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DEVELOPMENT WITH RESOURCE CONSERVING URBANISM

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Introduction

The agglomeration economics of urban places make cities the most efficient form of human spatial organization yet devised by man. They are the nexus for an almost infinite range of human transactions -- economic, social, cultural and political -- essential for man's progress and development. However, there is something very inefficient, wasteful and unhealthy about the way our cities have been evolving in modern times.

The patterns of urban growth and development, the design and location of buildings and their support systems, and the pollution born of excess tend to be wasteful of vital energy and other non-renewable resources and detract, unnecessarily, from the quality of life. It is only recently, with the growing awareness of global resource constraints and the ecological and human limits for pollution absorption, that serious attempts have been initiated to induce change into these patterns. Scientists, planners and concerned citizens groups are exploring an impressive range of alternatives. These include solar and wind energy, energy conserving architecture and urban design, resource conserving planning models, more economical transport systems, waste recycling, water recycling and conservation, innovative applications of communications technology and more. Unfortunately, installation or application of these approaches is extremely costly in most cities in the more advanced countries because so much capital has been sunk into the existing patterns and systems. In the U.S., for example, fundamental social and economic systems, to say nothing of the huge investment in bricks and mortar, have

been established around a highly energy intensive urban model in which a functional urban core is surrounded by an extensive residential belt.

In the developing countries wasteful patterns of urban development, similar to those which have evolved historically in the more advanced countries, tend to prevail. However, there is a critical difference. Apart from some of the major cities, the process of urbanization still is in a relatively nascent stage. There is not yet a full commitment to conventional patterns of urban growth and development. Each country has some regions in which the net sunk investment in urban places is relatively small; for some of the poorer countries, this holds virtually for the entire urban system. The cost of introducing resource conserving and environmentally sound approaches to urban development would be far less than in the cities of the more advanced countries. In fact, the net result would be considerably lower consumption of national resources by cities than present projects, based on traditional patterns of urban growth, would suggest.

The opportunity for developing countries to abandon conventional patterns of human settlement that are resource wasting and to begin pursuit of resource conserving approaches lies in the combination of circumstances just described; the existence of alternatives, the recency of the urbanization trend in developing countries, the comparatively low cost of introducing optional patterns under these conditions, and the considerable long-run savings in national resources that could be realized through inducing these changes. These savings represent national and local

resources freed for investment in other priority sectors of development and for addressing serious problems of poverty. The costs of deferring such action are the depletion of scarce resources that would be consumed needlessly, the high cost of installing alternative approaches, systems, and patterns once urbanization has reached a mature state, and the opportunity costs reflected in the alternative investment possibilities thus foregone.

Cities as Intensive Consumers of Resources

Richard Meier, in his pioneering work, Planning for an Urban World: The Design of Resource Conserving Cities, characterized cities as "resource transformers." By this he meant that cities convert resources into something else -- principally, human capital and the life support systems needed to support urban man. However euphemistically one chooses to describe the process, cities are colossal consumers of the world's resources and Meier concedes that "national states have done little to increase the efficiency of the consumption process." The city "is where most of the material-using and related productive activieies of economies take place" and this is consistent with the strong empirical link between urbanization and industrialization. (Strout, 1976)

To attempt to impress this audience with the intensive resource consuming characteristics of cities is to "carry coals to Newcastle." It is worth pointing out, however, that resource consumption in the cities of the more advanced countries is at a much higher level than that of most cities

in the developing countries. Currently developed countries, with only 29% of the world's population account for 70% of the world's energy consumption. The United States alone consumes 23% of the world total. (Zungaro, 1978) The great bulk of this energy is consumed in cities.

Recognition of Need for Change

While experts had been noting for years the steady climb in consumption of energy and other resources, it took a combination of serious environmental pressures, a highly visible and successful UN Conference on the Environment in 1972 and a global quadrupling of oil prices in 1973 to being about the galvanized action much in evidence today. This Athens Conference, the first of its kind to focus on the community as a consumer and producer of energy, is a good illustration of affirmative action and global concern. Many countries, including the United States, have formed cabinet level agencies to deal with energy problems in the few years since 1973. While it was long overdue, the concepts of resource conservation, recycling and alternative energy sources, appear to be firmly established. Indeed, much that has been developed and still is in the formative stages has been brought to our attention through the acceleration of research and development and professional and public discussion of problems, issues, approaches, and policies.

