Letters

Automotive Emission Standards and Fuel Economy

The Clean Air Act of 1970 (PL 91-604) requiring reduction of automotive emissions by a rather arbitrary 90 percent by 1976 has until recently enjoyed considerable public support, despite the grumblings of the automotive manufacturers and the bitter complaints of new car buyers about poor performance and gas mileage. However, with a serious threat of gas rationing and drastically increased prices facing us, we must reexamine the consequences of proceeding in this direction (*1*).

The rather simple steps taken before 1971, such as crankcase blow-by control, evaporative controls, leaner mixture ratios, and minor engine modifications to improve burning efficiency were successful in reducing carbon monoxide emissions by 41 percent and hydrocarbon emissions by 73 percent (*2*). These steps added negligibly to the cost of an automobile and did not result in any loss of performance or economy.

By 1973 all the easy fixes had been used. Further reductions required more drastic and uneconomical measures. Since nitrogen oxide emissions are directly related to wall temperatures, which in turn are related to thermodynamic efficiency, there does not appear to be any way to significantly reduce these emissions without sacrificing efficiency. The steps taken in 1973 to lower the compression ratio and recycle exhaust succeeded in reducing nitrogen oxides by 54 percent, but at a cost of approximately 30 percent in fuel economy. Family-sized automobiles (4500 to 5500 pounds) that averaged from 12 to 14 miles per gallon (mpg) in 1970 now average from 8.3 to 9.7 mpg. Even the new engine designs (such as the Wankel engine and the Honda stratified charge engine) that are reportedly capable of meeting the 1976 emission standards, do so by sacrificing efficiency.

It is estimated (*3*) that addition of air pollution control devices on a new car in 1975 will cost $314. If we assume that 10 million cars are sold each year, the total cost for these devices will be $3.14 billion per year. Replacement of catalytic converters every 50,000 miles requires an amortized cost of $40 per year for each car. The total annual cost will thus be $4 billion. The fuel consumption of cars manufactured in 1973 is already 30 percent higher than that of 1970 models and we are nowhere near meeting the 1976 emission standards. Even if we assume that these standards can be met with no further sacrifice in economy, the cost of the 30 percent increase in fuel consumption is more than $12 billion at current prices. Thus, we can estimate that the implementation of the 1976 automotive emission standards will cost approximately $20 billion per year.

What will we actually accomplish as a result of this expenditure? Certainly the automobile will become a negligible polluter. However, to require a 90 percent reduction of emissions from a source that is responsible for less than half of the pollution seems somewhat disproportionate. The Los Angeles area already has one of the lowest rates of automotive emission per square mile of any major city in the United States. Its air pollution problem is due to its peculiar geographical location and the resulting high incidence of inversion conditions. Even without automobiles, there would probably still be an air pollution problem in the Los Angeles area from home heating, power generation, and the petrochemical industry. In cities where there is more heavy industry, the reduction of automotive air pollution would produce even less of an improvement in the quality of the air.

There appears to be little evidence that automotive air pollution produces any widespread deterioration of the environment in nonurban areas. Wouldn't it be more reasonable to invest the $20 billion we are about to pay for emission controls in mass transit for the cities, where the population density is high enough to make it practical, and reserve the use of automobiles for small towns and rural areas, where mass transit is not feasible? Furthermore, the requirement by the Clean Air Act that automotive emissions be reduced by 90 percent should be replaced with a provision that every effort should be made to reduce automotive emissions that does not interfere with fuel economy.

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References and Notes

1. The U.S. Senate has already voted to postpone until 1977 the requirement that automotive emissions be reduced by 90 percent.
2. These percentages were obtained by taking the values for automotive emissions reported in the 1968 inventory of the National Air Pollution Control Administration and dividing them by the total number of miles driven to get the average grams per mile. These values were then compared with the 1970 emission standards.
3. H. E. Hesketh, *Understanding and Controlling Air Pollution* (Ann Arbor Science Publications, Ann Arbor, Michigan, 1972), p. 162.

