

Energy and the Future of Man

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For months now, we have been bombarded with information about an "energy crisis." Certainly there is no need to repeat for you the content of this news, which by now is well known to us all.

Chiefly, there has been fear that there would be insufficient heating oil and gasoline. It has been found in addition that certain derivatives of crude oil, such as chemical feedstocks and end products such as ammonium nitrate, polyethylene, and even lowly asphalt are involved.

In all of this, concern and attention has been directed to our immediate needs, our immediate comfort and convenience, and the needs of our ever expanding industry.

The attitude exhibited by nearly all officials and reporters has been that this "crisis" is temporary in nature, that it occurred as a result of poor planning, a lack of economic incentive on the part of oil interests, price regulations, pollution restrictions, etc.

Notably absent from the pronouncements has been any voice of caution saying, "There is only so much oil in the crust of the earth; the real crisis will come when there is none at all!"

This time will certainly come, and at the present rate of consumption of the known world reserves of oil that can be produced in the conventional manner from wells, the time will be less than one hundred years.

② Coal, too, is another limited fuel source in the crust of the earth. At the present rate of use, known reserves may last four to five hundred years. Only a few years ago the estimate was two thousand years; but industry's needs have accelerated. Perhaps two hundred years would be a better guess. There is no way to predict accurately. Certainly, when petroleum reserves are exhausted, coal will be used much faster.

To forestall argument, there are a number of other energy sources, among them solar power (the ultimate source of all commercial and animal power), geothermal power, hydroelectric power, atomic power, wind power, vegetable and animal fuels, as well as human and animal power.

Speaking of animal power, we are, at this stage of human development, so briefly into substitutes for human and animal power that we still measure the substitutes in terms of horsepower.

The time is so short that we only have to look back to 1863, the year of the Emancipation Proclamation, to find the dividing line when mechanical power generated by steam engines in the U.S. economy exceeded for the first time the output of biological horsepower by horses and men.

It is no accident that slavery, both actual and economic, began to lose

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its place as substitute mechanical power became available. We take pride in the fact that we no longer have slavery and assume that slavery was abolished because we are advanced morally, and socially enlightened. This is not true; we don't have slavery simply because we don't need it at present. Human and animal muscle has all but been eliminated from the production process. The human slave has been replaced by the mechanical slave, in the same way that the tractor has replaced the horse (at least, temporarily).

Even in 1940, according to an article in Fortune magazine by R. Buckminster Fuller, "we had in the United States working for us 24 hours a day, every day of the year, the equivalent of 139 inanimate energy slaves for every U.S. animate human being, man, woman and child." Unfortunately, at that time six out of seven of the energy slaves were engaged in the production of weapons. At present there should be three to four times that 139 energy slaves working for each of us 24 hours a day.

Back, though, to the topic of energy shortage, or "crisis": it was mentioned that present thoughts on scarcity are directed toward immediate requirements of individuals and industry, with no attention to long range considerations. At this stage the entire world apparently accepts and approves consumption for industrial progress and personal comfort at the

④ direct cost of very finite, exhaustible, energy reserves.

Because industry has brought, through the harnessing of these multitudes of energy slaves, such great social progress and has itself grown so tremendously, and solved by amazing technical applications such a multitude of problems, it is generally assumed that even the problem of synthesizing energy can be overcome. Unfortunately, we have no assurance that this can be done in any practical manner. Industry depends almost totally on petroleum and coal. Energy is basic. Energy is not contrived or derived. It comes almost 100% from the burning of carbon and carbon compounds.

Coal and oil are not renewable. Geologists state that they were deposited in the earth's crust over a period of countless millions of years. These deposits represent a monstrous accumulation of solar energy trapped beneath the earth's surface, the liquified and solidified organic remains of very ancient marine life and vegetation. This is an exhaustible, and not a renewable, resource, such as growing timber, or breeding and fattening animals.

Now that a beginning has been sketched, and our thinking has briefly been directed toward an ultimate, rather than an immediate, problem, let us attempt to place in perspective some other problems

with which we humans are now confronted. First, let us list them: pollution, the ever-increasing cost of welfare, unemployment, higher priced food, clothing, shelter, the shortage of willing labor, increased crime, drug abuse — but this should be enough. Perhaps we should have included streaking. Strangely enough, this might also fit into our consideration.

All of these things, I submit to you, are symptoms. Many more symptoms could be listed. The basic disease giving rise to a multitude of such symptoms is a suicidal consumption rate for goods, which is sustained in a temporary fashion only through an unconscionable waste of irreplaceable materials and fuels, but chiefly fuels.

