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THE MANY GLITTERS OF CONSERVATION*

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EXTENDED ABSTRACT

Certain mind boggling aspects have crept into the energy problem forefront in the name of conservation. In addition, there are the manifold glitters of hoopla. On Channel 7, The Good Morning America program of May 6, 1980 exposed us to the latest of electric car drive systems and an airborne bicycle powered by solar photo-voltaic cells. Was this news or hoopla?

A gallon of gasoline costs up to $1.40 and contains 140,000 BTU. At 14 mpg, an engine drive consumes 10,000 BTU per mile. Otto cycle engine output is 4,000 BTU. Transmission losses reduce energy for overcoming traction and drag to 2,500 BTU. An electric car with 2,500 BTU axle output per mile needs battery output of 3,000 BTU to allow for motor and control losses. Replenishment must be 4,000 BTU to replace battery losses, and through-put at your electric meter will be 5,000 BTU to allow for charger losses. Required input at a fossil fuel utility plant will be 16,700 BTU to account for 30% system efficiency. For a nuclear fission utility plant, required input will be 22,300 BTU to account for lower wet steam turbine efficiency of 60% rather than 80%. The 5,000 BTU per mile is 1.5 KWHR at your meter, and would cost 13.2¢ at a third tier rate of 8.8¢ per KWHR for electric cars. The 10,000 BTU per mile costs 10.0¢ per mile for gasoline fuel. Not taken into account directly are additional electrical power requirements to produce zinc, chlorine and graphite for use in high performance batteries. Ground transportation represents 45% of U.S. energy requirements, and wholesale conversion to battery power would require a tripling of electrical power plants. Electric cars will remain hoopla until most power plants are powered by solar energy, swift water currents and atomic fusion and we can once again afford the price of excess power generation.

A Douglas DC7B can seat up to 95 people, with a gross weight or minimum thrust of 126,000 pounds, which is roughly equivalent to 11,500 HP or 8,000 KW or 30,000,000 BTU/HR at a cruising speed of 360 mph /1/. Power required for take-off or maximum speed can be 13,000 HP. The wing area is 1,463 sq. ft., so gross area could be as much as 3,600 sq. ft. If 90% or 3,200 sq. ft. of this area could be lined with photo-voltaic cells, about 130 BTU/HR per sq. ft. could be collected as DC electricity at a conversion efficiency of 43% for a total input of 400,000 BTU/HR, or 117 KW which is 1.3% of the required power. At present costs of $10,000 per KW, the auxiliary power plant could cost $1,200,000. This can be seriously considered for powering a man-made satellite out in space, but not down here. Solar-powered aircraft will remain a toy or merely hoopla forever.

Perhaps the media should not be faulted for broadcasting hoopla far and wide. Hoopla is easy to report, fun to report, of immediate interest to viewers with short attention spans which in turn is of primary interest to program sponsors, thus completing the hoopla loop.

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In 1978 it was reported that 50% of U.S. housing starts were furnished with electrical heating because "there wouldn't be any more natural gas." This is running in the wrong direction at maximum speed. A modern, gas-fired furnace in a home heating system can extract 3# of 4# of fuel as useful heat, while the remaining 1# is lost up the flue. To do the same job electrically requires the utility system to burn 10# of fuel in a thermal-electric plant or the equivalent of 15# of fuel in a nuclear fission plant which is less efficient. These facts are made painfully clear to utility customers in Northern California where a 3-tier billing system is in use for both electricity and natural gas. Despite the mild climate, space heating makes the third tier at a cost of $88.19/MW-HR for electricity and $22.31/MW-HR for natural gas (8.819¢/KW-HR and 66.7¢/Therm) as of August 1980. It is clear from these energy prices that customer conversion of space heating, domestic water heaters and stoves from electrical appliances to gas-fired appliances would have a quick payback. Redi Kilowatt, however, is hardly on the ropes, since lighting, motors and almost all luxury appliances are either electrical or powered by rechargeable batteries, and a total retreat from convenience and progress is not in the offing or necessary if we turn to alternate energy sources for our electricity.

The advent of many left turns and multiple one-way lanes, separated by curbed planting boxes, has done much to make driving safer on our secondary thoroughfares. The InterState system, at great expense, eliminated crossings and traffic lights, which is fine for drivers passing through. Side effects of the laudable drive for driving safety find our side streets cluttered with stop signs, two-way stop signs and two- and three-way traffic lights. The obvious intent is to put some kind of a traffic control at every intersection of America, and the program is well along. This has had a decidedly adverse effect on gasoline and fuel oil conservation efforts. Internal combustion and gas turbine engines have sharp parabolic efficiency curves. When operated at optimum speed, efficiency is reasonably good but, at very high speeds and very low speeds, efficiency goes to pot. It has been estimated that a car's engine will burn more fuel during a minute of idling than it needs to restart, and in three minutes of idling, it burns as much as it would require to go half a mile /2/. Without sacrificing safety, certain modifications to traffic control notions are necessary in order to eliminate enormous waste. These include:

(1) Replace one-way stop signs with yield signs. This would encourage rolling stops as opposed to the complete stop. It is far less wasteful of energy to re-accelerate a car which is rolling as opposed to a total breakaway start when this is safe.
(2) Retain two-way stop signs since the slow-down or stopping of each car is minimal. One-way stop signs can impound a large number of cars at full stop, while a long line of vehicles passes the other way at their leisure. This is wasteful of both patience and fuel.
(3) Retain two-way traffic lights. Each driver has a 45% chance of hitting it green and, if stopped by red, his wait is short and least wasteful of fuel. Left turn arrows should be reprogrammed to light for a few seconds even if not tripped so that drivers arriving a split second after lights change can proceed to left turn, instead of screeching to a halt and then idling for awhile.
(4) Eliminate three-way traffic lights by reprogramming to two-way operation. Each driver at these more elaborate intersections has close to

one chance in four of getting through without stopping. This leaves two to three cars at such an intersection stopped and idling while the third or fourth car goes through. This also leaves a majority of cars operating at very low efficiency and it is not uncommon at such traffic-squelching stop lights for cars to have to move up and stop a second time before going through, which is a gross waste of fuel.

Getting back to houses and space heating, there has been tremendous emphasis of adding insulation to existing houses to create R11 and R22 protection. What does this mean? In the past, many wall and roof systems consisted from inside to outside of 1/2" gypsum board, a 3-1/2" gap filled with air or studs as in an exterior wall, a gap of several feet filled with air as in an attic space, 1/2" plywood sheathing, a single ply of tarred felt vapor barrier and a covering of shingles. From a practical point of view, a homeowner can at great expense add 3-1/2" batts between wall studs and 7" batts between ceiling joists. In new construction the cost is less because existing solid surfaces do not have to be removed and replaced, and workmen do not have to poke and pry batts into tight corners at eave lines. Substitute applications which can be blown into interstices have failings, such as flammability, sag when wetted, and poorer insulation ratings. There is an alternate approach. The main protection of even the poorest construction is its air gap. If the number of air gaps is made three or five, the insulation effect would be close to equivalent. If this can be done at low cost, it makes sense. Twin, 3-mil-thick, 2-film sheets of bubbled formation are mass-produced for use as packing material. Such sheets in one or more layers could be used to create the extra air gaps and at very reasonable cost. This merely suggests that there is more than one way to skin a cat and that the use of ultra thick batts may be a case of overkill at first class cost.

In warmer climes, many homesteads are equipped with swimming pools. These normally have to be heated for maximum enjoyment. Formerly this was done using natural gas-fired heaters, and the norm was equal utility bills each month of a year. In the wintertime, the house was heated and the pool was not. In the summertime, the pool was heated and the house was not. Gas bills could be highest in Spring and Fall when both were heated at times. The old way is impractical in light of present gas billing. Today, pools are heated by solar heat augmented in various ways more often than not. One extreme is a total flat plate collection system which can add 6°F by day and drop 2°F by night, costing thousands of dollars. The other is a flotation cover of 2-film bubbly plastic, often blue in color, which adds 3°F by day and loses 1°F by night, costs hundreds of dollars but does not require pumping power. The less expensive approach all too easily can hold swimming pool water between 88°F and 93°F. To prevent algae overruns requires constant chlorination and occasional removal of some or all of the solar heat collecting cover.

The installation of certain solar collection devices as per the current federal and state tax collection agencies results in rebates ranging from 15% of cost for federal income tax returns to 55% for California income tax returns. Many states have similar provisions. Such tax write-offs benefit well-to-do people. In California the Public Utility Commission (CPUC) has introduced

a three-tiered system of billing for electricity and natural gas supplied to residential units. This system benefits institutions, businesses and tenants in small apartments who pay at the first tier level /3/. People living in nested condominiums are paying for half of their energy use at the second tier prices. People living in separate houses or large condominiums are paying for a third at second tier prices and a third at the third tier prices. America does not have a comprehensive energy policy. Such a policy has been suggested at every level of government /4/. In the absence of a comprehensive energy policy, it is urged that there be no more cheap shots taken by activist political agencies. The initiation of a comprehensive energy policy requires a national consensus as to what to do. Once we have decided what we will do is a good point of departure for the formulation of taxation with representation.

Conservation has many glitters. Some are good, but many are bad. We were not going to leave 20 billion barrels of oil underneath the tundra for caribou convenience while buying oil at OPEC prices, yet groups slowed this source of energy for three years. We are not going to leave California offshore oil untapped for seagull convenience as long as an energy crunch exists. Conservation has much merit, but should not be pushed to block progress anywhere, every time. America needs selectively intelligent conservationists, but we must not let erroneous mythologies blunt our communal efforts.

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