piston displacement. The tax was designed (at the beginning of the century), and works in practice, as essentially a property tax, and I would therefore dispute any claim that European governments have superior wisdom in matters of energy conservation.

The *actual* horsepower that can be obtained from a given piston displacement can be anywhere between 30 and 150 horsepower per liter of displacement (and even more for motorcycle engines), depending on the sophistication of design, and therefore taxable horsepower bears no relation to actual horsepower. In addition, gasoline mileage obtained on the road depends very little on engine horsepower (actual or taxable), but on factors such as gross vehicle weight, overall thermal efficiency of the engine with all accessories (for example, power steering or air conditioning), efficiency of power transmission to the driving wheels (which is noticeably less with automatic transmission than with manual), average speed, and, last but not least, presence or absence of smog controls, and driving habits (the proverbial "lead foot").

In this connection, crash-safety standards increase vehicle gross weight, and smog controls reduce the thermal efficiency of the engine; thus both factors tend to increase gasoline consumption per mile traveled. In this way energy conservation comes into direct conflict with safety and environmental considerations, and we are no longer faced with an either-or proposition, but with a much more difficult question of trade-off: How much increased energy consumption is the crash-safety and smog control worth?

On the whole, taxation calculated from piston displacement has had an inhibiting influence on engine design, and for this reason the Europeans have not been too keen on smog control (not to mention the noise factor) at home, for it is difficult to put effective smog (and noise) controls on a small-displacement engine and still have some power left (for example, I understand that Renault is pulling out of the North American market after 1975 largely for this reason).

If we have to tax automobiles in order to conserve fuel, let us avoid dictating design criteria (piston displacement, horsepower, number of wheels) and simply tax by vehicle weight, or tax fuel directly; in the latter case we probably cut down on unnecessary travel as well. If we tax fuel directly or tax by vehicle weight, we will likely end up with smaller cars using less gasoline, but if we insist on "zero pollution" and "total safety," we will end up driving 5-ton battering rams getting 1 mile to the gallon.

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Highway Salting

A report entitled "Release of mercury from contaminated freshwater sediment by the runoff of road deicing salt" of which I was a coauthor, appeared in *Science* in 1972 (10 Mar., p. 1142). The results showed that the addition of sodium or calcium chloride to artificially contaminated sediments increased the relative amount of mercury in the water in equilibrium with the sediments by two to five or more orders of magnitude.

Since that report was published, I and others have shown that increasing concentrations of chloride do indeed result in the release of mercury but that the amount of mercury released is dependent on the type of sediment, the *p*H, redox conditions, and the chemical form of the mercury. In naturally contaminated sediments, the mercury has generally been bound very strongly, and little release has occurred.

Unfortunately a number of environmental groups have cited the report as a strong argument against the use of road deicing salt. In view of the fact that mercury, except when associated with an unusual industrial pollution activity, is not present in significant amounts in most sediments, and because the amount of mercury that might be released by chlorides depends on a specific set of conditions which may not occur in the natural environment, I do not believe the contents of the report can be used as a reason for banning highway salting.

More comprehensive studies under realistic field conditions are needed in research involving the environmental sciences. Extrapolation of laboratory data to field conditions can often lead to inaccurate conclusions.

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