Sustainable housing design and the natural environment

Meltem Yilmaz and Rusen Keleş

• Dr Yilmaz teaches in the Department of Interior Architecture and Environmental Design of the University of Hacettepe, Ankara, Turkey, from which she has a Masters degree. She also has a Ph.D from the Department of Urban and Environmental Sciences, University of Ankara. She has presented papers on environmental problems and vernacular architecture at numerous national and international congresses, and published others in various scholarly journals.

• Professor Keleş taught at Ankara University, Faculty of Political Science for many years and served as Dean of the Faculty from 1971 to 1975. He was also Head of both the Ernst Reuter Center for Urban Studies and the Center for Environmental Studies at the same university. He currently teaches at the Eastern Mediterranean University, North Cyprus. Dr Keleş has published extensively on Comparative Urbanization, Theories of Local Government, Environmental Policies, and Urban Politics. His major publications include The Politics of Urbanization: Government and Growth in Modern Turkey *(with Michael N. Danielson, New York, Holmes and Meier, 1985)*; The Urban Poverty in the Third World, *Institute of Developing Economies, Tokyo, 1988; and* Housing in the Middle East *(with Hiromaso Kano), Institute of Developing Economies, Tokyo, 1986. Dr Keles is a member of the World Society for Ekistics.*

The text that follows is an edited version of a paper presented at the international symposion on "The Natural City," Toronto, 23-25 June, 2004, sponsored by the University of Toronto's Division of the Environment, Institute for Environmental Studies, and the World Society for Ekistics.

Introduction

The contemporary environment today has been undergoing many changes. Particularly the interference of human activities with the natural environment adds new dimensions to the ecological equilibrium of the world. There is a general acceptance, regarding the environmental crisis on both local and global levels that the present form and degree of resource exploitation and associated consumption practices are unsustainable.

The very development created by humankind for reasons of comfort is threatening all forms of life. Never before in history have human beings had such an impact on the Earth. The resulting problems are a product of the size and growth of population, quantity of consumption and quality of technology. The range of urban environmental challenges varies according to income level and spatial level of impact. Problems of urban waste and pollution are inextricably linked to poverty and productivity, as well as broader macroeconomic performance. The poorest cities are most affected by environmental health problems that are largely contained within city boundaries. Also, within the city, the poor are typically more exposed to and affected by urban environmental insults. Urban areas supporting a higher level of economy, are plagued by sophisticated pollution and waste problems that are citywide to global in nature.

Much of the world is currently experiencing intense growth, especially in and around cities. Unfortunately, the development that such growth entails is often at odds with the natural environment. Cities may increasingly be the causes and the victims of environmental ills. However, cities also have the resources to prevent and cure their environmental problems. The concentration of money, intellect and organization in cities also results in a higher demand for environmental quality. So, cities offer an opportunity for reducing industrial and transport-related pollution (LEITMANN, 1999, pp. 10-11).

In most cities, over 80 percent of urbanization consists of housing (OKTAY, 2001, p. 5). For this reason, housing has an important impact on the quality of the environment. Accordingly, housing design must be based on the **participation** of users and principles of **sustainability**, to provide for long-range user needs while reducing energy use.

New forms of development, combining technological progress with greater equity, uplifting and safe natural and built environments, are possible. Developing sustainability in every field is the central task for people and governments. In this paper, sustainability will be considred with special attention to housing design. But before that, there is need to give a brief definition of the concept of sustainability.

Sustainability

The concept of sustainability certainly addresses excessive use of finite resources and the efficient management of the ecosystem, greenhouse gases, storm water pollution, efficient food production as well as fundamental concerns for social equity and social justice. The idea of sustainable development aims to ground the human standard of living on the carrying capacity of nature (ATAKARA and TANRIKUL, 2004, p. 441).

In contrast to the commitment to ruthless development, sustainable development has to be understood as a kind of development which is qualitative and controlled. Development in general should not be abandoned to market forces, but must be one of the responsibilities of the state. With this understanding, all public policies must prevent any further reduction or degradation of natural, cultural and social capital.

Nature conservation is central to the notion of sustainable development. Indeed, sustainable development was put forward

as a concept partly as a means of promoting nature preservation and conservation (ADAMS, 2001, p. 25). A generally accepted definition of sustainable development can be found in the Brundtland Report: (UN, WORLD COMMISSION ON ENVIRONMENT AND DEVELOPMENT, 1987):

> ... Sustainable development is development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs.

The concept of "sustainability" has progressed with "Agenda 21" which was developed after the Rio Summit by the European Union in 1995. According to Agenda 21 principles, value resources means valuing existing building stock as both physical material, as well as embodied energy, and cultural resources and heritage of people. Part of the process of advancing sustainable development involves requiring local and regional authorities to carry out audits of "present conditions," which include the social, economic and cultural contexts. The thrust of Agenda 21 is that sustainability should be incorporated into all regional plans, and community participation is a key activity to ensure that those ultimately affected by development proposals are fully represented (FARMER, 1999, p. 211). The Rio model has clearly increased the number and parameters of the concept. For the first time, politicians and the broader public have realized that the destruction of the environment does not come only from directly perceptible causes such as poverty, the consumerist model of living, inadequate education, the exclusion of social groups from decision making, and other similar factors.

