Urban Planning for a Green & Sustainable Future

Historical Outline

In The Beginning, when fossil fuel based energy was not easily and cheaply available, all was Green:

Buildings were designed in sympathetic response to local climate, otherwise the occupants suffered inferior conditions. They were constructed of locally or regionally available materials, which could not be transported long distances. Light was basically daylight, with candles & oil lamps as supplements for nighttime.

Water was a "local" system - locally harvested, stored, & used according to availability. Recycling of available resources was the norm, with "absolute waste" as a minor phenomenon.

With arrival of the era of Cheap and Available Energy, and with it Mechanised Transport, things began to change:

The average householder was able to improve his thermal comfort, first with heating from burning coal & oil, and later cooling with electricity. He could light his house with gas, & then with electricity.

Building materials could be moved with increasing ease over ever extending distances, and personal movement ceased to be limited to walking or cycling distances.

Water could be pumped in large quantities over long distances. Waste, as recycling became less of a necessity or norm, could be transported away & dumped out of sight.

And Cities Grew...and Grew...

With this situation, urban planning and building design became divorced from environmental considerations and responsibility:

Buildings ceased to be designed on the basis of form & orientation in relation to climate, and it became the norm for thermal comfort & functionality of buildings to depend entirely on mechanised, energy-dependent systems.

Daylight ceased to be considered as the main source of daytime illumination.

Use of locally available materials ceased to be a factor in building design.

Mechanised transport, in the form of the private car, became the generating force in the planning and development of cities, and in the creation of urban sprawl.

Water came out of the pipe, in any quantity demanded.

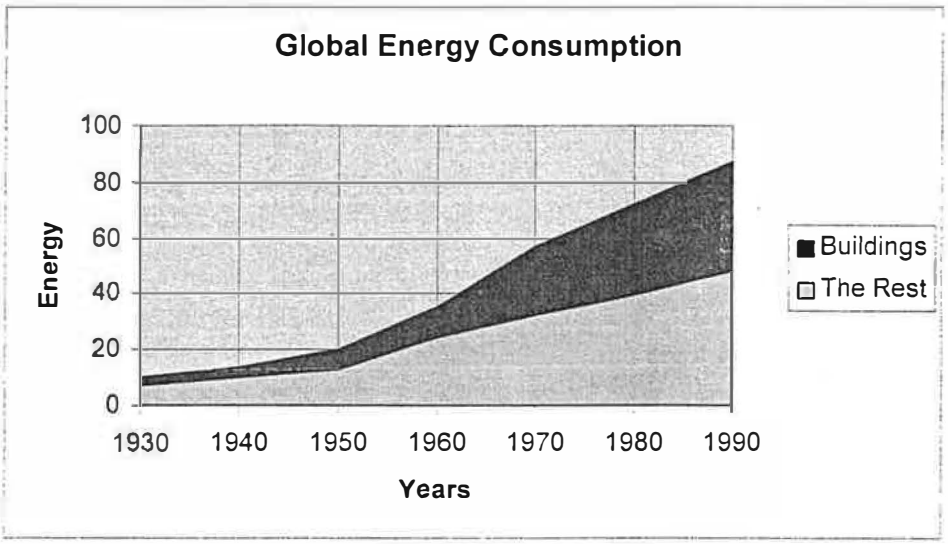
Liner process patterns, of production, consumption,& disposal became the norm, and waste, solid and liquid, became a major factor of urban development and management.

Current Situation

Today, we are aware that the course of development followed over the last hundred years is creating a dangerous impact on the whole global eco-system, and that steps must be taken to change this course if environmental changes and disaster are to be avoided. **This is the challenge facing the urban planning and building design establishment today.**

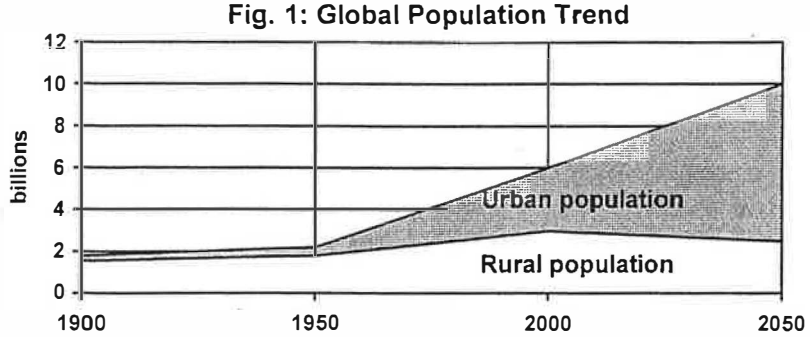
Today, 45% of global energy consumption is used for heating, cooling & lighting of buildings, with a further 5% in building construction. **Over 50% of this energy could have been saved through improved building design and construction, on a purely economic basis.**

Currently, the knowledge exists to design modern, technologically advanced, economic, climatically responsive buildings that are also ecologically friendly and healthy for their inhabitants. Over the last twenty years this knowledge has been researched, developed, tested and applied in many demonstration projects worldwide, and is no longer at all experimental. However, they have not been widely applied in mainstream building construction, for a wide variety of reasons.