Marine Advisory Programs

In her report on the RANN (Research Applied to National Needs) symposium sponsored by the National Science Foundation (NSF) (News and Comment, 7 Dec. 1973, p. 1006), Constance Holden writes that, according to NSF's Frank Hersman, "the Agriculture Department's extension service represents the government's only effective effort to get the results of new research out into the field, where it counts. RANN wants to follow this example by developing an 'environmental extension system,' an information dissemination system for local governments, and a consortium of major cities to see how RANN and other research can be used to serve urban needs." I commend this technique as a valuable and useful method of assuring that research results reach the intended consumer.

The Cooperative Extension Service is not the only effective effort to get results of research out into the field. The National Oceanic and Atmospheric Administration (NOAA) sponsors a ma-

rine advisory service through the National Sea Grant Program and its other component organizations. This program was inaugurated by NSF years ago under PL 89–688 and is providing the same services to the marine community as the "environmental extension system" recommended by Hersman. There are now 28 separate marine advisory programs located in the 30 coastal and Great Lakes states. These programs are concentrating on fisheries, coastal zone development, recreation, and marine science education.

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Deepwater Illumination

I wish to propose a means of creating a captive marine ecology that might prove of benefit in mariculture. Light at intensities sufficient to permit photosynthesis could be introduced into circumscribed regions in the ocean at depths at which such light intensities are normally not found. Such an experiment could be conducted with submerged banks of lights turned on and off in a circadian rhythm. However, for long-term study another method could be used in which no expenditure of electric power is needed. Towers that are either hollow or made of material more transparent than seawater could be built in coastal waters to reach to depths of 100 to 300 meters. Sunlight could then be transmitted directly into the deeper waters. The algal growth and its dependent fauna that would be made possible by such illumination would be truly captive, in that the conditions of pressure, temperature, and light intensity necessary for this ecology would exist only in the immediate vicinity of the tower, and harvesting would be greatly facilitated.

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"Miracle" Sorghum

As one who has some acquaintance with growers of sorghum and millet in the savanna regions of East Africa, I would like to comment on Deborah Shapley's report "Sorghum: 'Miracle' grain for the world protein shortage" (12 Oct. 1973, p. 147). The report suggests that the development of new high-protein strains of sorghum will aid the poor in less developed countries—principally Africans, East Asians, and Indians—who have been bypassed by the green revolution. This suggestion rests on several untenable assumptions insofar as it relates to the Africans I know. First, the people described as "poor" are not necessarily poor in their own eyes. What, then, does it mean to say that the new sorghums will help them? Are we planning to force them to grow "miracle" sorghum for their own good? The second assumption is that these people will desire to grow the new grains because they are hungry. This is nonsense. These Africans make decisions about growing new crops on the basis of the economic context in which they live. In the 1950's, the Nyaturu of Tanzania generally refused to cooperate with government plans for the construction of storage silos for bulrush millet. The plans were designed to alleviate the stress of periodic droughts, but the Nyaturu thought that storing the millet would threaten their basic economy—they exchanged grain for livestock in order to achieve wealth, and the periodic droughts appeared to them to increase the frequency of exchange.

The claim that the high-protein content of the new sorghum will alleviate kwashiorkor is particularly strange, since so many of the sorghum growers also raise livestock and consume more meat than other Africans do.

Isn't it about time that the brilliant technical expertise which has led to such dramatic improvements in crops is combined with a more sophisticated understanding of the non-Western economies they are meant to serve? Most particularly, shouldn't we explore the possibility that when the emergency conditions which bring hunger are not present, the people in less developed countries evaluate new crops, as we do, on the basis of such considerations as opportunity cost, marketability, and relevance to their society? American farmers don't grow hybrid corn just because it gives better yields or is nutritionally more adequate. Africans will also evaluate new plants on more complex economic grounds.

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