One can assume that the Sixth Environment Action programme of the European Union, called Environment 2010: Our future, our choice (2001-2010), has been widely affected by the basic philosophy of sustainable development. In fact, one of the principles of the EU program suggests that, since individual citizens make daily decisions that directly or indirectly impact the environment, better quality and accessiblity of information on the environment and on practical matters will help shape both beliefs and decisions. Information for citizens must aim at encouraging more sustainable lifestyles. Accordingly, the Sixth EU Environment Programme sets primary priority areas for action as tackling climate change; preserving bio-diversity, environment and health; sustainable use of natural resources and management of wastes, that relate to designing sustainable dwellings.

Sustainability represents a balance that accommodates human needs without diminishing the health and productivity of natural systems. The American Institute of Architects defines sustainability as: "the ability of society to continue functioning into the future without being forced into decline through exhaustion or overloading of the key resources on which that system depends" (MENDLER and ODELL, 2000, p. 1).

Sustainability is a shared responsibility. Co-operation and partnership between different levels of society, organizations and interests is therefore crucial (VLAVIANOS-ARVANITIS, 2002, p. 27).

Although sustainability is one of the most significant concepts of the past two decades, the idea of sustainability is not new. Traditional planning and building methods were often good examples of sustainable design in their time, and represented wise uses of local resources matched with local skills. In combination, they produced a built environment which met human and environmental needs. However, factors such as demographic growth, and shifts from rural to urban areas create an imbalanced population distribution, natural and human-made resource depletion, and significant changes in expectations and lifestyles, all of which combine to erode the viability of traditional approaches to shelter provision. A building method that worked well in the past in its given context may have now become difficult to afford, build and maintain, and it may no longer meet the desired requirements of the family or community (OKTAY, 2001, p. 2). But it is essential to look to buildings in the distant past for ideas about how to build in the future. Indeed, before the advent of air-conditioning and other technologies that are now taken for granted, architects and builders had no choice but to create sustainable structures. In the late 19th century – before electrical heating, cooling and illumination – architects used a combination of mechanical devices and "passive" techniques (which worked without electrical or mechanical equipment) to illuminate and ventilate the interior spaces of even high-rise and long-span buildings.

Most conventional practitioners of modern design and construction find it easier to proceed as if nature and a sense of place did not exist. Rather than rely on depleting fossil fuel resources, an ecologically aware design would investigate local energy sources, the availability of sunlight, shade and water, the vernacular architecture of the region, the lives of local birds, trees and grasses. That kind of design preserves aesthetic, economic, social and ecological values. By finding ways to create buildings that consume less energy in their day-to-day operation, use renewable materials and rely on natural means to ventilate and illuminate their interiors, architects, engineers and builders come closer to the goal of true sustainability (GISSEN, 2003, pp. 10 and 11).

Matter and energy cannot be created or destroyed. Matter and energy tend to disperse. This means that any and all matter that is introduced into society will never cease to exist and will, sooner or later, find its way into the natural system. Toxic materials are no exception. They, too, will disperse and find their way ultimately into people's bodies. These are scientific principles; people can ignore them, but they will not disappear (MENDLER and ODELL, 2000, p. ix). So, humanity must learn to live without exhausting the resources of the world in order to survive. This can be possible only by sustainable design practices. Principles of sustainability can be grouped under four headings:

- Fuels, metals, and other minerals must not be extracted at a faster pace than they can be redeposited and reintegrated into the earth's crust, turning them back into nature's building blocks.
- Human-made materials must not be produced at a faster pace than they can be broken down and integrated back into the cycles of nature.
- The productivity and diversity of nature must not be systematically diminished.
- In recognition of the first three conditions, there must be fair and efficient use of resources to meet human needs. This means that basic human needs must be met in the most resource-efficient ways possible, and meeting basic needs for all must take precedence over providing luxuries for the few.

Living in rapidly growing cities, human beings must search for ways to build today with available resources. Architecture does not end with its foundation and outer walls: urban planning, as well as, interior, landscape, product and systems design are part of sustainable architecture (CROWTHER, 1992, p. 89). High-rise construction removes people from nature. Housing is, in many respects, a central setting for individuals with high psychological and social significance. Accordingly, the provision of housing is an important need in the development of any city.

Sustainable housing design

Over the past two decades, sustainable design has been in the process of being defined world-wide. Sustainable housing design is the kind of design which respects natural resources, and embraces, human, cultural, and historical significance.

Architecture is an intervention upon Nature. It protects human beings from the intensities of solar exposure, climate and other humans (CROWTHER, 1992, p. 86). Besides, architecture is a reflection of the contemporary society in attitude, customs, desires, needs and technology; and in present-day society, natural coherence and sustainability become important priorities in

the process of design. Sustainability in architecture requires efficient and healthful interior solar and climatic space planning. The relationship of the interior spaces with the exterior spaces has to be strong and the integration of nature with architechural design has to be provided for.

