Response to Professor Platt's *Foreign Affairs* letter, Jan.–Feb. 2002

The Jan.–Feb. 2002 issue of *Foreign Affairs*, at p. 233, published the following letter, "Fuzzy Math," from Lucian B. Platt, Professor of Geology Emeritus, Bryn Mawr College:

"Amory Lovins and Hunter Lovins ('Fool's Gold in Alaska,' July/August 2001) claim that drilling in the Arctic National Wildlife Refuge is bad, unnecessary, and probably uneconomical. Many of their points are wrong, and the decision as to whether to drill in the ANWR should be based on better information.

"Planning for worldwide supply continuing for decades has been one of the great strengths of the more than trillion-dollar global oil industry. There seems to have been no time or place in which the companies failed to deliver adequate supply; every interruption has been caused by government interference. The search for oil takes place worldwide and has been successful on every continent except Antarctica. Unlike with agricultural commodities, a new crop of which can be grown on the same field next year, oil fields get emptied. New ones must be found even if world use declines. But world use goes up decade after decade, even with an occasional downturn year.

"Simple arithmetic applied to the figures that Lovins and Lovins offer indicates the following: from 1977 to 1985 world production of oil fell by 6 million barrels per day while production by the Organization of Petroleum Exporting Countries dropped by 13 million barrels per day, so daily non-OPEC production went up 7 million barrels per day, from 30 million in 1977 to 37 million in 1985. These millions of barrels come from new producing areas, including the North Sea, offshore Australia, and the North Slope of Alaska—places where previous capital investment finally began paying off.

"The authors also assert that 'the refuge is unlikely to hold economically recoverable oil.' They cite the conservative estimate of the U.S. government that 3.2 billion barrels is the likely yield from the refuge, but the oil companies suggest two or three times as much.

"Regarding the Alaskan pipeline, the authors claim that '[that] one fragile link, soon to be geriatric, would then bring as much oil to U.S. refineries as now flows through the Strait of Hormuz—a choke point that is harder to disrupt, is easier to fix, and has alternative routes.' But the pipeline has never broken, even though people have caused minor damage three times. The latest attempt, the first in 20 years, was caused by gunfire on October 4, 2001. Fifty previous shots had not penetrated this tough pipe. It is not close to being geriatric; the company that runs it says it is not yet through even half of its useful life.

"The statement that the pipeline is only half-full is sloppy writing at best. The contents could not be pumped up hill and down dale if the pipe were only half-full. And the statement that 'Canada, which shares threatened wildlife, also opposes drilling' neglects to recognize that the threatened wildlife turns out to be thriving—the caribou population, for example, has doubled in the 24 years of pipeline pumping. The reason Canada opposes new development in northern Alaska relates to its desire to have its own pipeline built to the south along the Mackenzie River.

"One of the worst overstatements is this: 'If one of its vital pumping stations were attacked in the winter, its nine million barrels of hot oil could congeal into the world's largest Chapstick.' This is cute phrasing but does not meet a reality check. Oil enters the pipeline at 116 degrees Fahrenheit and arrives about a week later in Valdez at 63 degrees. This flow has been going on for 24 years. Oil in the 400 miles of buried pipe would not congeal even if it sat for a year. Moreover, the seven pumping stations have shunts to deal with any breakdown. Oil will flow after repairs of any conceivable disruption of the pipe.

"Lovins and Lovins assert that '[if] three or four percent of all U.S. cars were as efficient as today's hybrid models, they would save the equivalent of all the refuge's oil. In all, many tens of times more oil is available—sooner, more surely, and more cheaply—from proven energy efficiency.' These claims do not work. If four percent of all U.S. cars stopped completely, never mind efficiency, the savings would be 400,000 barrels per day, or 146 million barrels per year. It would take 22 years of several million fewer cars on the road to save the amount of oil estimated to be in the refuge. Achieving great efficiency soon is impossible because fewer than 10 percent of the cars on the road are replaced each year; the other 90 percent continue in their inefficient ways. Meanwhile, the energy alternative of fuel cells for cars is not a near-term prospect according to four companies involved in fuel-cell research: Ballard, Manhattan Scientifics, Mechanical Technology, and Medis Technologies. Until there are realistic options, civilization needs the flow of new oil."

