

LEADING THE WAY TO THE PROMISED LAND

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Today let us consider the energy basis for the future and the way you graduates as individuals can stay adapted to changing times ahead. Maybe it was Pogo of Charlie Brown who was asked why he walked along looking backwards. He says: "How can I see where I am going if I can't see where I been?"

Charlie Brown's uncertainty is ours: How do we know which way to lead? Often we prepare for the battles of yesteryear with plans that worked last time. New conditions arriving unannounced often cause failure. In 1860 a southern region in the war between the states tried to match an agrarian economy against one newly powered by water, fuels, and city-based industry. Because of this changing energy pattern, the south was preordained to lose. The graduates in the 1840's had learned classics but not enough about the way energy supports civilizations. Few people understood the meaning of the outcome.

In 1945 the U.S. was using half the world's fuel energy flow. The graduating classes in those days formed an opinion about how much geography the U.S. power could dominate. By 1965 the relative use of the world's energy had dropped to 1/3 for the U.S and 2/3 for the rest of the world. The leaders with attitudes formed earlier attempted actions in Vietnam that may have been possible in 1945, but not in 1965 after the base of energy had shrunk. There were failures for lack of understanding of our energy basis.

As we have to dig deeper and deeper to get oil and coal and go further and further away at sea or in Alaska, a greater and greater part of the economy goes into the getting and processing of energy. There is less net energy to run the rest of the economy.

The price of energy and all things derived from it rises disproportionately. For the same amount of circulating money, real work done is less. Part of inflation is due to decreasing net energy. Growth slows down and the economy levels.

The price we have to pay for imported energy depends on the net energy at home. As we have to pay more to dig deeper, those abroad can raise their prices accordingly. To attempt energy independence and use up our own fuels now hastens the rise of prices. The productivity that would have gone for growth goes abroad to balance our payments for oil.

Underdeveloped countries with more unused land, water, labor, and minerals can attract capital more than we, and they can grow until about 1995 along with the OPEC countries, when the whole world's assets begin to decline. Because its energies are no longer rich and because it has so much assets to maintain already, the U.S. growth stops sooner. In the 1940's we tried to keep Americans on the family farm while great flows of coal, oil, and gas came to the cities fueling growth and jobs. Everyone moved to the city in spite of government policies.

Soon now, however, fuel flows will be declining and once again the renewable rural energies will be proportionately more valuable. Opportunities will attract people out, decentralizing the cities. We may try to keep the cities subsidized against the real trend, but the pattern will follow the energies.

The U.S.'s immediate energy position hinges on its foreign policy. Going almost unnoticed is Carter's brilliant success in bringing Saudia Arabia under the American perimeter so that its oils are available at a lower price. The real price of oil has dropped 21%

in the last 3 years, causing the American economy to ripple upward. With Saudi-Arabia part of the U.S., our economy crests later; without it, the economy crests now.

However, fighting a major war during declining energies is to be avoided at all costs, even if the war is over energy. The demise of ancient Greece has been attributed to major war during a time of exhausted soils and forests. It is correct that an economy to be vital must grow if there are energies to support growth, but the corresponding principle is also correct, that economies cannot be vital if growth is attempted when energy flows are diminishing. Some fear regression, but those in ecology are used to observing the growth of forests followed by the leveling stage called Climax, which is more harmonious than growth, with better characteristics of cleanliness, even distributions of wealth and quality of life.

These matters are controversial, and many have honest differences of opinion, thinking there are alternative energies. Vested interests with billion dollar government contracts gain by making promises they can't keep. You graduates, to stay adapted, have to consider the possibility, and in my view, the probability that the assets of the industrial nations, their energy flows, and real gross national product will soon crest and decline and that of the rest of the world slightly later.

What about solar and nuclear energies? Because sunlight is so dilute only one Calorie remains after 2000 Calories of sunlight are processed and concentrated into fuel. The nation can be supported on renewable solar energies using forest, agriculture, and fisheries for food and fiber, but not at the present level. Either the population must be reduced by 1/3 or the standard of living by 1/3. Green plants have already maximized the conversion of solar energy to useful work using the same process that those developing photocells offer as a substitution. Solar technology is inferior to green plants and is not net energy for it requires 2 calories to yield 1. Solar technology done in conjunction with necessities such as building houses can save heating energy, but it does not yield net energy with which to run the economy.

Present nuclear energy with 5000 degrees in its core has proved to be a disappointment with less net energy than coal because so much of its energy is too hot and has to be ejected to the environment in cooling waters. Fusion with 40 million degrees temperature at its core will surely take more energy to contain and cool than it yields. Although we can expect the economy to crest and regress, it is nothing to fear, since the transition can be gradual because of coal reserves that give the U.S. a preferred position after the 1990's. As the nation tightens its belt, its tourists will spend less, its retirees bring less money, and less luxury products will be bought. Florida agriculture will diversify and substitute local sales for luxury orange juice and winter vegetables as transportation costs rise. Luxury air conditioning will decrease. Electricity per person will be less as more coal is used to heat houses directly, perhaps coming over from the west in pipeline slurry with Mississippi water.