Modern technology and methods of construction have sadly degraded natural resources – agricultural land, forests, air, and water. There has been a loss of energy on the Earth because of misuse of resources. Sustainable design assumes that this misuse can no longer be sustained, because the world's population is expected to be more than double in the next 50 years. One of the defining features of the machine-age 20th century is how people have become separated and sealed off from the environment. Whether in air-conditioned buildings, shopping centers or theme parks, technology has been used to construct a world that removes people from nature (FARMER, 1999, pp. 209-210). Sustainable design requires a fundamental change in mind set and a change in values towards less consumption and more environmental awareness.

Individuals and groups play an important role in the creation of their habitats. At the same time, sustainable housing provides opportunities for long-term flexibility and adaptability. As far as housing is concerned, local sustainable development deals with improving the quality of life of the local community through the prudent use of local resources. The aim, therefore, is to achieve a high degree of local self-sufficiency, which is related to ecological site design as a determinant of urban ecology.

In this context, as energy use is largely determined by the density of layout, location, orientation, etc. of the original design, designers and builders can exert a great deal of influence over improvement in sustainable design (OKTAY, 2001, pp. 5 and 6). It is important to keep in mind that sustainable housing design is not a new approach to building. It has in some sense existed since people first selected a south-facing cave rather than one facing north to achieve comfort in a temperate climate. The discovery of the vernacular building by local people using local materials adapted to local climatic conditions was the beginning of sustainable architecture. In such shelter, humans recognized one supreme and absolute limitation: the impact of the environment, which included building materials which the local environment was able to afford. Primitive architecture reveals a very high level of performance, even when judged in the light of modern technology. It reflects, on the one hand, a precise and detailed knowledge of local climate conditions and, on the other, a remarkable understanding of the performance characteristics of the building materials locally available. So, an understanding of primitive architecture is important because, with the rapid industrialization and urbanization of the Western world, there is a growing tendency to minimize or ignore the importance and complexity of the natural environment.

Criteria for sustainable housing design

Human and environmental needs have largely been neglected in modern developments that emphasize such factors as growth, speed, and intense, chemical stimulants. Despite the fact that building designs themselves have greatly improved over the last few decades, more thinking needs to be done about the relationship of architecture to the community and the environment in order to enhance sustainability.

Many factors account for the shift toward a more human and contextual design approach. One of the most significant has been community-based development organizations. Local organizations embody the goals of social justice, such as participation, empowerment and accountability in the communities they serve (OKTAY, 2001, p. 8).

Energy

First-wave societies drew their energies from human and animal muscle power; or from the sun, wind and water. Second-wave industrial societies began to draw their energy from irreplaceable fossil fuels – oil, coal and natural gas. This revolutionary shift meant that, for the first time, a civilization was eating into nature's capital, rather than merely living off the interest it provided. Third-wave civilization must draw on a variety of energy sources – hydrogen, solar, geothermal, perhaps advanced fusion power – as well as other energy sources not yet imagined (ONAL, 1997, p. 26).

The design of vernacular houses varies from region to region according to the natural resources available. Their energy consumption has to be low because of limited resources.

After World War II, architects explored the potential of air-conditioning for high-rise, mid-rise and long-span spaces, that reflected a move away from passive strategies. These buildings featured an entirely new language of smooth-skinned glass-and-steel boxes without operable windows, ventilators or external sunshades. With the development of low-wattage fluorescent lighting that did not emit much heat, the floor area of these structures widened to the point where natural light was replaced completely with artificial light.

The affordability of these new buildings and the fossil fuels used to drive the generators that powered them explains, in large part, why passive environmental control was phased out. The consumption of fossil fuels is one of the biggest environmental problems. Drilling in ecologically sensitive areas, oil spills, air pollution and the destruction of the atmosphere all result from the incredible demand for fossil fuels. Cars and factories are often considered the most obvious enemies of the environment, but buildings consume more than half the energy use worldwide. Mechanical systems that supply air-conditioning and heating, lighting systems, and other building technologies have to be redesigned to consume less energy – and alternate sources of energy have to be developed. Building owners can purchase energy made from renewable or clean sources (solar, wind or hydroelectiric), and architects can design buildings that generate their own clean and renewable energy (GISSEN, 2003, p. 19).

The energy needs of buildings relate to the elements of climate:temperature, wind and availability of light. Particular climate-related needs of all types of buildings vary from south to north, from one climactic region to the other. However, there are some needs which are common everywhere in the world: heating, in winter and at night; cooling; day lighting, whenever available; ventilation, some natural and some forced.

Depending on the regional climate and the predominant need for heating or cooling, three major strategies are available (ONAL, 1997, p. 83):

- in cold weather:
  - maximizing solar and other free heat gains,
  - providing good heat distribution and storage,
  - reducing heat losses and allowing for suitable ventilation;
- in warm weather:
  - minimizing heat gains,
  - avoiding overheating, and
  - optimizing cool air ventilation;
- replacing electric lights with the use of natural light.

The usage of photovoltaic panels on buildings generates electricity from sunlight. At present, this system is being used mostly for high-rise buildings but it can be expanded to residential buildings.