Following the concern for "Green", Sustainable Building, there has developed a growing interest in the "Sustainable City", since cities account for the majority of global resource consumption, produce most of the world's waste and pollution, and directly and indirectly are responsible for the majority of global environmental degradation. This is becoming increasingly important with the exponential growth of cities as a global phenomenon: in 1900, 14% of the global population of 1.8 billion lived in cities, whereas today, 50% of the present global population of 6 billion are urban dwellers – an actual increase of over 1000%.
This field of concern is the subject of intense debate and research globally, with many initiatives and examples 'on the ground'.

Fig. 1: Global Population Trend



In response to the fast developing awareness of the necessity for action, there is a growing level of concern on the part of administrators & bureaucrats to actively integrate sustainable building & urban development in their work and programmes, especially in northern Europe.
This is now creating serious, official, demand-side initiatives in building & urban development – in contrast to past situations.

Responsible design & development:

In contrast to most countries of the "developed world", many areas of the "developing world" are in a stage of massive urban and building development, representing a massive financial and social investment in both new construction and redevelopment.

There are two options that can be taken with this massive "opportunity":
Either to continue with current status quo in trends of design and construction, and continue the exponential growth of urban energy consumption, or to take the "green" road and drastically improve the energy *and* economic efficiency of the developing built environment.

The choice will be taken one way or the other. It is clear, however, that without governmentally directed pressure, education, regulation & incentive, the status quo will prevail, by default.

If the developing world succeeds in taking the "Green Road", it will massively reduce the potential dependence on (largely imported) fossil fuel energy, reduce CO2 emissions, and improve the overall standards of living, working and comfort conditions. Since the *real costs* involved in taking the Green Road are negligible, can we afford *not* to take it?

Elements of "Green" & Sustainable Design & Development

If we are to take advantage of the opportunity before us, we must plan, design, and build in ways that will bring us onto the "Green Road". This of course requires "doing things differently", compared to present practice. Whereas in northern Europe there is significant official movement in this direction (as demonstrated at the Sustainable Building 2000 Conference in Maastrich, October 2000), in most other areas of the world, official concern and action is only just beginning.

A frequently asked question is "what are the issues that we have to deal with?"
I have tried to put together check-list of concepts, issues & actions that cover the broader concerns of "Green" planning, development and building; energy-related issues are central to many of these concerns, but included also are the environmental and macro-social issues of design for a sustainable future, in its broader sense.

Planning for Sustainability
Re-Definition of "The City" is required to create an ecologically and socially sustainable, optimal "life-basis" for the majority of mankind. This is an important consideration, now that "The City" has become the normative basis for life for more than 50% of mankind: as such, we should aim to make it the *optimal*basis for life.

However, when discussing the "sustainable city", we come up against a problem of definitions: it is far easier to define what a sustainable city ***isnot***, than to say what it ***should be***, as we have no existing models to look to. We have no "image" of the sustainable city to "sell". The best we can do is to analyse the issues, and then try to formulate a model as a basis for actual development and application.

Issues of Urban Sustainability

We need to achieve an integration of facilities & functions of the City to create a convivial continuity of life experience for its inhabitants. Complex & multi-function zoning and urban scale should be used to create a variety of urban function & experience to fit the varied requirements of human needs & dreams. A City where the Citizen can find *his* place in *his* environment, and thus identify with *his* City.

We must achieve an integration of urban planning and transport systems so that transport works as a *service* of the City, not a substitute for it.
First of all, mixed-use high-density development, multiple centres, & public facilities should be coordinated along dedicated primary public transport routes. All major public, cultural & commercial facilities should be located within pedestrian distance of primary public transport routes. Planning priority should be given to public transport systems, making the private car a secondary option for urban travel. (Successfully achieved in Curitiba, Brazil)

Transport is a service to the City, *not its reason for being*, and should not dominate the urban landscape, as do parked vehicles and traffic jams today. The "public space" of the City should be pedestrian 'networks of urban spaces', through which quiet, non-polluting public transport and bicycle routes pass. Bicycle routes should be a basic part of City structure, and private transport should be relegated to a secondary, non-dominant network.
The city should be planned to make pedestrian & bicycle scale access the norm of daily life. Everyday activities, involving movement between residence, place of work, schools, shops, daily recreation, and access to nature, should all have options within distances independent of mechanized transport.

