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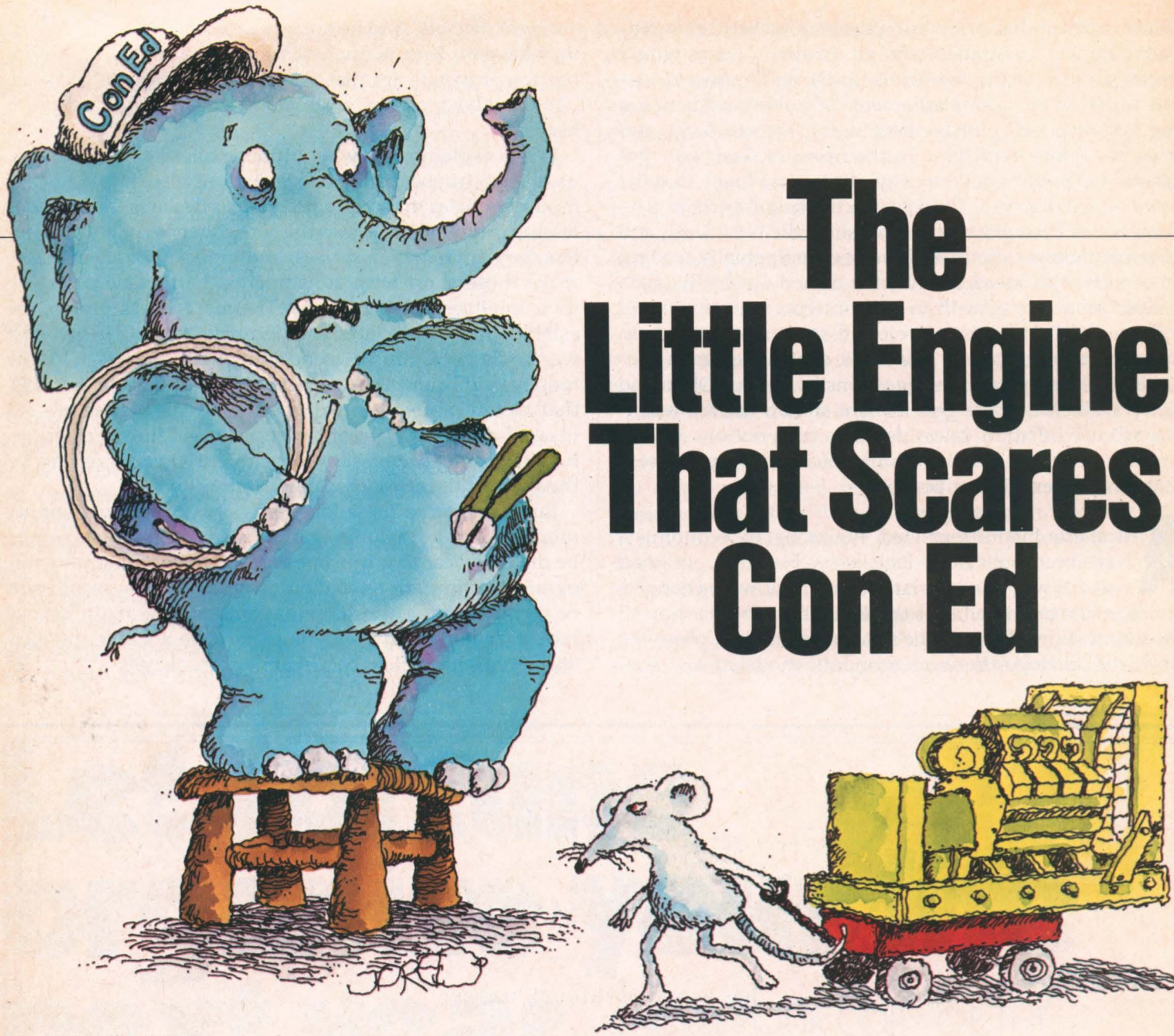


The Little Engine That Scares Con Ed

by TOM ALEXANDER

Like telephone companies and railroads, electric utilities have traditionally been viewed as natural monopolies—institutions that serve society most efficiently if they are the sole, regulated source of the services they provide. But railroads have long since encountered competition from trucks, airlines, and pipelines; telephones now compete against microwave and satellite systems. Recently, one of the nation's biggest manufacturers of diesel engines, Cummins Engine Co., set out to provide some back-door competition for the second-oldest electric utility in the U.S., New York's Consolidated Edison Co.