Buildings consume at least 40 percent of the world's energy. They account for about a third of the emissions of heat-trapping carbon dioxide from fossil fuel burning and two-fifths of acid rain-causing sulfur dioxide and nitrogen oxides. So, in building designs, the reliance on fossil fuels has to be reduced and the

use of cleaner sources of power has to be explored. Fuel cells, photovoltaics, solar hot water, and other renewable energy sources have to be considered in building designs.

The reduction of energy consumption for the illumination of the buildings is also important. There have been substantial advances in the efficiency and quality of lamps. The coloration of fluorescent lamps has improved, so designers no longer need to use incandescent lighting to create a "warm" interior. With incandescent lamps, only 10 percent of the energy emitted is in the form of light – the other 90 percent is heat (MENDLER and ODELL, 2000, pp. 9 and 10).

Climate

Without the benefit of abundant energy, past communities had to work with their climate. In hot dry climates, for example, buildings were shaded to avoid the unbearable heat of the summer sun by tall vegetation, rock overhangs, or by the courtyard building form; they were also oriented to receive the pleasant warmth of the winter sun. Massive walls keep buildings cool in summer, as do high ceilings vented at the top to increase air flow. Ancient builders learned to design houses to take advantage of the sun's energy during the moderately cool winters and to avoid the sun's heat during the hot summers. Thus, solar housing came into being – designing buildings to make optimal use of the sun by responding to its changing positions during different seasons.

Solar principles and other local climatic qualities were used not only for single, isolated villas but for groups of houses within an urban context as well. Villages and small towns were planned to receive benefits of the sun with optimal community and building plan shapes, east/west street orientations, and good solar access to most buildings and outdoor public places (OKTAY, 2001, p. 34).

Architecture itself as a fixed state construction has to contend with the dynamics of people and the dynamics of the sun and climate. Within its "fixity," adaptive ecologic attributes can be given to architecture by design (CROWTHER, 1992, p. 80). Architecture must be a response to climate (McCARTHY and BATTLE, 1998, p. 62). In colder climates, comfort depended on shelter from prevailing winds by siting, land form, and vegetation, together with low ceilings, thick walls, and windows on the exposed side. In the extreme cold (as in the extreme heat), buildings were buried in the earth or covered (ONAL, 1997, p. 27). Northern facades usually have only a few openings, whereas the southern facades contain the main openings, thus maximizing the benefit of the limited sunshine. The ideal orientation for buildings in such a climate is with their long axis running east-west.

In wet areas, houses were raised above the ground or had raised floors, with a steep pitched roof and overhanging eaves. Each region has its own climatic conditions and cultural patterns, which must be the basis for solutions in each individual case.

The use of solar energy in building forms has challenged designers from ancient times and continues to do so today. There is a broad range of use for solar systems, from space and hot-water heating, to natural lighting and electricity production. The enormous benefit of a solar system is in the use of a pollution-free, renewable energy source – the sun. The solar trajectory affects the amount of radiation received on vertical surfaces: in winter, a southerly-oriented surface receives a lot of radiation, because the sun is low, but any other orientation would receive much less solar energy. In summer, on the other hand, when the sun is higher at noon, a southerly-oriented surface receives less direct radiation, while a westerly or easterly orientation is heavily impacted during the evening or the morning hours (VLAVIANOS-ARVANTIS, 2002, p. 56).

Climate and the need to heat or cool a building plays a major role in the design of the external envelope – transparent elements like windows and sunspaces, walls, roofs and floors – of a building. By improving the building envelope, passive solar strategies can be developed to improve comfort and reduce energy demands (MENDLER and ODELL, 2000, p. 9). There are various factors which affect heating, cooling, etc. in a building (ONAL, 1997, p. 106): The thermal inertia or mass of walls, floors, partitions and roof influence the rate of temperature change inside the building. External colors and surfaces affect heat absorption and reflection. Insulation of the external envelope and; reduction of infiltration can reduce heat loss. Contact with the ground can help to keep a building cool in summer, with moderate heat loss in winter. Designing with outside air in mind can be useful for cross- ventilation and cooling.

Estimating the microclimatic influences of wind is more difficult and uncertain. In winter, cold winds increase heat loss, by cooling the external fabric, and by increasing the air infiltration through openings. Shelter-planting and topography can act to reduce wind speed, and hence reduce heat loss. The reduction of wind flow has to be provided without reducing solar gain. This improves the comfort in adjoining outdoor spaces also.

In summer, it may be useful to direct the prevailing wind flow, by vegetation or topography, so as to funnel cooler breezes through the building in order to reduce the cooling load (ONAL, 1997, p. 88). The density and the heights of the buildings are significant in reducing the effects of the harshest weather conditions. Wind tends to pass low in densely built areas, but it is caught, directed downward, and intensified by tall, free-standing buildings.

Natural forces can be used to define form in architecture so that design is not only about art, but also includes a thoughtful physical response to the environment (McCARTHY and BATTLE, 1998, p. 62).

Building materials

A vernacular building lacked the benefit of cheap, mass-produced imported materials. It relied, instead, on largely local resources and skills. Depending upon local materials, the colors and forms of vernacular buildings often harmonized with their settings. Certainly, building materials can enhance or negate climatic advantage. Moreover, the sensual perception of an interior space is largely determined by the materials which line its surfaces; as light is transmitted and refracted through materials, or reflected by the texture and color of the internal surfaces, its quality and utility are established (ONAL, 1997, p. 25).

