

## ENERGY AND GROWTH

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Most speakers at this conference are examining the production side of the energy questions; my view is of its use - specifically, its use to generate growth.

Energy in its various forms is, of course, the means man employs to convert solar-fed natural systems into higher-yield managed systems. It is precisely our capabilities to direct energy and its great assortment of products which have enabled us to grow the high-yields of Florida's farms, ranches and forests. It is that same capability which has enabled us to swell our cities to their present impressive sizes.

One concept of the magnitude of our ability to manipulate energy to subsidize growth is rendered by some crude calculations which show that all of primeval North America would be required to sustain the present population of Florida alone.

Obviously one can have many thoughts about our energy-supported population of two hundred million plus persons and all of us do. Some examples: It sure makes money. Watch that crazy driver. Technology will save us. The projected growth is -----. Fishing isn't what it used to be. You can't put a fence at the border. What happens if the juice goes off? Drive safely. Have a good day.

I won't spend any more time on our current mix of paradise and peril; one needs only to visit south Florida's Gold Coast for an adequate exhibition of them. As Governor Askew has said, "We have problems."

For many years I studied the effects of energy-fed growth and its handmaiden technology on the wildlife and wild systems of south Florida. In the last seven or eight years I have examined just as intently its effects on urban systems there. It was a natural transition for me to make for, they both operate under the same principles, ecologic and economic. They are two sides of the same coin. Their unity is exemplified by the statement, "As south Florida's Everglades goes, so goes its Gold Coast," or vice-versa.

I have seen, in my south Florida studies, so many logarithmic, exponential or increasing exponential curves which depict environmental, social and economic conditions - practically all of them deriving from energy and growth - that my day is brightened when I find some phenomenon whose behavior or effect is not exponential. Last week I learned that Florida Power and Light Company's customers paid successively less for electricity each year from 1961 through 1970. I tried not to notice that they paid a little more in 1971.

Our galaxy of exponential functions is cause for concern. I believe they account in good part for our present paralysis of bewilderment. Since virtually every one of them leads to some critical level we are faced with choosing between a set of assorted misfortunes or, more optimistically, responding rationally to a set of inescapable realities. The central one of which is the impossibility of an endless spiral.

It is not easy to understand why we are in trouble - to recognize why it is that actions which led yesterday to successes, lead us today to the precipice. One of the best ways I have found to explain it is a little anecdote about a sinking ship and a life boat. The life boat quickly retrieves ten persons from the sea which is good; the boat has capacity and supplies for twenty. Everyone is eased, reasonably comfortable and tending to relax. A short time later five more people are retrieved. Now all passengers pull their feet in. Four more are inserted; all sit up straight. A short while later another survivor swims up to the boat. Number twenty.

This is the sort of progression ecologists think of in regard to exponentially rising stresses and critical levels - that we all have to think of now. That last passenger increased the total weight in the lifeboat by less than ten percent, but he did tighten things up.

Ten percent more nutrients in an enriched lake can bring on the algal blooms and the gizzard shad. Ten percent more DDT in an eagle can finish him. Ten percent less water in Everglades National Park can disrupt that biological broth. Ten percent more students in a class, ten percent more cars on an expressway can choke either operation. To most persons, a ten percent gain or loss in salary or profits is likely to be momentous.

Any discussion of "energy and growth" comes ultimately to be a treatment of the assimilative or carrying capacity of life support systems, both urban and wild. With no source of energy other than direct solar radiation, the carrying capacity of natural systems for humans is relatively low. And they do have limits.

But we can and do extend the carrying capacities of natural systems with inputs of energy. The primeval Gold Coast might have sustained 50,000 persons; there are more than two million there now. Energy inputs have elevated its people-carrying capacity to enormous heights. That would seem a desirable accomplishment if one could ignore its galaxy of exponential functions; air pollution; water pollution; diseased fishes; crime; accidents; an aggravated school system; water shortages; jammed beaches, parks and jails. Even its prime supplier of energy, the power industry, struggles painfully from one precipice to another.

Has something gone wrong? Not really. Predictable events have simply been ignored. What we are seeing in south Florida are symptoms of stress or the occurrence of critical thresholds in a highly-energized life-support system whose carrying capacity, however much elevated, is being surpassed.

There is even an orderly progression in these problems - from early symptomatic ones which denote primarily erosion of the quality of human life to more basic effects which are produced by collapse of components of the system.

All life-support systems have limits. Had the primeval Gold Coast become over-populated, it too would have exhibited stress symptoms and critical effects. The array would have differed somewhat from our present assortment, and I am sure its order of complexity would have been lower than ours.

Joseph Wood Krutch underscored a vital part of our current dilemma when he said, "The more completely we bring nature, 'under control,' the more complicated our methods must become, the more disastrous the chain reaction set up by any failure of wisdom, or watchfulness or technique...."

Allied to the intricacy of a high energy-technological society, and the delicacy with which it must be managed is the delicacy of a free society and the intricacy with which it makes decisions. Both procedures become enormously painful under the rigors of an urgent problem.

In order to solve an urban overload problem with technology, i.e., energy, three positive conditions are required. First, the essential technology must exist. Second, there must be a social decision to install it. Third, there must be money to buy it. The absence of any one of these three ingredients is fatal to the effort and leaves us with the problem. We are encountering this threesome in the strident sewage problems of the Gold Coast.