The culprit is our old friend and short term benefactor, INDUSTRY, geared, not for the survival of progressive, civilized, man, but running wildly and suicidally, with the throttle open, chiefly for the comfort, pleasure, and profit of the present generation, future generations of man be damned.

Again, a doctor diagnosing the illness of a patient knows that symptoms indicate the presence of illness. The symptoms are not the illness.

Not so, however, do we approach our social and economic problems. Too often we see the isolated symptoms, and address our remedies to them.

So blind are we to the real

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problem that, under the guise of aid to backward countries, we blindly export to them the knowledge and means for massive industrialization, our own brand of ultimate economic and social suicide, totally dependent on further raping of the earth for its energy treasures.

Let me hasten to say that this paper is non-political. It is not antisocial or anti-anything so much as it is pro-human, or pro-survival.

The idea which led to this paper was that of making an attempt to arrive at an acceptance of some logical means or rule or set of rules to determine, in a civilized society, what is good and what is bad, in an ultimate sense.

To do this it is necessary to go back to basics. It is necessary to settle on or define some indisputable, desirable goal or goals. Assuming that there is unanimity in accepting the goal or goals, the next step is to recognize and eliminate obstacles which lie in the path of attaining the goal. Having done this, one can then proceed with an analysis of current individual actions and actions in concert by society, and evaluate these actions in light of the assumptions.

Once having entered into such an exercise we soon discover that it can lead to highly controversial conclusions, to unpopular determinations which are scarcely acceptable to our highly civilized and industrialized society or to its individual

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members. Still, the truth of the assumptions, and the validity of the conclusions are, I believe, indisputable.

Unpopular, yes: indisputable, no.

My assumptions are as follows:

1. Of the highest importance is the survival of a civilized human race, in perpetuity.

Let us think, for the time, of biological continuity as man's immortality.

2. If any action of man, supposedly desirable, cannot be sustained indefinitely, it is inherently wrong, for such an action will automatically close options for mankind in the future.

Just as the survival of human kind is of greatest importance, and because of this, no action should be undertaken or contemplated by humans or their societies which cannot be sustained perpetually.

— These assumptions appear innocent enough upon first reading, and we are inclined to accept them, without seriously questioning them. Upon careful examination, however, we find the implications enormous and, for our present generation, completely unpalatable.

For, as can be seen, the entire base of our massive industrialization and consumption is shown to be inherently wrong, since it cannot be sustained indefinitely, and consequently humans

⑧ of the future will have options closed for them through our actions, thence threatening the very survival of civilized man in perpetuity.

Admittedly, mental excursions into the future have nearly always been pathetically inept. Thomas Malthus was right, plotting the future under the rules of his own time. But the rules of the game changed, so we didn't starve after all.

Visions of the future fall into two classifications; one extremely optimistic, with man envisioned as progressing into a scientific dream world of great advancement, convenience, and complexity and, at the other extreme, dismally pessimistic, picturing man in a pitifully reduced state, living on an earth choked with pollution, starving because the fertile land has all washed away into the ocean, or perhaps living on an earth seared by atomic blasts and irreparably poisoned by radiation, its remaining life a nightmare distortion of present reality.

These predictions arise from basic states of mind, and through the old Malthusian tool of trend projection.

Therefore, in making a prediction, I do so knowing the fallibility of any extrapolation technique and knowing that my own semi-pessimistic attitude will color the results. Let me speak boldly, though, and quote no one when I say that man does face a future in reduced circumstances. Man will survive, because he has historically

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shown a strong spirit to survive, and because he is endlessly inventive and adaptive. The lamp of intelligence will keep on burning. Surviving man will, like the Eskimo, learn to live under harsh conditions, chiefly agricultural as in the not-too-distant past, for his energy slaves will then be dead.

Human slavery will return, both economic and actual. There will be no welfarism. Nearly all of the horsepower will be produced by horses and men. In that future time men of our generation will be cursed as "The Selfish and Foolish Masters," and their curses will be richly deserved.

The men of the future will have found that technical knowledge and prowess do not overcome such a basic need as our need for fuel. They will have found that the technical means for dealing with such a need rest again on a need for fuel.

Let us take solar power as an example, assuming translation to electricity. Ore cannot be smelted with it. To produce power in usable form, mechanical equipment consisting of metals, glass, etc. must be mined, smelted, refined, processed, transported, assembled, transported again and installed, all at the cost of power from whatever source.

Next consider nuclear power. One cannot smelt ore with it. As before the fuel and mechanical equipment can be had only at an initial cost of fuel and power. Always we come back to the necessity

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for an original energy or fuel source.