Review of Prospects

A host of energy and resource conserving approaches and new or improved technologies already are available or are in some phase of testing and refinement. Virtually all of these in the energy field will be discussed at this conference and the array is impressive. The following chart,

covering the fields of energy, transportation, water supply, waste and sewage management, and architecture, gives some indication of potential areas for improvement or major breakthrough.

Illustrative Resource Conserving Technologies*

ENERGY:

- wind energy
- fuel cells
- heat pump
- coal gasification, liquefaction
- nuclear fusion
- geothermics
- tidal and hydroelectric power
- solar bioconversion
- solar plants in space
- solar cells
- sea thermal power

TRANSPORTATION:

- electric cars
- hydrogen-powered cars
- pedestrian and bicycle paths
- Personal Rapid Transit (PRT)
- public transportation systems
- trains

WATER SUPPLY:

- various techniques to remove
- impurities and process water that was formerly thought unsuitable for human use.

WASTE MANAGEMENT AND SEWAGE:

- conversion to fertilizer
- hydrogenation of organic material to fuel oil
- pyrolysis of organic wastes which are high in cellulose content to gas, oil, and combustible solids
- conversion of wastes to methane through anaerobic fermentation
- composting
- sewage farming-- irrigation with sewage water
- direct use of manure as fertilizer

ARCHITECTURE:

- insulation
- use of heat-absorbing or heat-reflecting materials and colors
- shading systems (such as solar control louvers)
- building orientation to the sun's path
- use of trees and plants for cooling
- design to take advantage of prevailing winds
- elimination of "decorative" (unnecessary) lighting
- use of unitary air conditioners instead of central systems for spaces which have irregular occupancy hours
- more efficient equipment
- ventilation systems
- decentralized direct fuel equipment to power heating and air conditioning rather than purchased electricity

*Compiled by John Dargan, The American University, Washington, D. C.

Not covered in this list are the integrated approaches which combine sectoral services and approaches to improve efficiency. For example, the U.S. Department of Housing and Urban Development is experimenting with a new concept called Modular Integrated Utility Systems (MIUS). The program is:

> devoted to development of the technical, economic, and institutional advantages of integrating the systems for providing all or several of the utility services for a community...[including' electric power, heating and cooling, potable water, liquid waste treatment, and solid waste management. The objective of the MIUS concept is to provide the desired utility services consistent with reduced use of critical natural resources, protection of the environment, and minimized cost. (Samuels , 1976)

MIUS would achieve this objective through using the material and energy residuals from one utility process for inputs to other utility services. The principal wastes involved are rejected heat from power generation, liquid sewage, garbage and trash. (HUD, 1974).

In the same category are the numerous systems approaches to urban land use and transportation analysis, modeling and planning which either describe the urban system in its present state, predict the future state of the urban system through simulation and extrapolation into the future, or model the future state of the urban system subject to a given objective criterion or constraint. (Sharpe and Harlquist).
TOPAZ (Technique for the Optimum Placement of Activities Into Zones) is a good example of a planning model which combine all three of these features. When it was applied to the city of Melbourne, Australia, the model showed that energy savings of up to 40% could be realized through adjustments in the land use and transportation systems in the city. (Sharpe, 1978; Brotchie, Dickey and Sharpe). Systems models are useful tools for exploring strategic options concerning the interrelatedness of land use, transportation, and energy conservation (Carroll, 1977).

A logical operational sequel to some of these approaches is the Department of Energy's Comprehensive Community Energy Management Program. This program is intended to provide a conceptual and methodological framework within which communities can "determine energy objectives, select energy management and conservation alternatives, and prepare time phased implementation plans consistent with project land use and development projections. (Hittman Associates, 1978). The methodology and approach for this program are contained in the Department of Energy's draft workbook entitled "Comprehensive Community Energy Planning." While the program is in the early stages of implementation, it is an important step in stimulating community interest and action in energy conservation.

It is an example of the kind of programs needed now to effect long-term energy consumption.