For over a year now, Cummins Cogeneration Co., a small division of the Columbus, Indiana, manufacturer, has been concentrating on selling co-generation plants in New York City and its environs. These are diesel-powered electric generators designed so that the waste heat from both their exhausts and cooling system can be recaptured and used. Equipped with such plants, energy users can cut themselves loose from Con Ed and not only make all their own electricity for less money than the utility charges, but heat and cool their buildings in the bargain. So far, Cummins has managed to sell the system to only four large customers, but some fifty others are interested and ten have signed contracts for engineering studies.

Cummins might reasonably have expected its enterprise to nettle Con Ed, but it apparently never anticipated that the elephantine utility would react as though its very survival was threatened. Nor did Cummins foresee the confusion and disarray that its marketing effort would stir up in New York City officialdom, which is torn between its desire to reduce the city's outsized energy costs and its fear of seeing Con Ed hurt.

There is nothing new about co-generation. Many different technical methods have been devised, all of them capitalizing on the fact that generating electricity wastes about twice as much energy in the form of heat as can be turned into electricity. This inefficiency has been recog-

Cummins Engine has begun to cut into the big utility's market with co-generation —power production in which waste heat is used to warm and cool buildings.

nized since the earliest days of electrical generation, and in the early decades of the century scores of local power companies sold steam produced in conjunction with electricity for space heating or for industrial use.

One of the oldest and still one of the world's biggest co-generation companies, in fact, is Con Edison itself, which pipes steam to some 2,324 customers—mostly office buildings and large apartment houses—in central and lower Manhattan. But Con Edison's steam prices have been rising steadily, among other reasons because of increasing taxes, driving away customers at an accelerating rate. So the utility sees a double threat in the little Cummins division's invasion of its market.

No job for the janitor

Co-generation acquired additional cachet as an energy-conservation measure when President Carter mentioned it prominently in a 1977 speech promoting his energy plans. Stimulated by government research grants and prospects of double the normal 10 percent investment tax credit, at least a dozen companies besides Cummins, including General Motors, Caterpillar Tractor, and International Harvester, are currently marketing co-generation sets or trying to develop them. Unlike Cummins, most of the other companies have been content merely to make equipment, leaving it to others to install, run, and maintain the whole system.

Cummins tried that arrangement for a while in the Sixties, but after some bad experiences stopped taking orders because so many of its co-generation plants were breaking down while in use. The company concluded that few architects, engineers, and contractors had sufficient experience to design and install a co-generation system, and once put in place, the complex apparatus was often inexpertly operated and maintained. "A company will spend $5,000 on an office copier and routinely sign a maintenance contract with Xerox," says Thomas R. Casten, general manager of Cummins Cogeneration. "But they'll spend $250,000 on a total energy plant and let the janitor maintain it."

Research associate: Wilton Woods

As Casten tells it, one inexperienced contractor installed a Cummins system in the Virgin Islands, planning to use the by-product heat to desalt seawater. But the contractor laid plastic seawater pipes in a trench alongside hot-water pipes. The plastic melted and split, seawater leaked into the boiler, and the boiler exploded.

Contradicting the experts

Casten's interest in co-generation was roused after he was appointed director of corporate strategy for Cummins Engine in 1974. His main job was to figure out what a diesel-engine maker would do twenty-five years in the future when, as many experts were then predicting, the oil that fuels the engines would be running out. After nine months on the job, Casten decided that this underlying assumption was wrong. Oil won't run out in twenty-five years, he concluded, but will merely be harder to get and therefore more expensive; much of it will probably have to come from such unconventional sources as tar sands, shale, or coal, but oil will remain an important source of energy.

Casten proposed that Cummins turn the long-term threat to its livelihood into a new opportunity by becoming the I.B.M. of co-generation. The company, he argued, should not only build equipment that would make optimal use of high-priced oil, but also design, install, and maintain entire co-generation systems.

One of diesel co-generation's big advantages, says Casten, is the steadily improving technology of small, mass-produced, high-speed diesel-power plants that have been developed in recent decades, mainly for such equipment as trucks, cranes, and power shovels. In earlier times, he says, diesel generators for large installations usually employed huge, slow-turning engines originally developed for ships. While longer lived and slightly more efficient than smaller units (the small, fast-running engines must be rebuilt after about 25,000 hours, or three to four years, of use) the large engines cost far more per horsepower of output, and they occupy a lot more space in a building.

