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•independence?

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The actions of the OPEC nations to slow the depletion of their resources and to extend the time period over which benefits from their resources can be enjoyed has helped us perceive earlier than otherwise the ultimate crises that will result from our dependence upon disappearing resources.

Of primary concern to us is the stability and soundness of our society, which assures our ability to live comfortable and rewarding lives. We have associated this stability with increasingly higher levels of energy use. We are only now becoming aware that these levels of energy use are not only unnecessary to the stability that we seek, but are becoming dangerous to it because of our increasing dependence on disappearing resources. Our belief that we need this energy, and the resulting rapid depletion of it, is causing increasing economic instability, inflation, and unemployment.

By accelerating the depletion of domestic resources, we only increase our future dependence on imported resources, unless those resources are used for transition to a permanently sustainable domestic resource base. MERELY SUBSTITUTING VANISHING DOMESTIC RESOURCES FOR VANISHING FOREIGN RESOURCES ONLY SUBSTITUTES ONE SOURCE OF INSTABILITY FOR ANOTHER, AND CANNOT POSSIBLY LEAD TO ECONOMIC AND SOCIAL INDEPENDENCE. Rapid development of ANY energy source now foreseeable, on the scale necessary to significantly augment or replace the highly concentrated and inexpensive sources currently approaching depletion, is economically impossible.

Some of the problems of rapid development of energy supplies are:

INVESTMENT COSTS: Even partial self-sufficiency in energy supply by 1985 would require capital investment of at least $500-$600 billion over the next ten years. This amount represents additional private investment, in energy systems alone, as large as all net private investment in the entire U.S. economy. Even if these energy supply systems could be developed, such a program could only be attempted through deficit financing. When we incur debt, we assume that adequate physical resources will be available in the future with which to repay the debt. Decreasing resource availability will make repayment of all debts increasingly difficult. Diversion of energy, materials, and dollars towards energy production would push inflationary pressures beyond even the most dismal predictions. Just to maintain the current rate of national growth and to replace the decline in oil and gas availability would alone require building the equivalent of approximately two Bonneville dams or one 1000-megawatt nuclear reactor EVERY DAY until the end of the century. Investment problems are compounded by the fact that any investment in disappearing energy sources will be lost as these resources are depleted.

DECREASING RESOURCE ACCESSIBILITY: We don't pay for energy or materials—only for the work necessary to make them available to us. The energy and material resources we have been using have been highly con-

centrated and have required relatively little work to obtain, releasing more of our time and money for producing goods and services for our use. As our resources become more difficult to obtain, an increasing fraction of our total energy budget is needed to deliver a given amount of work, resulting in fewer goods and services for the energy and human effort we expend. And, because the energy we use to produce goods and services is the NET energy left after we have used the ever increasing energy needed to get this NET energy, our estimates of the work our energy reserves can do to produce our goods and services need to be revised downward. INFLATION IS UNAVOIDABLE AS LONG AS THE RESOURCES WE WANT CONTINUE TO BECOME MORE DIFFICULT TO GET. It can be stabilized only at the level of productivity possible with safe and inexhaustible energy sources and material recycling. The RATE of this inflation can be minimized by extending the time period over which it occurs—through early development of inexhaustible energy sources and material recycling and by a reduction in the rate of depletion of reserves of concentrated resources.

NUCLEAR POWER: Conventional light water reactors in the United States have been plagued with operating difficulties resulting in excessive down time. Construction of reactor facilities is suffering from delays, high cost overruns, and difficulties in financing. Without a full scale breeder program, the supply of U^{235} would be quickly depleted. Such a program, however, is replete with technical and financial difficulties. For both light water reactors and breeders, the requirement of isolating deadly plutonium wastes from the biosphere for thousands of years presents unprecedented physical and social engineering problems, and raises fundamental ethical questions. Planning should not depend on the eventual development of fusion power until scientific feasibility has been demonstrated.

MATERIAL RESOURCE DEPENDENCY: Even if independence of foreign energy supplies could be temporarily attained, it would only give us an illusion of independence. We are heavily dependent on certain material resources of other nations, such as nickel, manganese, and tin; and will become more so as we continue to deplete our domestic reserves of other materials.

Those who attempt continued growth as net energies decline are merely creating the conditions for a sharper and more disruptive economic transition for themselves the longer they wait to adjust their consumption to what will inevitably be required of them.

Our only realistic options for resolving our energy problems are to:

- Use remaining depletable energy reserves to move toward use of safe and continuously available energy, such as solar energy.
- Increase utilization of human skills and effort to make possible lower overall energy use.
- Recognize and increase the utilization of the free work of natural systems, such as allowing natural lands to perform tertiary treatment of sewage.
- Reduce our demands to levels which can extend the life of our reserves and which can be sustained by future energy budgets.