Of course, in the cities of more developed countries which, for the most part, already have made substantial investments in utility systems, buildings and existing pattern of land uses, it is expensive to alter the level and intensity of resource consumption. Modifying artificially cooled and heated buildings to adapt to the climate is expensive or out of the question; land use patterns normally can only be changed substantially in the very long run; sewer systems, power lines, telephone cables, transportation corridors and water lines already are installed and would have to be dug up if they were to be modified; and social patterns and expectations as well as bureaucratic policies and procedures are set so that attempts to reduce waste tend to be met with inertia. In short, to use a medical corollary, most of the cities in advanced countries can be made more resource conserving and environmentally sound only through "curative" measures. These measures, while costly in the extreme, nevertheless, must be undertaken.

Opportunities for Developing Countries

What I wish to emphasize in this paper is the proposition suggested earlier -- namely, that the developing countries have the opportunity now to adopt an essentially "preventive" approach to resource consuming urbanism and thus avoid future costly "curative" measures with which most of the advanced countries now are grappling.

Buildings do not have to be converted to resource conserving designs if they are not initially constructed with a total dependence on finite sources of energy. Cities do not have to struggle with costly and inefficient transportation systems if they do not evolve to accomodate the automobile; road and utility systems do not have to be torn up and altered if they are designed in the first instance to minimize waste and envirnomental pollution and to accomodate or adapt to future technologies. Many cities in developing countries have not yet experienced their major period of growth and development. It would be timely for these communities to plan and prepare now for resource efficient expansion. Moreover, many cities which have been expanding rapidly have not invested so heavily in substantial buildings and physical infrastructure that it would be impractical to begin to move in the direction of more resource conserving patterns.

There are high costs for developing countries associated with postponement of such actions. A recent study shows that growth in developing countries tends to be energy intensive and that growth in energy consumption per capita exceeds that of the Gross Domestic Product. Moreover, this phenomenon tends to hit small and poorer countries hardest. On the other hand, per capita consumption of energy increases dramatically with advancing stages of economic development. It is estimated, for example, that "a four fold increase in per capita GNP, from $125 to $500, would require a ten fold increase in commercial energy consumption." (Strout, 1976). A significant proportion of this increase is lost or

wasted energy due to the inefficient patterns of energy generation and conversion.

However, the problems of changing these patterns are almost as evident as the opportunities. While a respectable body of literature has been developed, innovative planning models tested, and numerous scientific operational experiments are completed or underway, most of the literature and planning relates to the more advanced countries and the experiments tend to be isolated cases. These developments have not been examined collectively in terms of their applicability to urbanization in developing countries, nor, to my knowledge, have any developing countries participated in experimental approaches to resource conserving urban design and development prior to this conference. Dialogue with and among developing countries in this area has been limited to the events leading to and the holding of the environmental conference in Stockholm in 1972, the human settlements conference in Vancouver in 1976, the water conference in Mar del Plata in 1977 and more recently, preparations for the forthcoming U.N. Conference on Science and Technology Development.

Many of the resource conserving approaches currently available or being developed are too costly for application on a wide scale in developing countries. However, there is an impressive array of so called "passive" architectural and building approaches which incorporate energy and resource "conscious" designs. These involve use of sun, wind, earth, water, color, texture, and siting in ways that preclude excessive energy and resource consumption. These approaches are capable of producing

short-term energy savings at relatively little cost.

Approaches that can produce results in the long-term are found in the planning models and frameworks discussed above. These, too, can be applied without excessive cost through the incorporation of resource conserving consciousness in urban development planning and decision processes.

Conclusions

How to move in this direction on an international scale, I am sure, is one of the underlying concerns of this conference. As a beginning, we are inclined to believe that a great deal of preparatory work needs to be done by professionals in developing and developed countries before meaningful approaches or strategies can be formulated. It consists, generally, of examining the existing literature, technological development, and planning and design innovations, to determine relevance to developing countries. Some of the areas that need attention are: (1) comprehensive inventory and assessment of existing resource conserving technologies, approaches and planning models; (2) careful screening for application under varying natural and developmental conditions; (3) integration of these materials for stimulation of dialogue or for use in planning and application; (4) identification of important areas requiring further research and development, and (5) identification of critéria for successful application of resource conserving urbanism approaches in developing countries.

We would welcome suggestions or comments from this group on any of the issues or questions raised or overlooked in this paper. This would benefit greatly our thinking and action in this area.

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