There are things not to do in a cresting economy, like building great capitalcosting central facilities based on assumed growth such as power plants, regional tertiary sewage facilities, more shopping centers, big highways, high energy mass transit. All this does is raise taxes and utility rates, causing industry and jobs to go elsewhere. There are things to do, like retaining and connecting our wetlands in a web for water conservation, waste recycling, and aesthetic buffers. Our Center for Wetlands, in experiments in Gainesville, has shown that wetlands absorb microbes, heavy metals, and nutrients and recharge groundwaters, the swamp acting as nature's filter. In a dissertation for a Ph.D. awarded today, Sandra Brown shows 30 to 50% of the water saved by the Green Swamp as compared to plans to drain and substitute reservoirs: cypress trees conserve water. Growth of valuable cypress wood is accelerated 4 times by waste-waters.

A new river of grass from Lake Okeechobee south to the Everglades can process water in a strip 3 miles wide, taking all the nutrients and agricultural backpumping, but providing water to lands on either side. The mucklands will be rebuilt by the plants and later this strip can be farmed again, an adjacent strip carrying the waters. We can get dams and pollutions off the lakes and rivers so that the

mullet and shad can swim in and out again and so hydroperoids can maximize productivity of the shallows. Regression means more jobs because less high energy machines are used. More miniaturized machines are used: smaller buses, trucks, computers, and farm implements.

What will the pattern of life and economy be with declining energies? Agriculture and Forestry have to use more land, more labor, and less energyintensive tractors, pesticides, and fertilizer,p For Florida with its sandy soils, this means getting water tables back up to help hold peaty content that holds nutrients. In a Ph.D. dissertation awarded today, Burt Smith found typical Florida forest-grazing lands so depauperate of phosphorus due to removal of nutrients with tree harvests, that regrowth of trees or cattle was hardly possible depending on tiny nutrient inputs from rain. Yet 25 feet underground are rich phosphate deposits from millions of years of leaching. We may need to broadcast this phosphate over the entire state instead of selling it to Soviets so we can run sports cars a little longer.

The urban city mess of unemployed youth and crime will start to be solved as a mechanism is found to start a new homesteading, helping these youth to leave the declining cities, build their own cabins, and develop new farming communities of a subsistence nature, learning to be proud and versatile like a black man named Quince under whom I worked on a farm as a boy.

In understanding energy, we learn that high quality things require much energy to make or replace them. Four coal units are required to make one of electricity. Hundreds of Calories of coal to make one Calorie of technological service and thousands of Calories converge in support of one Calorie of service of educated humans. Labor is high embodied energy.

Rationing or artificially pricing fuels will hurt the economy's ability to compete. The place to save energy is in the embodied energy of luxuries of the middle and upper income groups. Energy conservation is best brought about by nationwide cutting of salaries or letting inflation do it, rerouting those

funds to unemployed for work, increasing productivity. Minimum wage needs to be eliminated for those under 21 and over 65 to insure their proportionate participation in the work force. Women in the work force will continue to increase, since less children and decreased populations are needed in a regressing economy.

It is high quality service such as that of government and higher education that feel the pinch first as energies become expensive because they are at the end of the energy chain. In higher education, we are already starting to plan for lowered resources. For economy, graduate programs have to be clustered so that each program's courses reinforces the others and exceed the minimum critical size. The state cannot support 9 graduate universities, but may have to learn it the hard way with a collapse of quality with students going outside as they once did. The larger universities can be gradually reduced from their oversize and their playboy roles by diverting those students who are not yet committed to higher education. Grades are the best proof of classroom motivation, not machine graded tests.

To teach more with less requires general education with principles. For example, an introductory freshman course in energy, economics, environment, and systems could precede other courses, helping everyone to understand changing times and see the unity of knowledge better. For example, a dissertation for a Ph.D. awarded today to John Alexander shows the common pattern of gradual storing of energy, which is then consumed in a burst of frenzied activity. Examples are earthquakes, storms, volcanoes, forest fires, locust epidemics, and war. We regard such surges of energy use as a disaster, although the pulse usually serves to make the processes of the biosphere recycle better and compete. A fascinating question is raised that you graduates must think about. Will the magnificent accumulation of world assets of our civilization be consumed in a frenzied surge of final consumption, returning us catastrophically to the base level of renewable energies as in the time of Genghis Khan or the spread of Islam? Or is there a better gradual way? During the Civil War one regiment was observed to be retreating and the commander was asked: Why

are you going in that direction? The answer was: "We's advancing backwards." The facts of energetics require us to advance by regressing.

Americans are always talking about leading the world. My message to the graduates of 1978 is that

you have the marvelous opportunity and adventure like Moses to lead the world's way over the hill and down to a new promised land.