On seeing on 2 January 2002 that this letter had been published, the Lovinses immediately submitted the following response, which the Editor, on 14 January, declined to publish, but agreed on 18 January to mention in *Foreign Affairs* as available at this website:

The doubling of U.S. oil productivity since 1975 hasn't convinced Professor Platt there are any practical, let alone cheaper and faster, substitutes for ever-increasing amounts of oil, so we won't try. But the extensively documented notes posted September 22, 2001 at www.rmi.org/sitepages/pid171.php do rebut each of his claims that our article erred. Here are the most important:

Some drilling advocates do claim 2–3 times more oil than the U.S. Geological Survey's peer-reviewed independent study—usually by fudging the crucial differences between oil that's economically recoverable, technically recoverable even if unprofitable, and physically present even if unrecoverable. Major oil companies' headquarters don't; their numbers match ours. They realize that Refuge oil costs more than most prospects elsewhere, let alone non-oil alternatives. A nation that respects markets or an oil company that earns profits won't rely on such uncompetitive resources. America needn't.

Professor Platt says the car fleet turns over too slowly for efficiency gains to do much. But they needn't do much: just 0.4 mpg replaces Refuge oil, and two decades ago the U.S. did that every five months. Today, cars improved by not 0.4 but up to 40 mpg are selling briskly. Even if fleet turnover weren't accelerated (as we suggest in the February 11, 2002 *American Prospect*), Refuge oil can be saved many times over before it could even start flowing about a decade hence.

Our 1982 Pentagon analysis *Brittle Power* (www.rmi.org/sitepages/pid533.php) showed, and many security experts and government studies have confirmed, that Professor Platt's vulnerability analysis is unsound. Whether oil in the Trans-Alaska Pipeline would become unpumpably gooey as soon as 5–7 days after a winter interruption, rather than the claimed 22+ days, is the biggest operational concern stated by its regulator, the Joint Pipeline Office. JPO's February 2001 report shows the operator has no approved solution: its interim cold-restart plan is for +40°F, not –40°F, and "does not provide assurance that the pipeline could be restarted after extended winter shutdown."

JPO documents the extensive corrosion, erosion, subsidence, and other problems of both aging equipment and deficient management. In October 2000, improper work procedures caused sparks that could have blown up the vital Valdez terminal. In September 2001, sloppy operations overpressurized the pipeline during restart after the routine annual shutdown—for the seventh year in a row.

It is not true that the pipeline had "never broken" until a drunk holed it with one rifle shot last October, shutting down one-sixth of U.S. oil output for 60 hours despite easy repair access. In 1978, a crude bomb made a two-inch hole, spilling 16,000 barrels. In 1999, the gravest threat yet, a sophisticated 14-bomb attack at key three points, was averted only by luck. Its plotter, hoping to profit from oil futures, was an amiable bungler compared to the 9/11 terrorists—six of whose possible colleagues, reported Reuters, were briefly detained last October carrying photos of the pipeline.

On November 1, 2001, former CIA Director R. James Woolsey testified to a House committee [the Energy Subcommittee of the Science Committee] that although he's a normally oil-favoring Oklahoman and doesn't oppose Refuge drilling on environmental grounds, he does on national security grounds, because oil delivery through TAPS "seems to me to be a very vulnerable situation indeed." We concur. Senators who've made Refuge oil the centerpiece of their whimsically titled Homeland Energy Security Bill haven't connected the dots. Neither has Professor Platt.

—AMORY B. LOVINS AND L. HUNTER LOVINS
Co-CEOs, Rocky Mountain Institute

The following supplementary responses reference the annotated version of the Lovinses' article:

Oil reserves: The supply curve linked to "range of projections" on p. 78n of the article shows that although USGS's mean reserve estimate is 3.2 billion barrels at sustained West Coast crude-oil prices of $22/bbl (4Q2000 $), that would rise to 6.8 billion barrels at $43/bbl, and at that price, could even rise to 10.8 billion barrels with 5% finding probability. *A priori* it is equally likely that reserves could be only 3.4 billion bbl even at $43/bbl. Obviously, it's possible to support claims of several times 3.2 billion bbl by assuming very high oil prices, or unlikely discoveries, or both. However, such claims are more in the nature of a gamble than a sound prediction. As the article explains,

even $22/bbl exceeds almost all government or industry projections of typical oil prices for at least the next two decades.