But what gives the little diesels their greatest appeal is a striking reversal in the economics of electric-power generation. Until the late Sixties, big central plants provided more kilowatts per dollar invested. Not anymore. Today, co-generation units cost between $300 and $600 per kilowatt of output—a half or even a third what it costs to build new central electric-power stations and their associated transmission and distribution networks. A variety of factors have made the big plants much more expensive—mandatory safety and environmental requirements, regulatory delays, low production volumes, costly on-site fabrication, and high interest rates during construction. And largely because of the OPEC inflation of oil prices, operating costs of the big plants are higher than those of plants that also utilize wasted heat.

An obvious battleground

"It took me three years to convince our management that it was not really a paradox to burn oil to save oil," says Casten. Having sold his idea, Casten picked New York City as the obvious first battleground in his campaign. Con Ed's customers pay about twice as much for their electricity as the average consumer elsewhere, and half again as much as those in the next highest-priced large city, Boston. Part of that high price may be a result of Con Ed's notorious managerial shortcomings, which New Yorkers love to belabor. To be fair, however, Con Ed does have some singular problems. Because of air-pollution restrictions, Con Ed's power plants must burn costly low-sulfur boiler fuel. Threaded through Manhattan's obdurate granite, Con Ed also has the world's most extensive —and expensive—tangle of underground cables and steam pipes, many of them timeworn. And the differential between the daytime peak and the nighttime slack in demand for power is greater than the average utility has to cope with. New York has comparatively few two- and three-shift industries, and it has a large commuter population that leaves at night while the

apartment dwellers who remain consume less electricity than the national average.

Worst of all, Con Ed has long been regarded by the city's fathers as the local equivalent of cartoonist Al Capp's lovable, kickable Shmoo: an almost inexhaustible source of goodies. The company is forced to collect some 7.5 percent of the city's tax revenues in the guise of utility bills. More than 27 percent of the average Con Ed customer's bill consists of federal, state, and local taxes. Per kilowatt-hour sold, those taxes run from two to twelve times the burden borne by utility customers in other major cities.

A six-year payoff

By now, the city has come to recognize that towering utility bills play a significant role in driving manufacturing and other businesses out of New York City; the exodus has cost the city 610,000 jobs since 1969, a loss that now deprives the city of some $200 million a year in tax revenues. Right across the Hudson River, New Jersey has been wooing companies with promises of utility bills half as high as Con Ed's. In response, the city's Office of Economic Development has been actively promoting co-generation as one answer to New York's forbidding energy costs.

Toward that end, the development office has secured a $3-million federal Housing and Urban Development grant, which it in turn plans to lend at low interest to help energy-intensive electroplating and plastics companies to install co-generation. The city is arranging loans covering 45 percent of the cost of five installations. Cummins Cogeneration and H.O. Penn Machinery Co., a co-generation equipment distributor, have lined up loans for another 45 percent of the cost; the buyers will put up the final 10 percent.

Cummins has also sold plants to Saw Mill River Tennis Courts in Westchester County, a Cummins Engine distributor in the Bronx, and Seal-Kap Packaging Co. in Queens. But it was a deal that Cummins made in the heart of Manhattan that stirred Con Ed into action.

In late June, the Tishman Speyer Silverstein Partnership, renovating a thirty-story office building at 11 West Forty-second Street, made plans to stop using Con Ed's power lines and steam and supply all the building's needs with a 5,600-kilowatt Cummins system at a cost estimated at about $2.5 million. Such an installation should save enough money to pay for itself (before taxes) in less than six years.

Con Ed officials were aghast. If a substantial number of its other customers followed the Tishman example, the utility envisaged the possibility of losing an eighth or more of its power market and as much as a third of its steam market.

The utility immediately asked for a hearing before the mayor's Energy Policy Advisory Group, a blue-ribbon citizens' panel New York's Mayor Edward Koch had set up to help reconcile the energy, environmental, and economic needs of the city. Appearing before the group in early October, Bertram Schwartz, a Con Ed senior vice president, urged the city to impose a moratorium on all new co-generation facilities, at least until the city had assessed all the implications.

The backlash of a sales decline

Among other things, Schwartz argued that Cummins's machines would deepen the nation's dependence upon imported oil and increase air pollution in Manhattan, where it is already the worst in the region. Schwartz contended that instead of stemming the job exodus from the city, co-generation might increase it. For any decline in electric sales would force Con Ed to redistribute the burden of its fixed costs —roughly two-thirds of its total costs —among the rest of its customers.