The Sustainable City must develop a "cyclic metabolism" of processes of production, consumption & recycling, as opposed to the current "Linear Throughput" and mass waste generation model. This involves the integration of all city activities & processes into a cyclic regenerative system, with minimal environmental pollution and impact. Urban management and incentive are required to direct the *output* of each "process" as *resource input* to another, resulting in "absolute waste" only as an option of last resort. These processes include all material, water, and energy flows: such a system, when properly managed & integrated, can result in dramatic economic savings, aside from reduction of pollution.

The City should be developed in sympathy with its local climatic conditions, using the local climate as a generator of sustainable planning concepts.
Urban planning form determines the shading or exposure of streets, public spaces, & buildings to sun & wind. This in turn determines the comfort qualities of the urban microclimate, and to a large extent determines whether urban "heat island" effects will be created. (In Athens, some city-centre areas are up to 17 degree C hotter than surrounding suburban areas)
Urban planning also determines the orientation of spaces & buildings, & thus determines the solar & daylight access of buildings, and consequentially the potential building energy demand for heating, cooling, & lighting, and potential use of passive

heating and photovoltaic generation. It also determines air-flow through the urban matrix, and thus potential use of natural ventilation for cooling effect in buildings. Planning also determines run-off & absorption of rainwater at the urban scale, & thus "urban greenery" levels, and resulting micro-climatic conditions.

The luxury of ignoring energy issues is fading fast, and energy-responsible urban systems are going to be needed to deal with increasing energy costs, pollution, and UN Climate Change Convention requirements.
We must plan for *reduction of energy demand and consumption* in public & private city transport, and for heating, cooling, & lighting of buildings.
We must plan for *maximum use of renewable energy sources*, primarily solar and photovoltaic, but also wind & geothermal energy where relevant.
We should use the *most efficient & least polluting energy generation systems*, including waste energy conversion & reuse, and co-generation & combined-cycle systems: where possible, we should use natural gas energy to minimise CO2, SOx, & NOx pollution, and also maximise forest vegetation for absorption of CO2 & SOx.

We should plan for Integration of City with Climate, Ecosystem & Habitat, developing the City in harmony with its natural location & ecological context.
This includes support of the local & regional water-regimes, protection of natural & open areas from pollution, and preservation of areas of rich natural habitat.
It also includes creating substantive green space reserves within the City fabric, preserved, managed, & accessible. Major green areas should be connected to each other and the natural habitat with a network of protected "green corridors", to allow 'wildlife commuting'.
These "green lungs" of the city give psychological space, urban health, and connection of urban life to the natural environment.

Building for Sustainability
Within the context of our sustainable city, we must create buildings that comply with the concepts of "green design".

We should design buildings in response to climate, applying strategies of climatic design, using the local climatic conditions to generate indoor comfort conditions. This is achieved through conceptual planning, using building form and orientation to reduce heating &/or cooling demands, and then applying passive design concepts to provide natural heating &/or cooling effects, & only *then* to consider HVAC input.
We should design for maximum use of daylighting for all possible illumination requirements during daylight hours.

Buildings thus designed are inherently more comfortable for their occupants, apart from saving energy and thus reducing pollution throughout their life.

Since buildings are the major consumers of natural and manufactured resources, we should design for efficiency of building material use, avoid major use of scarce or distant-source materials, and avoid using materials whose supply causes environmental degradation. We should design to reduce the embodied energy in buildings, and restrict use of non-recyclable high-energy materials.

Buildings represent a massive investment of financial, social and material resources, and should be designed for longevity. This includes design for retaining, re-using, & recycling of building materials, & design for flexible re-use of buildings as a whole.

In many regions of the world, water is an increasingly scarce resource, and conservation has become essential. Collection, use, & re-use of rainwater on-site, and using water efficient appliances, can drastically reduce "mains" consumption.

Waste reduction in building should be considered at all stages, including recycling of building materials, re-use of existing buildings, and design for operational waste reduction, with separation facilities for waste recycling.

The Future

The above is not an exhaustive listing, but an overall view of the major issues we should be looking at in the fields of administration, urban planning, building design and construction over the coming years, if we are to seriously address the problems of environmental pollution and degradation facing us on the one hand, and the desire to create a *better* life for all on the other.

Above all, time is not on our side in this quandary. The process of climatic change is generally agreed to have reached a state of non-reversibility, and the question is how far can we act to reduce the scale of unpredictable global environmental changes?

These changes will not be in some far-off time, but within the lifetime of our children, and the time to act is now. Are we able and willing to rise to this challenge?

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