THE ENERGY TRANSITION: BACKGROUND ON SYNTHETIC FUEL ALTERNATIVES

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In the past, our energy transitions have occurred over long periods of time. It took 60 years to shift from a wood economy to a coal economy and 60 years to shift from a coal economy to a petroleum economy.

In terms of our resource base we have been able to make these shifts relatively easily — moving from domestic wood to domestic coal to domestic oil and natural gas. Our resource availability has been coincident with the movements in technology. Stated another way, our push to a transportation based continental economy was not impeded by a lack of liquid fuel when the internal combustion engine became available for improved transportation.

In the United States we do not have an overall energy problem. What we do have is a severe liquid fuel problem where our use of liquid fuel is not matched by our domestic liquid fuel resources. About 47 percent of our current energy consumption is in the form of oil and natural gas liquids, 26 percent is in the form of natural gas, 19 percent is in the form of coal, and 4 percent is nuclear. Our basic resources are almost the opposite with 87 percent in coal and only 1 percent each for natural gas and oil with natural gas liquids. We have a basic contradiction between the availability of resources and our use of them.

Two routes often suggested for meeting our liquid fuels crisis are conservation and the production of synthetics. As educators, it is critical to point out the limitations and necessary conditions for each of these.

For conservation, several important ones are only partially reflected in most suggested public policy. First, relative prices are the key to incentives for conservation. The real price of high test gasoline declined overall from 1967 to the fall of 1978, and little conservation of gasoline fuel was observed over this period. Only with the expectation and demonstration of a real long term upward shift in relative liquid fuel prices do we get sustained efforts at conservation.

Second, even with demonstrated and expected long term increases in relative liquid fuel prices we still face the reality of relatively slow turnover of the capital stock. For example, even with the post 1978 relative price increases in gasoline, the turnover of the capital stock of automobiles to more fuel efficient models has slowed down. Part of this relates to the 1980 recession, and part relates to increased relative price increases in the very capital stock that is supposed to turn over in response to the price increases in gasoline.

Consumer behavior towards the energy transition has been highly rational in economic terms, while sometimes flying in the face of the policy wishes of government leaders.

In the production of synthetics, our opportunities are much more limited than would be expected from the publicity attending liquids from shale, coal, and alcohol. At the same time their relative economic cost might not be as high as direct market figures might indicate.

With respect to the extent of opportunities, a number of persons subscribe to a backstop theory on liquid fuels. This means that if the Arabs raise their prices to a certain point, then it will suddenly be economic to go full blast with synthetics, especially coal and shale liquids. We will then have all the liquids we need from these sources.

We need to recognize that the lead time for these synthetic fuel plants is very long. We have not yet started to construct any of the giant plants engineers claim are most advantageous, and the lead time for the first several of these plants is five to seven years.

Second, as we greatly expand the production of liquids from such plants, we are likely to face some increasing costs based upon such things as transportation and materials handling bottlenecks and increased environmental costs from a concentrated increase of such activities.

With respect to the comparative costs of different liquids, this depends upon what method of cost analysis we employ. For example, in looking at the price of imported oil we can take the OPEC market price, be it $30 or $40 a barrel. However, there are a number of costs borne by society as a whole from importing oil. One of these is the political vulnerability to cut off, another is a negative balance of payments account, which is related to our domestic inflation problem. If these sorts of costs are added on, then the full cost of imported oil might well be in the $60 to $90 a barrel range. Such a price might make investment in import replacing synthetics economic today.

Since we have defined our problem as a liquid fuel problem, we might also look at ways to help our liquid problem without necessarily producing synthetic liquids or by conserving liquids directly. There are some approaches here which need to be investigated.

One example would be the electrification of the high traffic rail routes so that coal would be burned as electricity in electric locomotives rather than as oil in diesel locomotives. We find in some cases that the full cost of electrification, including the new coal fired generating capacity to run the system, is less than the cost of producing coal liquids to be burned in the existing stock of diesel locomotives.

Projections of future energy use echo many of these points. Change to the year 2000 is likely to be gradual and evolutionary rather than abrupt and revolutionary. We will cut back on the proportion of liquids and gas fuels that we use. We will probably double the proportion of coal that we use, but much of this increase will come from the direct use of coal rather than from coal conversion to liquid and gas fuels. We will have a greater diversity of energy sources, but the new ones like solar and biomass will still be minor actors rather than major players.

In making such "conservative" assessments, it is critical not to let our audiences lose sight of those things that are necessary to induce change. Gradual change can be relatively painless. Radical change often requires pain, disruption, or other incentives which force us to do such things as subsidize massive investment or turn over capital stock before it is depreciated. Hopes for quick, radical technological fixes for our energy problems would also require a willingness to pay high costs and suffer a certain amount of disruption. Any realistic set of alternative routes for energy transitions involves very real trade-offs. There is no clear painless solution.