Sewage treatment capability does exist. There is, however, much social indecision about the level of sophistication which is required and certainly about whose neighborhood should harbor its trappings. Finally the panoply of shiny technology widely envisioned not long ago seems to have receded somewhat - concomitant with shrinkages of that third commodity - money.

One of the hangups - i.e., the limitations - of the technological solution is that its cost rises exponentially with the degree of efficiency required. Again referring to sewage treatment technology, the degree of treatment must advance exponentially with the degree to which population overload surpasses the assimilative capacity of a region. Thus, if a receiving water body can assimilate the raw wastes of 10,000 people without harm to its resources, we must advance to primary treatment or 50 percent removal with 20,000 persons, to secondary treatment or 90 percent removal with 100,000 persons, and to advanced treatment or 99 percent removal with 1,000,000 persons - to retain the same beneficial resources in that water body.

EPA Administrator William D. Ruckelshaus has provided another example of this kind. In a speech entitled, "A Prototype of Environmental Civilization," given October 17, 1972, he said: But vanishing resources and overpopulation are not the only problems we face. Some are extremely subtle; indeed, geometric processes are even visible in the realm of industrial investment. During this year, investment in industrial facilities is expected to grow by 10.2 percent. At this high rate, capacity would double every seven years. Thus if pollution control technology is 85 percent effective in existing plants it will be just 70 percent as effective in cutting gross pollution tonnages seven years from now when production of everything, including contaminants, has doubled, and only 40 percent as effective seven years thence, when it has doubled again. After three successive seven-year doublings, the actual amount of pollution is 120 percent more than it was 21 years earlier, before abatement began, even assuming pollution control at a remarkable 85 percent effectiveness all along.

In like fashion, mounting pressures on the public facilities and services required in a large and growing city - water supply, sewage treatment, road systems, police, public housing, sanitation, schools, parks, courts, etc., - require that they all be increasingly efficient. While we have not adequately examined these issues in Florida, a number of such studies made around the Nation indicate that there is an optimum size for cities, that surpassing that size introduces diseconomies of scale which lead to insolvency in the city budget (see appended list). The per capita expenses simply exceed the per capita revenues, with the deficit gap continuing to widen with increasing size.

And so the parks, sewage systems, adequate transport, police, etc., simply aren't provided. They cannot be. As wealthy as this Nation is, we cannot afford the high cost of providing each urbanite the highly efficient and costly systems decent life requires. That would be like putting everyone in a Cadillac. As a consequence, one of our major environmental problems, if not the major environmental problem, is the collapse of our cities and the immobilization of their governments. And so we encounter a new limit to urban growth in our high energy society - money. Money which converts to energy. It is likely that this limitation will become more evident in the immediate future as vital federal make-up funds diminish. The problems seem also about to be exacerbated by the increasing costs and decreasing availability of vital energy fuels.

Florida's natural environment is more responsive to overload than those of many northern states. Its water bodies are much shallower, and therefore, more susceptible to all forms of pollution; its lakes and bays being naturally low in fertility are more susceptible to over-enrichment; lowering surface waters six inches in many areas opens thousands of acres to intensive population growth; its subtropical marine life comes within a few degrees of lethal temperature under natural summer conditions. Some expressions of these sensitivities are: the water enrichment problem of Lake Okeechobee, degraded materially by man in only eighty years in contrast to many lakes of the north, which endured several centuries of nutrient loading; the stringent problems of Metropolitan Miami - a youthful city less than eighty years of age; the difficult problem of heated water disposal at Turkey Point.

I suggested earlier that the Everglades and the Gold Coast are integrated parts of a single system - which means that we must consider direct effects, as well as second and third order effects - that changes in either part have on the other. In like fashion, we have to take an integrated view of activities within the city proper; what a new expressway does to growth, to neighborhoods, to air pollution, and to the city budget. If, for example, some unlimited source of water for Dade County were available, we should have to note that there is enough open land there to carry 2.5 to 3 million more people. We should, as a consequence, have to consider what this would do to transport systems, schools, fire protection, power needs, the city budget, and now, of course, to energy supplies essential to all of them. Many specialized missions of the agencies of government, executed successfully in the past to meet "projected growth" needs, become less and less tolerable precisely as pressures of that growth mount on a large urban area. My points are simply these:

- Both nature and man-made systems have limits.
- Both are integrated systems and must be so regarded.

- Both exhibit symptoms of stress as pressures mount, and will ultimately collapse under spiraling growth.
- Nothing in these matters is mysterious.

Out of the concern of Florida and south Floridians with such enlarging crises of energy and growth we must accomplish a vital feat in record time. That feat is to determine the acceptable limits of development within regions of the State - both those limits which are inherent in its natural resources, and those more elevated limits which we are able to attain through inputs of energy and tax dollars. Which resources, we must continually recall, are themselves limited. The survival of Florida's unique natural resources, the conditions of life for its people, the viability of its cities - in terms of their livability, their responsiveness to public needs and their economic solvency - depend on it.

The task is no placid one. Philosophically it involves recognition of the wrenching fact that many of the deep troubles of today result from the successes of yesterday - that the momentum which established a great region can as well destroy it.

If we elect to stay reasonably within the bounds of our life support systems, which must include the support of available energy and dollars, we shall have to discard as a working philosophy our habitual drive to provide endlessly for the needs of "projected growth." The essential question now is whether we shall have the wisdom and courage to do it, or shall simply pass the issue to a subsequent generation.

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