

U.S. Oil and Gas Consumption: Is Another Crisis Ahead?

Richard A. Kerr, in his Research News article "Oil and gas estimates plummet" (22 Sept., p. 1330), states that 86 billion barrels of oil (an estimated 35 billion barrels remaining plus 51 billion barrels recoverable in known U.S. fields) consumed at the recent rate of 5.4 billion barrels per year represents a 16-year supply. He states further that if imports provide 50% of U.S. needs, our domestic oil supply will last 32 years.

As M. King Hubbert has shown (1), however, the U.S. consumption of petroleum historically has increased exponentially at a rate of about 7% per year. If we calculate the lifetime of our domestic petroleum resources with an estimated consumption growth rate of 7%, we find that they will last about 11 years. If we assume reliance on foreign sources to meet half our demand, our own estimated 86 billion barrels plus imports of an equivalent quantity will have been exhausted in 16 years, not 32 years.

Until we recognize that our energy consumption grows exponentially, we will be continually surprised by petroleum shortfalls, budget deficits, and imbalance of trade and, as Kerr states, we "risk once again becoming hostage to the cartel."

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REFERENCES

1. M. K. Hubbert, in National Academy of Sciences—National Research Council Committee on Resources and Man, *Resources and Man* (Freeman, San Francisco, CA, 1969), p. 163.

In my 20 March 1987 (p. 1467) *Science* article "Impending U.S. energy crisis," I argued that the United States was headed for a new energy crisis on the basis of an extrapolation of the early impacts of the 1986 world oil price collapse. The nature of the crisis was undefined because a number of possible scenarios were conceivable.

One problem was related to the certain growth of U.S. dependence on foreign oil, which I speculated would reach 50% within a few years. It is interesting and alarming to note that the American Petroleum Institute's (API's) final figures on U.S. oil production and consumption for 1989 (1) show that imports reached a 10-year high at 46% of

demand. Behind the figures was the sharpest decline in U.S. domestic oil production in history. Not indicated in the API's report was a significant decrease in U.S. natural gas reserves and an unquantified drop in U.S. natural gas deliverability, which is the peak production capability of U.S. gas fields.

This information suggests three possible U.S. energy crisis scenarios. The first two relate to oil. While last year's roughly 7% decline in U.S. oil production may not be matched exactly in 1990 and beyond, further decreases are probable for the foreseeable future if recent conditions and trends continue. This further supports the possibility of a 60 to 70% dependence on foreign oil by the year 2000. At existing and projected levels of imports, there will be a growing vulnerability to supply disruption by natural disaster, manmade disaster (for example, another Exxon Valdez spill), or political action.

At the current price of roughly \$22 per barrel, last year's import level would represent roughly a \$64-billion drain on the U.S. economy. In light of the indicated trends, the nation appears headed for an imported oil bill that will grow to the \$100-billion-per-year level around the year 2000. I see no U.S. goods or services available for export to balance such a loss. Therefore, another likely U.S. energy crisis probably will take the form of a gargantuan drain on the U.S. economy for oil imports.

A more immediate threat is a natural gas deliverability crisis. During the relatively mild winter of 1988–1989, there were a small number of gas curtailments to schools and factories around the United States. The recent unseasonable "cold snap" was very close to causing similar curtailments early in the 1989–1990 heating season. The subsequent swing to unusually warm weather averted a gas delivery crisis for the time being. However, there is a growing probability that widespread gas curtailments will occur as natural gas reserves continue to dwindle, which is likely because of reduced U.S. exploration and production.

The probability of at least one of these U.S. energy crisis scenarios occurring is substantial, if not certain. It is sad that we as a nation do not seem to have the will to avert such problems.

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REFERENCES

1. *Oilgram News*, 18 January 1990, p. 5.

Punitive Damages and Innovation

In the article "Innovation on trial: Punitive damages versus new products" (15 Dec., p. 1395), Richard J. Mahoney and Stephen E. Littlejohn urge various reforms of rules governing punitive damages. Unfortunately, the article is not an objective or penetrating analysis of the relationship between punitive damages and innovation, and a few points may serve to illustrate its tendentious quality.

1) Mahoney and Littlejohn shrug off the fact that punitive damage awards often are reduced on appeal, asserting that, "on the contrary," the reduction in these awards is less (by an unspecified amount) for business defendants than for individuals.

2) They note that mean settlements tend to be 60 to 150% higher in cases alleging punitive damages than in other cases, and they treat this statistic as proof that punitive damages are extortionate. Yet, they do not mention the obvious hypothesis that plaintiffs are more likely to allege punitive damages in those cases in which liability is clearest. Such cases should generate higher settlements even if punitive damages were eliminated.

3) They assert, without explanation, that "[t]he law already ensures adequate compensation for nearly all conceivable harm." Evidently, their criterion for adequacy is not the economist's conception of making a wrongdoer bear the full social cost of its conduct, for existing damage rules do not compensate plaintiffs for all costs to themselves and to others and Mahoney and Littlejohn imply that insurance or other payments from collateral sources should reduce damage awards.

Manufacturers have suffered some egregiously erroneous awards in product liability cases. Compensatory as well as punitive damages for injurious, defective products are imposed wrongly on some occasions, and civil damages surely discourage some innovation; but these outcomes will persist whether the cause of action is negligence or strict liability. An intelligent prescription for reform must address the magnitude of these (and other) effects under alternative legal regimes. Mahoney and Littlejohn summarize some aspects of the limited information available on punitive damages, but their analysis of these data and their conclusions would more appropriately have been placed on the pages reserved for editorial opinions or News & Comment.

