Local authorities have also gotten into the act, making bio-prospecting even more daunting. In the Philippines, for example, a researcher must first navigate "multiple layers of national government review and consent," get "informed consent from indigenous communities" and "any affected private landowner," and undertake an extensive program of public education, to ensure that everyone who might possibly have an interest in the potential discovery learns about it in advance. During the year Safrin studied the situation there, only two of 37 proposed projects cleared all the hurdles.

We're all familiar with the "tragedy of the commons": Fisheries and other resources are overused when too many people have access rights to them. A tragedy of the *anticommons* has been developing in the genetic realm: Too many people have rights to *exclusion*. Safrin calls this "hyperownership."

She acknowledges that it's not practical to return to a completely open system. But the United States could restrict patents somewhat—excluding, for example, genes that are discovered but not improved. At the same time, the doctrine of "sovereign enclosure" should be modified so that individuals or indigenous groups control access to some genetic material themselves. And there are more creative ways for nations to reap monetary benefits from their genetic resources. Such a framework would allow scientists to unlock many more secrets of nature that will benefit all of humanity.

Putting Power Downtown

"Critical Thinking about Energy: The Case for Decentralized Generation of Electricity" by Thomas R. Casten and Brennan Downes, in *Skeptical Inquirer* (Jan.–Feb. 2005), 944 Deer Dr., N.E., Albuquerque, N.M. 87122.

It wasn't long after the world's first commercial power plant fired up in 1879 that city dwellers made a basic discovery: Smoke-spewing power plants make bad neighbors. Before long, the young industry began shifting its operations far from America's downtowns. It's time to come back, argue Casten, head of a company that develops and runs decentralized energy projects, and Downes, a project engineer with the firm.

The shift to big generating plants in remote locations created economies of scale, but the need to transmit electricity over great distances and, more important, the inability to recycle waste heat for use in nearby buildings also introduced big inefficiencies. In fact, U.S. average net electric efficiency reached its peak around 1910, before the exodus began, at about 65 percent of the input energy. By 1960, efficiency had declined to 33 percent, and there it remains today.

With today's technologies, it's possible to convert more than 50 percent of the energy created by burning fuel (including coal) into electricity, while also emitting few pollutants. If smaller "direct generation" (or "cogeneration") plants could be located near users in urban areas, the industry could easily see a return to the "good old days" of high efficiency. That's not just a theoretical possibility. By recycling waste heat and minimizing losses to transmission, actual plants of that sort have achieved 65 to 97 percent net efficiency.

All told today, there are 931 such plants, and they generate eight percent of the nation's electricity. Why aren't there more? Shielded from competition and required by government regulations to pass along any savings from efficiency gains to their customers, utility companies have had little incentive to innovate.

Global demand for electricity will double over the next three decades, the International Energy Agency predicts. The authors claim that building smaller, decentralized plants would save $5 trillion in capital investment, consume the equivalent of 122 billion fewer barrels of oil, and halve carbon dioxide emissions, producing less global warming. But they see little likelihood of a radical overhaul of utility regulation. They propose instead adoption of a national fossil fuel efficiency standard, backed up with penalties and rewards. Do that, they say, and the other pieces will begin to fall into place.