To be sure, the environmental impacts and resource use of proposed building materials have to be evaluated. Raw material sources, modes of production, and transport to the site, installation and use, and finally disposal or reuse should be questioned and evaluated prior to making a selection.

Nontoxic materials have to be sought from local, renewable, sustainably acquired resources like wood products and naturally processed products (VLAVIANOS-ARVANTIS, 2002, p. 52), that minimize pollution from manufacturing, installation and maintenance (MENDLER, 2000, p. 11). Many contemporary building materials are made using harmful chemicals, such as polyvinyl chloride (PVC), polycarbonate, and substances which deplete the ozone layer. Traditional, natural building materials such as adobe, straw-bale and bamboo are sustainable materials. They avoid adverse environmental impacts in their fabrication and are energy-efficient.

A report by the World Resources Institute projects a 300 percent rise in energy and material use as world population and economic activity increase over the next 50 years. If industry can become more efficient, using fewer resources to provide the goods and services people want, economic growth can be sustained. This idea is often called eco-efficiency and influenced architecture as well. "Reduce, reuse, recycle" is eco-efficiency's

popular mantra. Recycling building materials is one of the techniques being employed to reduce the environmental impact of buildings.

But in some conditions recycling can be problematic. Mixing construction materials not designed to be recycled can be quite destructive. Most recycling is actually downcycling, with materials losing value as they circulate through industrial systems. The strength of steel, for instance, is compromised when it is mixed with other metals in the recycling process. Recycled steel from the U.S. and Europe is used for building construction in Asia and its wide use in Turkey may have been responsible for the collapse of so many buildings during the earthquake that rocked the country in 1999.

Mixing metals dilutes their value and increases the impact of materials. When rare and valuable metals such as copper, nickel and manganese are blended in the recycling process, their discrete value is lost forever. A materials passport, much like the bar code on consumer goods, could change that. The passport would essentially guide materials through industrial cycles, routing them from production through reuse.

Another approach to reduce resource consumption is using less construction material. Dematerialization, as this strategy is often called, searches the possibilities of getting maximum performance from minimum materials. It states that: Lightweight fiber reinforced composite materials, intelligently composed, can yield structural strength while dramatically cutting resource consumption. Efficiently constructed buildings cut waste and light materials minimize resource consumption.

Rematerialization is also important for sustainable design. In the industrial world, it refers to chemical recycling that adds value to materials, allowing them to be used again and again in high-quality products. The process is modeled on nature's nutrient and energy systems, which perpetually recycle materials in closed-loop cycles. Industrial ecology applies the structure of these natural systems to the management of industry's material flows, so that all products and materials, after their useful commercial lives, can be returned to the soil or circulated in industry forever.

Architects have to select materials that are safe, and even benefical, for human and environmental health. In buildings, materials that provide nourishment for nature or are recyclable, have to be used. Just as in nature, when the by-products of one organism become food for another, the flow of these biological nutrients and technical nutrients in their respective cycles eliminates the concept of waste.

Insulation is also crucial to both health and performance buildings. Rice-husk insulation and rice straw are safe, effective, inexpensive, totally biodegradable, and produced with a renewable resource (BRAUNGART, 2003, pp. 118-122).

Indoor air quality

Air is an essential resource for supporting life, a unifying substance for mankind. Every molecule of air we breathe has a 99 percent chance of having been breathed before. Air knows no boundaries or borders, yet it is not recognized as a finite resource. As trees and other plant life – the planet's natural systems for cleaning air – are destroyed, the problem becomes more acute.

An analysis of global carbon emissions reveals that between 40 and 50 percent is generated by buildings, 25 percent is from transport, and 25 percent comes from industrial sources. This places a heavy responsibility on the shoulders of the construction industry. Designers need to address not only the issue of providing clean air for the occupants of buildings, but they must also ensure that buildings do not pollute their surrounding environments. This challenge is the key to the development of a sustainable future.

Settlement and land use

Today, it rarely happens that human beings have the opportunity to settle on virgin land. From birth people are "thrown" into a pre-existing, human-made environment, to which they have to adapt, often without a choice. An already existing place has to be understood as a settlement, and the construction of a new building within an old context is also, in a certain sense, an act of settling.

For a truly sustainable environment, there is need to maximize the exchange between services whilst minimizing the travel necessary to do so. This implies as much variety of activities as possible, easily available within a walking distance of where people live and work (OKTAY, 2001, p. 25). So links to public transit and strategies for pedestrian-friendly, mixed-use, livable communities have to be developed. To encourage the use of mass transit, higher-density mixed-use developments have to be located around transit nodes. To encourage pedestrian circulation, streets can be animated with retail space at street level, and the use of pedestrian networks can be promoted to connect neighborhoods, offices, schools, and shopping centers (FARMER, 1999, p. 8). The greater the self-sufficiency of site and architecture, the less the environmental impact.