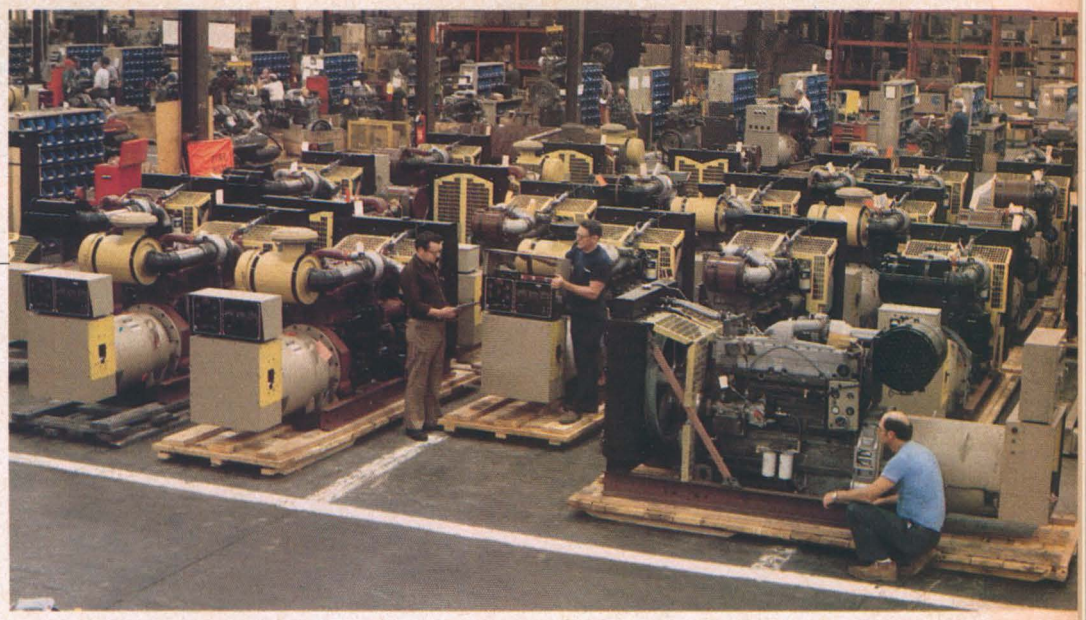
Schwartz also warned that private co-generation would deprive the city of some of those hefty tax revenues from Con Ed. In fact, he asserted, if it weren't for avoiding the taxes included in Con Ed's rates, co-generation would have little appeal for most of its customers.

COSTS AND RETURNS AT TEN CO-GENERATION PROJECTS

INSTALLATION	GENERATING CAPACITY	CAPITAL INVESTMENT	GROSS SAVINGS (first year)	PRETAX PAYBACK (in years)	PRETAX RETURN ON INVESTMENT
SKI AREA VERMONT	500 kw	$ 50,000	$ 35,000	1.4	70%
NURSING HOME STATEN ISLAND, N.Y.	420 kw	325,000	88,000	2.9	38%
HOCKEY RINK & TENNIS COURT,* WELLESLEY, MASS.	560 kw	200,000	60,000	3.1	32%
CONTAINER FACTORY* NEW YORK CITY	1005 kw	630,000	158,000	3.3	39.4%
SHOPPING MALL MIDDLETOWN, N.Y.	3700 kw	1,550,000	329,000	3.6	35%
CUMMINS DISTRIBUTOR* NEW YORK CITY	210 kw	170,000	43,000	4.4	24%
TENNIS COURT* WESTCHESTER CY., N.Y.	210 kw	145,000	27,000	4.5	24%
APARTMENT BUILDING NEW YORK CITY	1400 kw	1,200,000	187,000	5.0	20%
CHICKEN PROCESSOR FLORIDA	2800 kw	1,500,000	187,000	5.4	19.2%
PUBLIC SCHOOL WESTCHESTER CY., N.Y.	480 kw	350,000	51,000	6.1	21.3%

*Plants under construction or operating. Others await final approval.

The economic payoff varies widely in co-generation installations, according to data compiled by Cummins Cogeneration Co. But most projects pay for themselves in about three to five years. The variations reflect differences in the amount of recoverable heat used and whether the unit is put into a new or existing structure. In some areas where year-round utility rates are based on a seasonal peak, the savings on electricity alone can justify co-generation. Cummins finds that inflation will increase the annual savings over time.