Useful life of TAPS: We are unaware of any official statement that TAPS is "not yet through even half of its useful life." Our own inquiries to Alyeska on this subject elicited no clear response, and the Joint Pipeline Office's reports cited in our annotations make clear that there is no engineering basis for any such conclusion. The prospects for continued long-term operation of TAPS are currently under study by two contractors for the Joint Pipeline Office as part of Alyeska's application to renew its permits. It is plausible that barring attack, and with unlimited investment, TAPS could be kept running for decades longer. It is far more doubtful that maintenance budgets, already under severe pressure, could support such repairs and upgrades and still enable Alyeska to operate profitably.

"Half-full": Seeking a simple shortcut appropriate for *Foreign Affairs'* nontechnical readers, we obviously meant "full" in terms of throughput. TAPS currently carries about 1 Mbbl/d, or about half its full rated capacity of 2.136 Mbbl/d if all pumping stations were operating. We didn't mean to imply, and we doubt readers inferred, that the pipeline currently contains half oil and half air; if it did, it could indeed not pump oil, and it wouldn't contain its full load of 9 Mbbl as we stated. We considered the term "half-idle," but rejected it because it could imply that TAPS was pumping only half the time.

Oil in buried portion of TAPS: The cold-restart problem applies chiefly to the aboveground portion of the pipeline (more than half its length). We make no particular claim about, and have seen no good analysis of, the pumpability of oil caught in belowground portions during an unscheduled and prolonged winter shutdown. However, TAPS requires continuous flow along its entire length, so if aboveground portions become too gooey to pump, belowground portions can't be pumped either, making the distinction academic. (We apologize, by the way, for the misspelling "Chapstick": we later discovered that the trademarked product name is spelled ChapStik or Chap Stik.)

Pumping-station shunts: It's true that oil can be shunted around a damaged pumping station if the bypass pipes and valves have not been damaged too. The trouble is that then the station isn't pumping. Terrorists would presumably tend to attack the pumping stations needed to lift the oil over the Brooks Range. Without their pumping power, the oil can't cross the Range. At the present halved throughput, there is some spare pumping capacity, but of course more than one pumping station could be attacked, as could multiple sites on the line itself.

Repairs: Professor Platt states, with a great economy of truth, that "Oil will flow after repairs of any conceivable disruption of the pipe." This could be true if repairs were successfully completed before the oil congealed from winter cold—the cold-restart problem. The pipeline was designed to be able to restart if repairs are completed within 21 days, but it's currently stated by the Joint Pipeline Office not to meet that design criterion; JPO's estimate under worst-case winter conditions is about 5–7 days. Probably neither period is sufficient to repair major damage that was meant to be hard and slow to fix—especially in severe winter weather when key parts of the pipeline may not even be accessible for repair. Professor Platt's statement may also be true after a long enough time for congealed oil to be rewarmed the following summer and pumping resumed (assuming that the pipeline had not meanwhile been seriously damaged by overpressurization during attempts to pump the excessively gooey oil). But that process could be very slow and difficult; and meanwhile no oil would be delivered. It is tautologous but unhelpful to say that if, in the fullness of time, damage is repaired, then the pipeline can work again. The issue is the prolonged interruption of supply, together with the cost of repairs and the potential for additional attacks.

Canada: The Canadian government vigorously opposes Refuge drilling as a threat to wildlife that transits the international border and is protected by both international treaty and Canadian law. Our article was about economics and national security, not caribou, but the government wildlife agencies of the U.S. and Canada do not share drilling advocates' view that drilling would not harm that wildlife. (Neither did the pro-drilling Department of the Interior when this issue last came up 14 years ago.) Among other things, the caribou herd at issue is very different than the one Professor Platt refers to (www.alaskawild.org/caribou.html), and they are far from the only critical species at issue, such as polar bears and musk oxen (www.alaskawild.org/).

