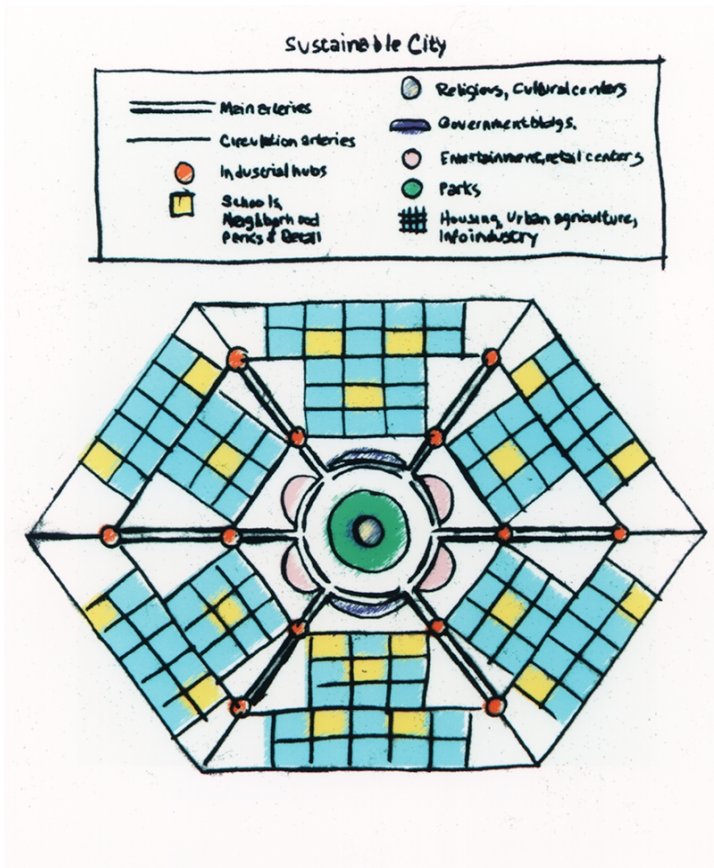


***Figure 1:*** A conceptual layout of a city designed to accommodate information, industrial, and agricultural economies and provide a healthy, vibrant central core. Each of the six wedges in the city would function as a distinctive unit with physical connectivity to the adjacent wedges and the central core.

As urbanization continues, it is likely to spawn a multitude of socio-economic effects. The revival of city-states, greater divisions between urban and rural dwellers, the transformation of local economies, fear of disease, demand for clean air, and conflict over water are a few growing global trends to watch for over the next 10-20 years. As these changes take place, some cities will adapt and prosper while others will stagnate, decline, and even die. New cities will be born either in brand new locations or out of the ashes of old cities destroyed by war, civil strife, or natural disaster.

> **"Structure influences behavior."**
> Peter Senge, *The Fifth Discipline: The Art and Practice of the Learning Organization*

These new cities have the greatest potential to revolutionize urban

environments. Urban designers will have the opportunity to create cities as living organisms with three fundamental abilities to sustain themselves:

- The ability to consume renewable resources (e.g. water, food, air) slower than the rate the surrounding system needs to replenish them.
- The ability to invent and/or adopt viable substitutes for nonrenewable resources (e.g. energy, economic transformation).
- The ability to release pollution slower than the rate the surrounding system needs to contain and absorb it.

> **"Our beds are empty 2/3 of the time. Our living rooms are empty 7/8 of the time. Our office buildings are empty 1/2 of the time. It's time we gave this some thought."**
> *--Buckminster Fuller, visionary and inventor of the geodesic dome*

In addition to these basic sustenance needs, cities will have to offer urban dwellers a life filled with opportunities to learn, exercise, pray, socialize, work, and play in private and public settings. To accomplish this, urban designers need to construct cities with a look, feel, and functionality that invites people to participate in these different types of human activity while retaining the three enumerated abilities to sustain the city.

There are an infinite number of concepts for developing sustainable, vibrant cities within distinct cultural and geographic settings. Most of these concepts focus on three basic design parameters: layout, structure, and mobility. Figure 1 illustrates a simple layout concept for a sustainable city that can accommodate information, industrial, and agricultural economies together. Laid out like a spider's web, the city would have six main transportation arteries—a mixture of air, land, or sea vehicles—into and out of the central core with multiple circulation arteries connecting the six "wedges." The central core would hold the city's major religious and cultural centers along with mass entertainment and government. The neighborhoods lying between the circulation arteries would hold a mix of housing, schools, retail, cottage industry, health care services, and urban agriculture (see Figure 2). Industrial hubs would be placed at the intersections of the transportation arteries providing optimal access to the city core, workers, and the outside world. This access would provide industry the necessary transportation not only to ship out goods and services, but also to dispose of waste that cannot be readily reused or recycled within the city itself.