Some major objectives can be put forward regarding building location and siting in sustainable housing design which are:

- locating the building to benefit from the best available microclimate;
- considering both insulation and shelter when heating is required;
- considering prevailing breezes for cooling;
- respecting views and profiles of the skyline;
- respecting the elements and cultural significance of the urban (or rural) landscape.

The sustainable community integrates housing of mixed size and type appropriately within the overall community design. Integration, as opposed to segregation, is an objective of sustainable communities, accommodating individual and community needs and aspirations.

Participation

The fragments of dwelling traditions uncovered in Anatolian excavations cover a time span of about 10,000 years. Ten thousand years ago, the house was not a single entity, but part of a compound. Starting from primitive shelter, the function of housing tries to address the same issue: how to live safely. The concept of safety may change, but after millennial developments, there is still the usage of walls, roofs, windows and doors. The house – the most individualistic concept of any architectural tradition, the most societal of artifacts – is the most personal, but the most common object of production which expresses humans in their most intimate moods.

Concepts concerning human dwelling have changed in the 20th century, first slowly, then with the development of megapolises, very rapidly. While people still cherish the idea of owning a house, they forget to expect a "personality" from it. The house in the modern world is a consumer item, a neutral product, like a box. The individuality of one's own house has become a rare luxury. If modern man still has an individuality in his private environment, it may be found in the hidden corners of some room (KUBAN, 1996, pp. 1-5). So, the reintegration of the designer and builder is part of the social development of sustainable housing.

Identification

In general, identification means to experience a "total" environment as meaningful. Human identification means to relate meaningfully to a world of "construction." Human beings are not born

in isolation, but are part of a structured totality. Identification, thus, means to gain a world through the understanding of an existing environment. In general, the existing environment has to be interpreted by humans to become an inhabited world.

All landscapes are characterized by an atmosphere which maintains its identity through climatic and seasonal changes. This atmosphere is of essential importance because of its unifying role in the environment, and identification also consists in being open to such an environmental character. Identification is never separated from daily life, and is always related to human actions (NORBERG-SCHULZ, 1985, pp. 18-20).

Cities, buildings and society that define and constitute each other are parts of the same eco-system. In response to many factors, cities are always changing. Therefore, the urban environment has to be considered as an evolution of the local urban fabric, with respect to human activity and built form. This is also significant in the creation of "a sense of place," an important factor in achieving identity in urban settlements.

Considering the identity theme, the neighborhood strengthens the bonds between residents and between themselves and their environment. The process of neighborhood planning is seen as a way to provide the real needs of the residents. The definition of the neighborhood (its size, borders, etc.) is drawn from the requirements, expectations and lifestyles of its residents (OKTAY, 2001, pp. 11-12).

One of the requirements of a neighborhood is transportation. Neighborhood streets are public spaces that should comfortably and deliberately accommodate a variety of transportation means, especially pedestrians and bicyclists. Sidewalks and public transit offer an attractive and reasonable alternative to driving when they are safe, attractive and most importantly, lead to places where people want to go (VLAVIANOS-ARVANTIS, 2002, p. 47). Safe, well maintained, attractive and uncluttered public spaces provide the vital "glue" between buildings and play a crucial role in strengthening communities.

In the last decade of the 20th century, it has become increasingly apparent that driving must be reduced to minimize pollution, save energy and rejuvenate community life. Busy streets divide neighborhoods. Cars isolate one person from another. People who live on streets with heavy traffic are less likely to know their neighbors. One effective approach is to close the street off to through-traffic. Once a street has been closed in this way, it has been found in many places that neighbors feel a sense of ownership and often begin to improve the area as an extension of their household space. Parents feel more comfortable releasing children for play, and relationships between households are more likely to develop. Making streets narrower simply calm the traffic. Integrating narrow streets with pedestrian paths and bikeways promotes the forgotten activity of walking. As people walk, they meet their neighbors and friends; the neighborhood comes alive. Dedicating less land to cars means that more is available for people, parks and green-belts (OKTAY, 2001, p. 21).

Flexible design

Flexible design provides ease of expansion and reconfiguration when needed. Design in flexibility has to be considered, to accommodate future needs through the use of modular planning and flexible building infrastructures. The use of fixed cabling and chases that are embedded into the building structure can be difficult and costly to change (MENDLER and ODELL, 2000, p. 8).

Buildings should be adaptable as well. A building should not just be a static object designed for one season – it should be a compromise between all seasons, so the skin design of a building is very important. It would have to regulate energy flow through itself and store any excess energy that it does not need immediately (McCARTHY and BATTLE, 1998, p. 60).

Green spaces

The biggest challenge in today's contemporary human settlement developments seems to be the quantity, nature and location of green spaces within built environments. However, "quality" has been put up against "quantity," and green spaces have been associated more with quantity and less with quality. Green spaces in a city contribute to human activity, climate amelioration and ecological diversity, without separating or isolating people from each other.

Plants may enhance housing environments through protecting water quality, reducing soil erosion, improving air quality, lowering summer air temperatures, conserving natural resources and screening busy streets. However, for proper land design, the location of the plants, their species, year-round effect, shade effect, and windbreak effect should be considered. Besides, the used plant material should be adapted to the region's climate, soils, and water availability to ensure survival while reducing maintenance and irrigation requirements (MENDLER and ODELL, 2000, p. 11).