Diesel generators being assembled (right) at Cummins Engine's plant in Seymour, Indiana, are converted into co-generation sets when they are equipped with boilers that make steam or hot water from the heat of the exhaust and the water that cools the generator.

All this is disputed by Casten of Cummins, who contends: "Con Ed's rates are so high that co-generation would still benefit many users even if Con Ed paid *no* taxes or got all its fuel for nothing." That may sound like braggadocio, but the savings that Cummins predicts for several co-generation projects (see table, facing page) do exceed the fraction of the utility bill that consists of taxes.

As for the effects on New York City's tax revenues, Casten argues that the savings from co-generation would mean higher profits to be taxed, greater willingness of industries to stay in the city, and therefore more taxes over the long run. And as for oil consumption, Casten points out that Con Ed itself generates more than two-thirds of its electricity from oil, while diesel co-generation provides a less wasteful way of using oil. Schwartz acknowledges that this may be true in the short run, but he notes that the utility hopes eventually to replace its oil-burning plants with coal or nuclear facilities.

An environmental puzzle

It seems clear that the most critical unknown affecting co-generation's future in New York City is its environmental impact. At the moment, New York's air complies with federally mandated air-quality standards for all regulated pollutants except particulates. While conceding that diesels would emit less sulfur dioxide per kilowatt-hour of electricity than its own oil-fired plants, Con Ed cites figures from the federal Environmental Protection Agency showing that diesels emit ten times more oxides of nitrogen, six times more particulates, and twenty times more carbon monoxide.

In addition, Con Ed points out, the tall smokestacks on its plants project hot plumes of pollutants high into the atmosphere, where they are diluted and carried out of the city before falling to earth. In contrast, private co-generators would emit cooler, heavy plumes of pollution just above building-top levels. The downdrafts that swirl among Manhattan's massed skyscrapers would probably carry the fumes down into the city's canyons.

Casten disputes Con Ed's use of the EPA data, which appear to have been derived from tests on diesel engines that undergo repeated acceleration and varying loads. He says that Cummins's own measurements show that the constant-running engines used in co-generation produce less emissions than Con Ed's oil-fired plants for all pollutants except oxides of nitrogen. He also argues that regulators ought to (but don't) take account of the fact that co-generation uses a good deal less fuel to provide the same amount of useful energy.

In truth, nobody really seems to know *what* co-generation on a large scale would do to air quality, least of all the city itself. Last July, when Tishman and Seal-Kap applied to New York's Department of Environmental Protection for permits, the pollution bureaucracy did what bureaucracies generally do in controversial circumstances—they delayed taking action. All parties concerned had their eyes on November 1, when new state environmental-quality regulations were to take effect, requiring discouragingly elaborate environmental-impact analyses for all large projects. Some presumed that these regulations could delay the permit process for months or years until the air-pollution issue was finally resolved.

Five minutes before the deadline

After four months of waiting for their permits, Tishman and Seal-Kap threatened to go to court and get a writ of mandamus ordering the city to issue the permits. The permits were finally issued five minutes before the close of business on the day before the new rules took effect.

Both Judith Friedlaender, an assistant to the mayor who handles environmental affairs, and Peter J. Solomon, deputy mayor for economic policy and development, acknowledge that the delay in issuing the permits reflected the city's quandary over co-generation: the worry over environmental effects and fear of losing taxes and damaging Con Ed on one hand, versus their pet notion of exploiting co-generation to help businesses cope with higher energy costs on the other. They call the city's decision to issue the two permits an experiment in environmental and social policymaking.

A nudge for efficiency

The cautious go-ahead for co-generation also amounts to an experiment to determine what effect a whiff of competition might have on both regulated monopolies and the government agencies that regulate them. Because decisions by public rate-setting bodies have so much impact on a utility's profits, the average utility manager's job depends more upon whether he allows the lights to go out than whether he allows costs to go up. The rate-setting commissions, in turn, normally give a lot of weight to the concept of allowing utilities a reasonable return on their capital investment. The result is a system that promotes increasing capital outlays.

The presence of private co-generation in a utility's marketing area ought to serve both as a yardstick and as a lever to induce utilities to strive for maximum operating efficiency. The prospect of competition already has affected Con Ed's

"In time we'll be competitive across the country," says a Cummins executive.

behavior. Shortly after the co-generation loans to electroplaters and plastics molders were proposed, the utility offered to reduce the rates that it charges small manufacturers facing economic difficulties—without raising rates for other customers.