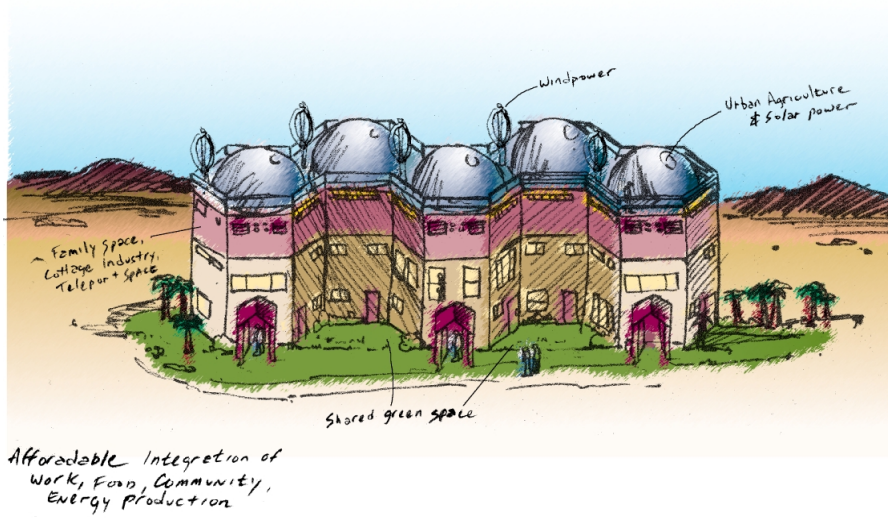


***Figure 2:*** A conceptual building that combines shelter with cottage industry, health care services, urban agriculture, and decentralized energy production. Each hexagonal unit could be connected by replacing the adjacent walls with portals.

Within the core and the triangular wedges would lie a variety of structures adaptable for multiple functions and designed to reflect the city's character and culture. Figure 2 shows how one structure could look within one of the neighborhoods. The interconnected, multi-story buildings provide space that can be used for shelter, work, agriculture, and energy production simultaneously. The rooftops bridge urban and rural life, replace lost cropland, suppress freshwater evaporation, and reuse domestic and industrial gray water for irrigation. Decentralized energy production would supplement the centralized power system without polluting the air. In addition to these sustainability elements, the hexagonal footprint would create shared green spaces that invite residents to interact with their neighbors at least two units away. Since only two of the six walls would be connected, this footprint would mitigate the appearance of attached housing, while enabling the combination of adjacent units to expand cottage industries, connect families, or create new neighborhood services (e.g. medical, education, infotech).

In addition to layout, structure, and circulation, cities also need to provide residents with controlled climate environments. Temperature, humidity, light, air purity, and precipitation have a profound impact not only on a city's basic functions, but also on people's moods, comfort, and attitudes. Technology can enable cities and residents to have more control over microclimates, but only if it functions in harmony with the surrounding natural environment and people's preferred living habits. Figure 3 shows one conceptual controlled environment designed to encourage walking or biking in hot conditions. As washable and wearable clothing, these individualized climates could be developed by premier fashion designers and operate as seamlessly as a basic sweater or jacket. On a larger scale, entire sections of cities could be surrounded by massive domes to control the release of industrial air pollution emissions, regulate solar irradiance, blend indoor and outdoor environments, and give a city a distinctive identity. These ideas are not new, but the acceptability and utility of these concepts remain untested.

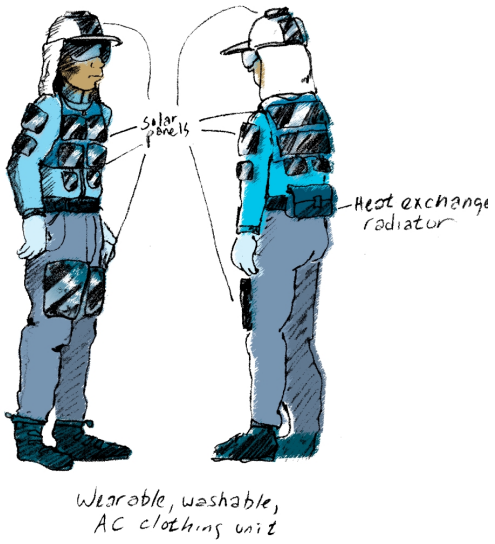


***Figure 3:*** A conceptual individualized climate. The washable, wearable unit would be designed to provide a preselected temperature and humidity at key body locations that would give the individual a sensation of overall comfort.

The world is experiencing three simultaneous urban developments: the growth of cities, the globalization of markets, and the mass movement of people. If these trends continue, cities will face ever-growing pressure to be economically and socially healthy in order to attract productive workers and satisfy the needs of its residents. Consequently, cities have little choice but to invest in new technologies and designs that not only leapfrog others' infrastructure capabilities, but also put them on the path towards sustainability. The need to attain sustainability is not simply an environmental imperative; it has become a competitive necessity.