Green spaces and built forms can modify microclimates on both greater and lesser scales. Plantings can be used to control microclimates in three ways:

- the first is by absorbing and reflecting solar radiation, creating cool shades beneath, reducing ambient summer temperatures and allowing radiation to pass through in the winter;
- the second is by creating a zone of calm air under the canopy; and,
- the third is the cooling function that trees provide by the release of cooling water vapor from their leaf surfaces through evaporation and transpiration.

Trees also provide valuable shelter where the wind is a problem around high buildings. By improving the quality of life outdoors, people will be less tempted to be inside, where they usually consume energy in one form or another (e.g. lights, television, etc.).

Trees should be considered as necessary parts of housing environments, just like streets, electricity cables, water and sewer facilities. Street trees, for example, are important not only because they absorb noise and air pollution, lower utility costs, and provide a habitat for birds and other wildlife, but also because the street and its frontages are a community's major public area. Trees create outdoor spaces that attract people. When people are drawn to spaces with trees, they are more likely to see and interact with their neighbors, and so they are more likely to get to know each other and become friends. Further, a natural environment with a range of vegetation offers children the best opportunities for free play (OKTAY, 1998, pp. 283-284).

Natural and landscaped open spaces are for the use, benefit and enjoyment of the entire community. When deliberately designed for safety, comfort and beauty, neighborhood squares, parks, playgrounds and green acres become places of community activity, as well as neighborhood identity (VLAVIANOS-ARVANITIS, 2002, p. 47).

Natural environment

The idea of nature, as it often appears in common consciousness, is that it is a vast resource subject to human exploitation, that it offers a great wealth of possibilities for the satisfaction of human needs and desires so long as one is able to master it by means of technology. Nevertheless, humans cannot dominate and control nature according to their will. This is clear once one has been informed about the ecological hazards of the 20th and 21st centuries. Even periodically occurring natural disasters, hurricanes, floods etc. that destroy human settlements and kill thousands of people every year, have not been sufficiently instructive to make people realize the limits of this challenge of nature.

New developments in science indicate that we are on the threshold of a new understanding of nature. The uncreative world machine has turned into a creative, evolutionary cosmos. From this view, nature emerges as alive rather than inanimate and machine-like and, as a consequence of this, our survival may depend on our recognition that we are part of nature, not separate from it (FARMER, 1999, p. 205).

Alienation in modern society's experience of nature and the immediate environment is so great that the nearer humans are to nature, the further they are removed from it: the more we approach nature with an exploitative attitude, the less chance we have to ever get into a genuine dialogue with it. Alienation from nature, a typical feature of modern civilization, is a consequence of enlightenment: the development of reflective consciousness brings about a critical distance between humans and the outside world.

The history of modernism that dominates the world today has been developed decisively upon a model of nature as something existing outside and independent of the human being. Throughout history, the continuing character of the principle of "domination" persists in the instrumental rationality of positivist science and modern technology. The previous fear of dangerous, unknown, overpowering nature has now been overcome by the principle of control. In architecture, any act of building on the earth becomes a symbol of human triumph over nature.

However, technology cannot be ignored or rejected as it contributes to human well-being. From the earliest moments of human history, homo sapiens has used technology to exploit natural resources. Neolithic farmers slashed and burned their way through the vast forests of Europe as they cleared the land to work with their digging sticks and stone tools. On the other hand, traditional farming communities that grew from these primitive origins necessarily had to develop a symbiotic relationship with the earth. Today, technology in itself is not to blame for the environmental crisis; it is rather the worldview that sees the earth as a mere stockpile of resources. This worldview must change and with it, peoples' attitudes to technology (FARMER, 1999, p. 207).

Dialogical rationality, on the other hand, conceives of humans and nature in their own right. The concept of dialogue presupposes the conditions of a peaceful interaction between participating subjects. A peaceful, open dialogue with nature that aims to understand its intrinsic qualities is also a pre-condition for making peace with man's inner nature. Although the human being, by virtue of its reflective capacities, holds a superior position among other beings, it is still dependent on nature for survival. If nature has granted humans the capability to create their own world, this should make them responsible for what they have created (ÖĞÜT, 2000, pp. 37-54).

Conclusion

The impending millennium has put housing back into the foreground of architectural projects. Although "intelligent buildings" have been anticipated for some 20 years, the prohibitive costs of many of the technologies involved have limited their realization. The possibilities of technology could transform buildings into automatic, self-regulating systems which could produce a subtly changing and modifying environment, at apparently little energy cost. However, sustainable design is more than a technological add-on. The social, political and economic structures which underlie the making of buildings will have to be reformed to enable designers to use their skills to provide naturally sound environments in the broadest sense.

The practical, ecologically aware experiments made by building single or small groups of housing, usually in suburbs, or the countryside, are important both for their role as prototypes and for their demonstration of the possibility of sustainable living. Care will be needed to ensure they do not experience the same problems as Biosphere, the experimental re-creation of a microcosm of the earth's ecosystem, which apparently foundered at the human, social level rather than the technical level (FARMER, 1999, p. 218).

