

contains no social conscience, and lacks an ethical dimension. Its so-called benefits are elitist, monetary, and egocentric.” Henry favors “forcing students to do *critical moral thinking* and to come to terms with the concept of moral excellence and with what might constitute the attainment of the good.”

The elite universities “probably have to be just what Mearsheimer says they are,” observes Eva T. H. Brann, dean emerita and a tutor at St. John’s College, in Annapolis, Maryland, a small liberal arts institution with a required “Great Books” curriculum. They are less communities than “disparate collections of atomic individuals joining in shifting patterns to accomplish various goals, among which the education of the young is not the least, but not the first

either.” Moreover, the many “assertively equal and vigorously competing disciplines” within the universities inevitably result in a multiplicity of “intellectual and ethical standards.”

The elite university will eventually disintegrate, Brann predicts, as “its own polymorphous and protean propensities drive it—aided by electronic substitutions—into increasing physical dispersion.” Meanwhile, she says, colleges and small universities can uphold the tradition of higher education. They can enforce certain standards of ethical behavior, and, at the same time, through common reading and conversation, in class and out, encourage “critical reflection about morality and virtue, about rules of action and ways of being.”

SCIENCE, TECHNOLOGY & ENVIRONMENT

The End (of Cheap Oil) Is Near

A Survey of Recent Articles

With gasoline as cheap (in constant dollars) as it was when the Cadillac was still king, many Americans are happily tooling around in gas-guzzling sport-utility behemoths with all the insouciance of Alfred E. Neuman. They could be in for a big shock, if some oil industry specialists are correct.

“What, me worry?” may seem a reasonable attitude on the surface. After all, the Organization of Petroleum Exporting Countries (OPEC) is no longer “a force to be reckoned with,” observes Fadhil J. Chalabi, executive director of the Center for Global Energy Studies in London and former acting secretary general of OPEC (1983–88). OPEC shocked the world with two sudden and substantial price increases, in 1973 (accompanied by an embargo on shipments to the United States), and in the winter of 1978–79 during the Iranian Revolution. But this proved to be OPEC’s “last hurrah,” Chalabi writes in *Foreign Policy* (Winter 1997–98), as high prices encouraged conservation, exploration, and new production, as well as the use of other fuels.

But the cheap oil (about \$15 per barrel last spring) won’t be around forever. Colin J. Campbell argues in the *National Interest* (Spring 1998), and with Jean H. Laherrère in

Scientific American (Mar. 1998), that the next oil crunch is just ahead, and it will not be temporary. “Within the next decade, the supply of conventional oil will be unable to keep up with demand,” predict Campbell and Laherrère, both with long careers in the oil industry and both now associated with Petro-consultants in Geneva.

Their conclusion, they note, contradicts the conventional wisdom in the industry, which—based on unverified estimates from companies and countries gathered by trade journals—is that there are about one trillion barrels of “proved” reserves worldwide. That suggests “that crude oil could remain plentiful and cheap for 43 more years—probably longer, because official charts show reserves growing.”

The trouble with that comforting picture, say Campbell and Laherrère, is partly that the estimate of “reserves” (i.e. the amount that companies can pump out of known oil fields before having to abandon them) is unrealistic—too high, by about 190 billion barrels. More important, not all reserves are created equal. It is not true, they point out, “that the last bucket of oil can be pumped from the ground just as quickly as the barrels

of oil gushing from wells today. In fact, the rate at which any well—or any country—can produce oil always rises to a maximum and then, when about half the oil is gone, begins falling gradually back to zero.”

Some of today’s larger oil producers, including Norway and the United Kingdom, will, unless they cut back sharply, reach their production peaks in about two years, according to Campbell and Laherrère. Then they will have to reduce output. By about 2002, the world will be dependent on Middle Eastern nations—particularly, Iran, Iraq, Kuwait, Saudi Arabia, and the United Arab Emirates—to satisfy growing demand. That raises the specter of another 1970s-style massive price increase. That would curb demand, leaving prices volatile. “But by 2010 or so, many Middle Eastern nations will themselves be past the midpoint. World production will then have to fall,” the two researchers predict. Unless demand for oil shrinks, prices will rise.

“The world is not running out of oil—at least not yet,” Campbell and Laherrère explain. “What our society does face, and soon, is the end of the abundant and cheap oil on which all industrial nations depend.”

Can anything be done? Yes, say other specialists writing in the same issue of *Scientific American*. Recent technological advances—in tracking the flow of underground crude oil, steering drills horizontally, pressurizing “dead” wells, and tapping oil fields that lie deep underwater—if deployed as planned on the largest oil fields within three to five years, “could lift global oil production rates more than 20 percent by 2010,” claims Roger N. Anderson, director of petroleum technology research at Columbia University’s Energy Center.

Another, unconventional source of oil is bitumen, “a black, tarlike substance . . . in

the pore spaces between the grains of certain sands and shales (solidified muds),” notes Richard L. George, president and CEO of Suncor Energy, a company involved in mining such resources. In Alberta, Canada, alone, he estimates, some 300 billion barrels could be recovered from oil sands—more than the reserves of conventional oil in Saudi Arabia.

Oil is not the only source of energy, of course. There’s nuclear fission, solar energy, and wind power, to name a few. Safaa A. Fouda, of CANMET Energy Technology Center, a Canadian government laboratory in Ontario, contends that natural gas holds great promise. It is not only the cleanest of fossil fuels but also one of the most plentiful: analysts estimate that there is enough readily recoverable natural gas in the world to produce 500 billion barrels of synthetic crude oil—more than twice the amount of conventional crude oil ever found in the United States. The challenge, she notes, is finding a cheap way to liquefy it, so that it can be piped to market inexpensively. Even today, she says, natural gas can be converted into liquid fuels at prices that are only about 10 percent higher per barrel than the price of crude oil. With the right process, liquid natural gas could even power cars and trucks that now run on gasoline.

Campbell and Laherrère also look to natural gas as a promising substitute for oil. “With sufficient preparation . . . the transition to the post-oil economy need not be traumatic,” they conclude. “If advanced methods of producing liquid fuels from natural gas can be made profitable and scaled up quickly, gas could become the next source of transportation fuel. Safer nuclear power, cheaper renewable energy, and oil conservation programs could all help postpone the inevitable decline of conventional oil.”

Bird Theory in Flight

“The Origin of Birds and Their Flight” by Kevin Padian and Luis M. Chiappe, in *Scientific American* (Feb. 1998), 415 Madison Ave., New York, N.Y. 10017-1111;

“The Big Flap” by Larry D. Martin, in *The Sciences* (Mar.–Apr. 1998), New York Academy of Sciences, 2 E. 63rd St., New York, N.Y. 10021.

Is that feathered creature outside your window a dinosaur, or at least a descendant of one? Yes, beyond any “reasonable

doubt,” assert Padian, a professor of integrative biology and curator in the Museum of Paleontology at the University of