Even though they compete, co-generation and central-station utilities actually play complementary roles. It should be possible to exploit this situation not only to the benefit of both but to the benefit of society as a whole. The greatest economic burden that utilities—and their customers—face is expanding capacity to meet rising demand, while maintaining an adequate standby reserve. In the topsy-turvy utility economics of the Seventies, every new customer and every increase in peak demand adds to the costs every other customer must pay.

A double dose of idle capacity

At the same time, every co-generation installation in the New York area has large amounts of excess generating capacity that stand idle most of the time because each plant must have backup equipment for use in case of a breakdown. Logically, Con Ed would provide power in such emergencies, but it charges such high rates that most co-generators in the New York area find it cheaper to cut themselves off entirely from the utility's lines.

The compliant New York State Public Service Commission lets Con Ed charge a backup rate that amounts to about 85 percent of what a customer would pay if he had no co-generating plant, and he must pay it even if he uses no electricity or steam at all in a given month. The rate is based on the full cost to Con Ed of maintaining the generating and transmitting capacity that would be required to serve all the customer's needs.

The rate arguably bears little relationship to Con Ed's actual costs. For one thing, most co-generation systems have several generating units, not all of which are likely to fail simultaneously. More important, in an area with many co-generators, no more than a small fraction of the total capacity is likely to be out of action at any one time. Rather than pay Con Ed's lofty backup rates, most co-generators in the New York area install their own standby generators, even though in some cases they may have to invest more than twice as much as they would if they had a utility backup.

There is no good reason why the two systems—public utilities and private co-generators—cannot share capacity to their mutual benefit. An electric wire can carry power as readily in one direction as in another. So in principle co-generators and utilities should be able to function interchangeably as buyers and sellers of power. In midwinter and midsummer, for example, a co-generation system that heats or cools a building will produce more electricity than the building can use. That surplus power could be sold to electric utilities straining to meet seasonal peak loads. If utilities bought power from co-generators, they could defer investment in some expensive new plants.

To be sure, these arrangements face a number of technical and economic obstacles. For one thing, any power entering a utility grid has to be precisely in phase with the 60-cycle alternating current that all systems use. But comparatively inexpensive technology can surmount this problem, as witness the fact that practically all U.S. and Canadian utility power plants are now interconnected in a grid in which power flows back and forth as demand fluctuates from one region to another.

Time to reshape rates

The main economic barrier is that a utility's daily demand peaks tend to coincide with those of most co-generators. To overcome that problem, the rates utilities charge for power could be reshaped to induce all consumers to flatten or shift their peak demands. Rates that utilities pay co-generators for power could be designed to induce them to operate their standby equipment at times when it is needed.

Many sections of the country already have some form of peak-load pricing, in which rates rise more or less in step with demand. California has ordered utilities to offer co-generators "equitable" standby rates, reflecting the fact that not all co-generation systems are likely to require backup power at the same time. Some utilities in Georgia and Texas are even promoting co-generation by their customers as a way to share their peak-load burden.

The spread of co-generation seems likely to be reinforced by economics as well. It is doubtful that the arrangement will make much sense in the foreseeable future for most one-family houses. The capital cost of the equipment is too large for small consumers to reap much, if any, saving. But the cost-benefit scale tips the other way for large users of power. For one thing, the bigger the co-generation installation, the less backup gear per kilowatt is needed as insurance against breakdowns. Moreover, as electrical demand grows, utility companies will increasingly meet it with power generated at high-cost new plants. Cummins expects electric utility rates to rise by about 9 to 11 percent annually throughout the U.S. for some years to come. With that in mind, Cummins's Casten cheerfully predicts: "In time, we'll be competitive across the country."

Sharing the benefits

In the interest of both economic efficiency and fairness, taxes, subsidies, and environmental regulations surely should favor neither one mode nor the other. But everyone should be able to benefit from cooperation between public and private generators. Private systems could be built smaller and cheaper, yet enjoy greater reliability; public utilities could defer costly outlays necessary to meet peak loads. For the whole nation, that should mean cheaper power, reduced fuel consumption, less pollution, lower oil imports, less capital invested in idle equipment.

Co-generation has opened up an opportunity for the kind of creative experimentation that is facilitated by our federal system, with its three tiers of government. Right now, when a great many electric utilities still have the luxury of some surplus generating capacity, is a good time for that experimentation to begin. F