Consider geothermal power. As in the previous cases, ore cannot be smelted with it. Too, as before, the tapping of this source would involve a tremendous cost in fuel for deep drilling, piping, power plants, etc.

Take the solar derivative hydroelectric power. It is of no help in smelting ore. Furthermore it is not in the category of a sustained source, for all our dams are filling with silt. And we may find that this silt, rather than power, may be the power dam's most valuable contribution to man of the future.

The only carbon source mentioned that might be considered continuous and renewable is that of fiber fuel, in which carbon occurs in cellulose, a less practical form of fuel than either coal or oil. While only a small fraction of industry's present needs could be supplied, this at least would be a source that could supply carbon for ore reduction on a sustained basis.

Already man has recognized the

endless nature of the asset termed a

managed forest. We have too on the

earth huge sprawling rainforests in which

the growth is so profuse that man

has scarcely disturbed the fringes of them.

In relation to industry's needs, which most

share with the elemental need for human

housing, the supply would be a small

fraction of fuel presently being consumed.

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Already man is becoming aware of the shadows of staggering future problems. There may be wisdom beyond our sensing in the bearded and bearded youngsters' attitude of rebellion and his rejection of society's materialistic measuring stick. There may be great wisdom in the Amish forthright rejection of the automobile as inherently evil. The nagging thought appears and reappears that, even though life is full and enjoyable, for some reason all is not good.

We are plundering the earth in a mad, unprecedented, drunken, manner, burning up in a few short years what took millions upon millions of years to store in the ground for man's reasonable needs. We are taking no thought for our descendants. If indeed there is such a thing as sin, our hands are deeply stained.

Our sin, if we may so describe it, is our complete abdication of basic biological responsibilities. We have simply lost sight of man's responsibility to future man. Witness our attitude toward procreation. Man no longer thinks of reproduction as a sacred responsibility: Sex is now a joke, a matter for amusement. Sex is for streaking. The sexual act through pills, diaphragms, loops, condoms, or convenient operations, is a selfish act committed solely for pleasure. (Not that it shouldn't be pleasant).

(12) The point is that, since the sexual act no longer relates primarily to its previous biological responsibility for endless perpetuation of the human chain, heterosexual promiscuity and homosexuality have become far more socially acceptable. The attitude seems to be, "Why not?," or "What's the difference, anyway?," a total negation of responsible attention to self perpetuation, the most elemental of instincts.

It is well known that the birth rate drops lower and lower with increases in industrialization. When there is total social acceptance of industry's gigantic rape of the earth, the corrosive effect is simultaneously all-pervasive. I repeat, we have abdicated our biological responsibilities.

Going back to the two assumptions earlier made, let us test the validity of certain statements as an exercise of their application.

(1) Since we live in a time of plenty, it is proper to pay workers to do nothing.

The argument generally accepted is that, since we live in an economy of plenty, those who do not work should have the right to share in the wealth that arises from great industrial activity and consequent profits.

On the basis of the assumptions, however, we realize that such excess benefits

(13) as may arise from the rape of the earth's energy resources at a breakneck pace rob future man and place his civilized survival in peril. Thus, payment to non-workers is inherently wrong. Payment could be made only in case surplus existed from industry operating on a level that could be permanently sustained.

(2) The advancement of civilization seems assured by progress in industrialization and the long term result of industrialization can only be beneficial.

This is obviously not a truthful statement, in light of the assumptions, and our certain knowledge of the rapid exhaustion of the earth's fossil reserves.

(3) The proper economic measure of a successful society is in goods produced and consumed and in services rendered. If production is on the increase, continually, we may say that this is a good situation, while a decrease in production is bad.

We know the popular answer. Our answer, in light of the assumptions, is that an increase is good only if it can be permanently sustained at its present, or some higher, level.

(4) It is beneficial for industrialized countries to give economic assistance to backward countries in order that they too may develop industry, mechanize their agriculture, build roads, and become more like us.

(14) This is a generally accepted idea. We see, however, that such action will hasten the day of complete depletion of our global energy reserves. Also, if we are interested in the welfare and ultimate survival of these so-called backward nations, let us not interrupt their patterns of sustained adaptation for this will place them, at some time in the future, in a precarious position, and simultaneously rob posterity of working models of primitive adaptation.

(5) The day of the horse, except for racing, pleasure riding, and pet food, is past.

The Amish and I agree that this statement is false. The day will come when the horse will resume his rightful place. The sun will grow his food, and a sustainable working relationship will again be established on the earth with this longtime servant of man.

Any number of such statements could be tested, and many common misconceptions overturned.

Still, even if we assume that we are on the wrong course, how are we to stop man in his wasteful, suicidal course? We in the United States don't make decisions for the world. Who applies the brakes? Government? Educators? Philosophers? Certainly, not businessmen!