- Store sufficient portions of our proven energy reserves for emergency use to insure the stability and soundness of our society.

- Earmark energy tax revenues to assist all people to meet basic human needs during the transition to permanently sustainable levels of energy consumption.

The potentials for achieving balance between energy supply and demand through demand reduction are technically, socially, and economically more feasible, and entail much less risk, than supply increases. In addition, demand reduction will provide continuing rather than temporary economic and social benefits and will automatically reduce environmental stress.

The relative difficulty of measuring qualitative things and the relative ease of measuring quantitative things has made it easier for us to value the quantities of life rather than its qualities. This has resulted in material growth becoming a fundamental value of our society, even after it ceases to improve the quality of our lives. Accepting the assumption that high energy and material use is necessary for a high quality of life has made it difficult for us to perceive the ease and benefit of reducing energy use.

Lack of familiarity with low-energy, technologically developed societies has caused us to associate reduction of resource use with backbreaking physical labor, loss of economic viability, loss of familiar employment opportunities, reduction in quality of life, and political, economic, and military vulnerability to other nations. Our limited experience with cutbacks caused by unanticipated shortages has led us to expect that unemployment necessarily accompanies reduced energy use, although wise use of human resources is more important when less energy and material resources are available, and full and rewarding employment is more easily achieved under such conditions than when plentiful and inexpensive energy is available to replace human skills.

Many countries, such as Japan, France, Switzerland, and New Zealand use approximately one-third the energy per person as we do, yet enjoy similar and equally rewarding lives. Our energy use has multiplied, not because of our personal needs, but because of the wasteful organizational structures we have used to satisfy those needs, and the self-indulgent demands we have been able to satisfy because of the easy and low-cost availability of energy.

Our actual needs for energy and material goods are quite small, and can be satisfied through inexhaustible energy sources and recycling of materials. Most of the things really important to our happiness and well-being have very little relationship to our use of energy—trust, a sense of belonging, love, identity, respect, accomplishment, harmony with our surroundings—and can only be gained through our personal growth, not simply the growth of our GNP. Our dreams are infinite, and attempts to realize them mainly through finite, limited material things can only lead to frustration and conflict.

The true value of our use of any exhaustible resource is not merely the enjoyment of its use, but its legacy. Responsible use of remaining non-renewable resources, whether domestic or imported, must insure that we survive their depletion and lead to new and better ways of life sustainable by a stable energy budget.

ENERGY INPUT REQUIREMENTS FOR MAJOR CURRENT AND PROPOSED U.S. ENERGY DELIVERY SYSTEMS

Energy Delivery System	Delivered Energy (BTU)	Primary Resource Required (BTU)	External Subsidy Required (BTU)	External Resource Required (BTU)
Non-Electric				
Domestic Natural Gas	1000	1161	17	24
Liquified Natural Gas from North Slope	1000	1287	33	48
Coal Gasification (Strip Mined)	1000	2052	103	138
Solar-Space Heat	1000	3333	109	191
Domestic On-Shore Petroleum	1000	1093	186	250
Geothermal Hot Water Heating	1000	2065	155	255
Alaska North Slope Petroleum	1000	1104	258	345
High Grade Oil Shale	1000	1238	359	483
Electric				
Hydro-Electric	1000	1399	23	32
Geothermal Steam-Electric	1000	7050	42	57
Nuclear Fission-Electric (LWR)	1000	7425	213	451
Coal Gasification-Electric (Strip Mined)	1000	6116	384	519
Coal Fired-Electric (Strip Mined)	1000	3498	426	566
Shale Oil-Electric	1000	3692	1172	1576

Notes:

1. *Normalized to 1000 BTU Delivered Energy.*
2. *Ranked, within class, in order of External Resource Required.*

Definitions:

1. *DELIVERED ENERGY: The output energy of a given energy system, e.g., electrical energy at the point and in the form sold and transmitted to a commercial, industrial, or residential customer.*
2. *PRIMARY RESOURCE REQUIRED: The energy potential of the in situ (pre-extraction) primary resource necessary to yield 1000 BTU delivered.*
3. *EXTERNAL SUBSIDY REQUIRED: The total direct and embodied energy required from other energy systems to build, operate, and maintain a given energy system. This external subsidy does not merge with the primary resource flow; it impels it. This subsidy is tapped off the output of other energy delivery systems, mostly coal, gas, and oil.*
4. *EXTERNAL RESOURCE REQUIRED: The energy potential of the in situ (pre-extraction) resource necessary to supply the external subsidy which impels the primary resource flow at the 1000 BTU level of delivery.*

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