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The article on product liability by Mahoney and Littlejohn reflects the pervasive misinterpretation of the so-called liability crisis. While it is undeniably true that opportunistic lawyers and greedy plaintiffs have exacerbated the problem, they did not create it. And that is because the issue is not really one of liability; it is one of accountability.

The fact is, large businesses and the people who run them have, over the last few decades, succeeded in large measure in insulating themselves from the consequences of their actions. They have immense resources (including the best lawyers) and great political clout, particularly through their role in financing elections. The solitary individual in our society is, at best, severely limited in his ability to hold such great and powerful organizations accountable. This weakness of the individual holds for both the marketplace and the political arena.

But there is one recourse in our society for the helpless individual, and that is the courts. The glorious principle of equality before the law diminishes the mighty organizations and raises the individual, like David, to the status of giant-killer.

It is unfortunate and, as Mahoney and Littlejohn correctly point out, ultimately injurious to the economy that respectable and conscientious companies can be victims. Instead of wishing away the problem, however, or engaging in ultimately vain activities like tort reform, the leaders of companies such as Monsanto would be better advised to work toward requiring higher standards of integrity and greater accountability in American industry. That, and that alone, will resolve the crisis.

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Thank you for publishing "Innovation on trial: Punitive damages versus new products." On the reasonable policy base that manufacturers must be responsible for their products, production processes, and operations, including liability for failure of the product or operations, or both, we have added the wish that business be the insurer against accidents and misfortune and be punished for failure (beyond responsibility for the consequential damages). While these additions may be legitimate choices our society can make, it is noteworthy that we do not similarly hold government—a more promising candidate for spreading risks and costs across society—responsible for misfortune or misfeasance, even its own. One consequence of loading business and indus-

try with extraneous general social costs is that U.S. industry may become less effective at its main function of devising, producing, and distributing goods and services of a design, quality, and cost we and consumers abroad will find attractive.

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Response: Kaye raises three significant issues: the reduction on appeal of punitive damage awards, the relationship between high settlement costs and the seeking of punitive damages by plaintiffs, and the adequacy of compensatory damages as that relates to punitive damages.

The reduction on appeal of many punitive damage awards is not an indication that the system is working, but rather that the basis for awarding punitive damages at the trial court level is seriously amiss. A recent study by the Government Accounting Office (1) shows that punitive damage awards are frequently reversed on appeal, but that this process doubled the legal costs for defendants.

Manufacturers and others should not have to rely on appellate review to remedy the inequities and social costs associated with randomly imposed punitive damages. There is a vital need for fair rules and structure within the system. We remain exposed to lengthy periods of uncertainty during which legal costs mount inexorably. Instead of moving forward with key research and development, we must remain focused on potential results of an arbitrary system of punishment.

The hypothesis that plaintiffs are more likely to allege punitive damages in those cases in which liability is clearest is simply wrong. Data show that punitive damages are sought routinely, without regard to the merit of cases. This has been confirmed by a U.S. Department of Justice study (2). Plaintiff's lawyers seek punitive damages because they believe that such action can be an effective means of raising settlements.

In the overwhelming majority of states, the sole purpose of punitive damages is to punish and deter conduct that society finds unacceptable. They do not compensate real losses. The punishment purpose is frustrated by the randomness and arbitrariness of punitive awards. Reforming punitive damages will have nothing to do with whether injured persons are properly compensated for their actual harms.

Despite the noncompensatory purpose of punitive damages, Kaye suggests that they are still needed to supplement what he considers to be inadequate compensatory damages. We do not know any basis for this

observation. The dramatic expansion of noneconomic compensatory damages such as pain and suffering (which can be five to ten times economic damages), the shift to strict liability, and the increase in overall compensatory awards has led seasoned observers of the tort liability system like George Priest to suggest (3) that overcompensation, rather than undercompensation, is a major problem.

We agree with Brown that companies like Monsanto should be judged by how they conduct themselves and that they should strive for the greatest degree of integrity and social consciousness. For example, we have voluntarily made ourselves accountable for reducing all toxic and hazardous releases and emissions, working toward an ultimate goal of zero effect.

Unfortunately, the current punitive damages system does not encourage such positive conduct. The random imposition of punitive damages drives conscientious firms away from socially useful endeavors, while weakening their deterrent effect on companies that are not conscientious. Reforming punitive damages is fully consistent with and supports higher standards of integrity and greater accountability.

We agree with Randall that U.S. industry should not be diverted from its principal societal mission of responsibly discovering and producing goods and services that improve the quality of life for our consumers here and abroad. That is why the punitive damage system must be reformed.

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REFERENCES

1. *Product Liability, Verdicts and Case Resolution in Five States* (General Accounting Office, Washington DC, 1989), p. 69.
2. R. K. Willard and R. L. Willmore, *An Update of the Liability Crisis* (Department of Justice, Washington, DC, 1987), p. 50.
3. G. L. Priest, *Fortune* 119 (no. 9), 323 (24 April 1989).

Erratum: In his letter of 2 March (p. 1018), Gobinda Sarkar's address should have been given as 922B, Homestead Village, Rochester, MN 55904.

Erratum: In the article "Academy sued on 'plagiarized' diet report" by Eliot Marshall (News & Comment, 2 Mar., p. 1022), every reference to the "9th RDA [Recommended Dietary Allowances]" should have been to the "10th RDA" (the 10th RDA was assembled twice by the National Academy of Sciences—in 1985 and 1989). The reference to the "8th RDA" (the 1980 report) should have been to the "9th RDA."

Erratum: The first sentence of the caption for the figure on page 525 accompanying Marcia Barinaga's Research News article "Neuroscience models the brain" (2 Feb., p. 524) should have read, "Computer simulation by Kenneth D. Miller models formation of ocular dominance columns." The photo credit for the figure should have been to Kenneth D. Miller.