If we are to be reduced within two to three hundred years to extremely low level industrialization, it is of greatest

(15) importance that we preserve the more advanced patterns of primitive adaptation, i.e. diagrams of wagons, buggies, harness, saddles, horse drawn plows, Breeding stock of draft horses must be kept alive.

Adaptations which now appear laughably primitive may become the new leek of the future. We must keep alive the knowledge and ^{available} means for surviving successfully in a sustained but greatly restricted economic pattern. Sailing vessels, windmills, watermills, and all those simple things that man spent centuries in developing to perfection in a time of minimal sustained patterns will possibly be needed. Even now that valuable technical information has largely been forgotten in our temporary industrial flurry. And what has not been forgotten and thrown away is written or printed on perishable paper which will disintegrate by the time the knowledge is again needed.

One must admit that this is a discouraging prospect, and I also admit that it may be as erroneous as it is discouraging.

There is hope. Let us dwell now on the case for optimism.

For one thing, simple trend projections become false assumptions if they involve man's actions and fail to take into account man as a reasoning creature. Since man is not a blind machine, since he reasons,

(16) eventually he perceives his problems and deals with them. There is encouragement already in man's newly mixed attitude of approval toward industry, occasioned by his perception of the magnitude of the problem of pollution. Pollution, as has been stated, is a symptom, and this symptom for some time has been under massive attack.

Man has begun to see the fringes of some terrifying problems. Because man reasons he is self-correcting. As a reasoning creature he will certainly try to stop short of any very obvious self-destructive course.

Another hope is the inexorable application of economic pressure by developing scarcities. Increased cost of fossil fuel will no doubt drive man to the consideration of alternate, cheaper, renewable sources for his energy needs before he completely exhausts his fossil fuels.

One great hope is contained in the fruits of industrialization itself, progress of a sort which displaces any fixed or traditional argument on cost for power or cost for materials or services. This hope ^{comes} through the quantum jumps of technology, which may be categorized as "ephemeralization." Reduced to simple terms, this means "doing vastly more with vastly and invisibly less." An example of one such quantum jump is the

(17) Communications satellite weighing five hundred pounds or less which outperforms 75,000 tons of transatlantic cable, almost a million fold increase in effective use of materials. In a world where only 4% of the energy consumed is now realized as effective work, we have had progress from the initial efficiency of the reciprocating engine, 15%, to turbines, 30%, to jet engines, 65%, then to atomic reactors 72% (assuming their by product heat is used for desalination), and finally fuel cells, with 80% efficiency. Traditional arguments disregard such quantum jumps as the transistor, or the tremendously improved efficiency of ultra high voltage transmission, etc. This "doing much more with much less" holds out some measure of hope that man may in the future may stabilize in a pattern somewhat above an absolute subsistence level.

The view which our astronauts gave us of our own "spaceship earth" as a finite object capable of being contained in a camera frame has shaken all thinking men on our earth, and has led us into patterns of thought recognizing our limited and vulnerable situation. Widespread recognition of possible exhaustion of fossil energy sources may lead to world cooperation in solving the problem of mankind's continuing needs. Industrial

(18) necessity may foster such cooperation and lead to such international interdependence that there could be installed electrical transmission lines from the lighted to the unlighted side of the earth, a complete global power network. Knowledge of the limited nature of fuel and power might prove to be a sobering deterrent to any nation, under such circumstances, when war, the most wasteful of all man's enterprises, threatened to cut off energy, the basic wealth. This economic consideration could save man from atomic annihilation. When man reaches the ragged edge of extinction, he will certainly realize the truth of the statement, "Either war is obsolete, or man are."

So, perhaps we shouldn't be so gloomy. Our depressed view of the future may be just as wrong as that of the patent official in Washington who in the 1870's declared that the time had certainly come to close the patent office permanently. He stated that its original purpose and function was now obsolete, since nothing additional could possibly be invented. One hundred years later, we know better, but we might have nodded in agreement and applauded the man's wisdom then.

Still, optimism not firmly based on certainties is dangerous. By squandering our energy resources at a mad and ever-increasing pace, without having solved the problem of some practical,

①9 sustained, replacement, we are placing future man in great jeopardy.

We are now burning up our fossil-fuel and, for that matter, also our atomic-fuel "savings account." The principal is going fast. It is said that any alternate would be "uneconomical" in comparison to the "costs" of burning our savings account. But you and I know that the real cost questions which aren't being faced by governments and businesses are what it will cost to carry on when we run out of oil, coals and maybe even fresh water and fresh air. And that cost could be the very survival of man as a civilized creature.