Professor Platt's slur that Canada's hidden agenda is not protecting wildlife but merely routing Refuge oil through a proposed Canadian pipeline has no factual basis of which we are aware. That argument is often advanced by the Alaskan Congressional delegation, which strenuously opposes, and wrote into the House energy bill an apparently treaty-breaking prohibition of, a Mackenzie Delta pipeline route (which would cost far less and might be less vulnerable)—perhaps because a Canadian pipeline would mean less revenue for Alaska. However, Canadian plans to build a natural-gas pipeline down the Mackenzie route are meanwhile advancing. Extending it into Alaska could also pick up much larger stranded North Slope (but non-Refuge) U.S. gas reserves at a cost that, unlike a dedicated Alaska-route gas pipeline, might make sense. A Mackenzie-based project with an extra undersea link to carry that

Alaskan gas too has in fact been proposed by ArctiGas Resources (*Wall St. J.*, 17 Jan. 2001, p. A10), but continues to be opposed by Alaskan authorities, who want their own pipeline instead.

Efficient cars: Professor Platt's arithmetic is roughly correct—though he's actually referring to light trucks as well as to cars—if one assumes that saving one barrel of gasoline saves only one barrel of crude oil. (As explained in the annotations, we used a 1:2.16 ratio because that's the 2000 average ratio of refinery gasoline output to crude-oil input. Other analysts' assumptions may differ, but 1:1 seems to us too low. For example, during the peak gasoline-saving period in U.S. history, 1978–82, the actual ratio of decreases in gasoline output to decreases in crude-oil input was 1:3.58, or 1:3.11 adjusted for changes in other blending components.) However, he fails to note that although not driving 4 million light vehicles for 22 years would save the 3.2 billion barrels' mean estimate of Refuge reserves at $22/bbl, that much oil would take *30* years for the Refuge to produce, so the demand-side resource he cites is bigger than the Refuge's oil. (Of course, we proposed making cars more efficient without compromising their service, rather than taking them off the road.)

Fuel cells: Of the four firms named by Professor Platt as vaguely stating that fuel-cell cars are "not a near-term prospect," only one (Ballard) develops fuel cells for cars. Ballard is bullish on automotive fuel cells and is rapidly developing them for commercial use by Ford, DaimlerChrysler, and many other automakers. Whether Professor Platt's characterization is true depends on the meaning of "near-term prospect." However, fuel cells, though not necessary to our thesis, are viewed by both the Big Three U.S. automakers and the U.S. Department of Energy as the future of automotive propulsion. Indeed, they jointly announced on 9 January 2002 a major "FreedomCAR" collaboration to speed fuel-cell vehicles to market (www.energy.gov/HQpress/releases02/janpr/pr02001, www.energy.gov/HQpress/releases02/janpr/FreedomCarFactSheet.htm).

Also noteworthy are two other recent studies:

- The autumn 2001 biennial planning scenarios from Royal Dutch/Shell Group (www.shell.com/files/media-en/scenarios.pdf). The "Dynamics-as-Usual" scenario envisages one-third of the world's energy, and all its additional energy, coming from renewable sources by 2050. The second, more radical scenario, explores a radical shift of technologies, especially to hydrogen fuel cells; it shows world oil demand stagnant until 2020, then declining steeply thereafter.
- A 2001 National Academy of Sciences report (www.nap.edu/books/0309076013/html/) found that although light-vehicle improvements have already cut gasoline consumption by 14%—comparable to Persian Gulf imports' share of U.S. oil use—conventional further gains cost-effective to the driver can roughly double fleet efficiency without compromising safety or performance. Typical potential fuel savings range from about 1/5 for small cars to 1/3 for midsize SUVs or nearly 1/2 for big pickup trucks. These findings are technically and economically conservative, and do not consider fuel cells at all. Their total size is enormously greater than would be needed to displace Refuge oil. Although the Academy later amended its findings to reduce some potential savings modestly while increasing some others, it also correctly noted that it "may have underestimated" the near-term (10–15-year) savings available from reducing vehicles' mass and drag (*Wall St. J.*, 17 Jan. 2002, p. A2).

—ABL, LHL