For sustainable housing design, the factors of durability, maintenance needs and embodied energy costs (including those needed to transport materials or components to the site and to assemble them) have to be re-evaluated. Studies can be done as to the effects of resource extraction and depletion on the natural habitat and which materials degrade biologically. Assessment can be made of the energy required for further processing, if materials can be recycled. The model for sustainable design is nature itself. Nature is efficient and effective by design, essentially producing no waste. Sustainable housing design guides an openness and attention to fitting materials, fitting forms and fitting systems, so that human habitation supports the life of a locale. Combining the local knowledge with an understanding of sustainable materials and energy systems, architects can create buildings that encourage healthy interaction with the natural environment.

The larger political questions of how urbanization can be equated with sustainable ways of living, have scarcely begun. Architecture can express, like any other language, the priorities of the day, and it can make tentative prototypes and perhaps dream of solutions. It may be that the environmental crisis will best be confronted by application in architecture.

Cities have to be able to effectively treat waste products, and generate energy, as well as consume it. In order to achieve this goal, architects, designers and engineers need to embrace a combination of new technology and inherited architectural vernacular. Some construction methods – including on-site welding, transportation of materials, and the use of raw and uncut materials – contaminate the building site with pollution, waste and noise. The environmental impact of building construction has to be limited. One of the most obvious solutions is to reuse buildings that already exist. But if that is not possible, architects can use materials that require little energy to produce and ship, and are renewable, modular (to reduce construction waste), and prefabricated (so construction can be done in factories and not on city streets).

Architecture and urban planning based on environmental preservation are the only options for maintaining quality of life and preventing lasting environmental damage. Pollution reduction, waste minimization and energy conservation can be furthered through environmentally friendly urban design and construction. The environmental community has promoted the slogans of reduce, recycle, and reuse. Recently a fourth has been suggested: Recover. The remediation of environmental pollution and damaged natural resources is vital to the support of future sustainable development. So, a new kind of architecture has to be created that actively promotes such development.

As a broadly interpreted concept, sustainability is becoming more and more difficult to realize under the impact of worldwide globalization. Nevertheless, globalization offers opportunities and challenges for sustainable development.

Bibliography

ADAMS, W.M. (2001), *Green Development, Environment and Sustainability in the Third World* (London, Routledge).

ATAKARA, C. and A. TANRIKUL (2004), "Sustainable developments for coastal problems in Kyrenia, Cyprus," *International Gazimagusa Symposium 2004* (Gazimagusa, Eastern Mediterranean University Press).

BRAUNGART, Michael (2003), "Beyond the limits of sustainable architecture: A new material sensibility for the twenty-first century," in David Gissen (ed.), *Big and Green Toward Sustainable Architecture in the 21st Century* (New York, Princeton Architectural Press).

CROWTHER, Richard (1992), *Ecologic Architecture* (Boston, Butterworth-Heinemann).
FARMER, John (1999), *Green Shift*, ed. by Kenneth Richardson (Boston, Architectural Press).
GISSEN, David (2003), "Energy," in David Gissen (ed.), *op. cit.*
GUNTHER, Thomas, Schmitz (1999), *Living Spaces Ecological Building and Design* (Köln, Könemann).
KUBAN, Dogan (1996), "Scraps of philosophy for human dwelling," in Yıldız Sey (ed.), *Housing and Settlement in Anatolia: A Historical Perspective* (Istanbul, History Foundation Publications).
LEITMANN, Josef (1999), *Sustaining Cities* (New York, McGraw-Hill).
McCARTHY, C., and G. BATTLE (1998), "The need and drive for sustainable architecture and urban design," in Andrew Scott (ed.), *Dimensions of Sustainability* (London, Routledge).
MEGA, Voula (1999), "Environmental, demographic and territorial dimensions of sustainable development," *Ekistics,* vol. 66, no. 394/395/396 (Jan./Feb.-Mar./Apr.-May/June).
MENDLER, S. and W. ODELL (2000), *The HOK Guidebook to Sustainable Design* (New York, Wiley).
NORBERG-SCHULZ, Christian (1985), *The Concept of Dwelling* (New York, Rizolli International).
OKTAY, Derya (1998), "Green spaces and the ecological quality of housing: The case of Cypriot settlements," *Ekistics,* vol. 65, no. 391/392/393 (July/Aug.-Sept./Oct.-Nov./Dec.).
—— (2001), *Planning Housing Environments for Sustainability: Evaluations in Cypriot Settlements* (Istanbul, YEM Yayın).
ONAL, Sebnem (1997), *Designing For Sustainable Architecture* (Gazimagusa, EMU Faculty of Architecture Dept. of Arch. Press).
ÖĞÜT, Rana Nergis (2000), "Reflections on the conception of nature within the framework of the dialectic of enlightenment," in A. Sargın Güven (ed.), *Nature As Space* (Ankara, METU Faculty of Architecture Press).
VLAVIANOS-ARVANITIS, Agni (2002), *Bio-Syllabus for European Environmental Education* (Athens, Biopolitics International Organisation).