Energy Conservation at an Industrial Research Center

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The events after the recent Arab-Israeli war have made everyone conscious of energy conservation and, at the same time, acutely aware of our previous profligate use of energy. In early November, the appeals of the President and other leaders to the public to conserve energy—specifically to lower the thermostat to 68°F, turn out unnecessary lights, drive at lower speeds, and conserve gasoline—fell on sympathetic ears. Americans began to think about energy savings mainly in terms of what they could do as individuals and how it affected their individual way of life. Even though most people understood very well that industry was the major consumer of energy, they had given very little thought to what industry could and should do. Because of the fuel allocations that we at the Celanese Summit Technical Center (STC) had already faced, we had given some thought to energy conservation.

Although an industrial research and development (R & D) laboratory probably cannot be equated with large, energy-consuming industrial plants, we decided in October that we should evaluate our energy consumption to determine how we could contribute to energy conservation. The events that followed and the savings achieved surprised us all. This article is a brief description of our experience, which we hope will be of interest to others responsible for energy conservation at R & D laboratories.

Very few scientists and engineers in our laboratories had given much thought to what a large consumer of energy an R & D laboratory is. When asked to address themselves to this problem, they were very interested to know what they could do to help. At a staff meeting called to discuss energy conservation, many ideas and suggestions as to actions that could be taken were put forth. As a first step, the STC facilities manager was appointed by the president of Celanese Research Company (the corporation's central laboratory) to develop a total site plan for energy conservation and was given the responsibility for its implementation.

The STC, which is fairly typical of research centers in the chemical industry, consists of 340,000 square feet of research laboratories and pilot facilities and is located on 50 acres in suburban northern New Jersey (*1*). The corporate laboratory, the Research and Development Center of the Celanese Plastics Company, and the Celanese Chemical Company's Marketing-Technical Development Laboratory are located on this site. All services to the approximately 360 technical people at this location are provided from a central operation. A full cafeteria is also located at the center.

By the middle of November, many suggestions had already been received from the staff. The following initial steps, which were comparatively easy to implement, were taken at STC:

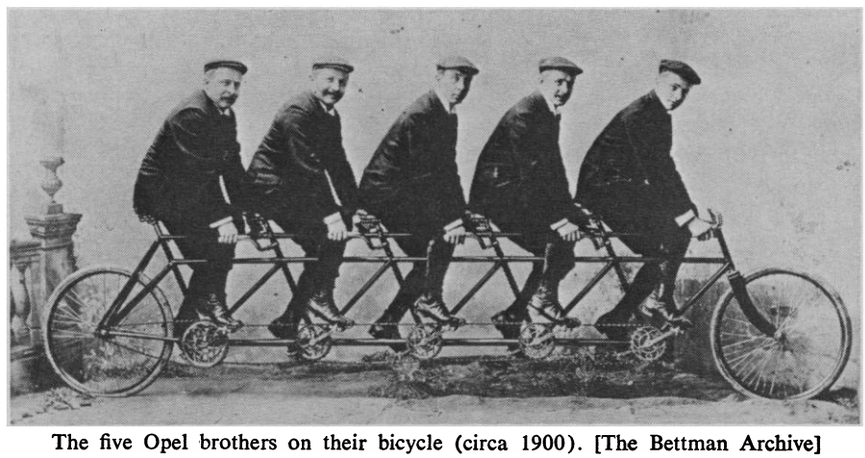
1) It was requested that the staff reduce office and laboratory thermostats to 68°F and not use electric heaters. All perimeter heating in halls was shut off.

2) Hall lights were reduced by 50 percent, principally by turning out every other fluorescent fixture, but in some instances by reducing the number of fluorescent tubes from four to two. The staff was asked to keep all unnecessary lights off "permanently" and to turn out remaining lights when leaving offices, laboratories, and conference rooms. Custodial crews were directed to turn out lights after cleaning an area. As a backup, security guards were told to turn out any lights left on.

3) The staff was requested to turn off all hot plates, heating mantles, ovens, and controlled temperature baths when not in use. Where necessary, automatic timers were employed to turn on devices that take a long time to heat up.

4) Lights in the parking lots were turned out in the early evening and turned on again in the morning darkness.

While most of the foregoing steps seem obvious, what was less apparent to most of the scientists and engineers was the fact that, because of health and safety reasons in a chemical laboratory, outside air is conditioned, blown through the laboratory just once, and sent back outside. This contrasts with home hot-air heating systems, which recirculate warm air in the rooms through the furnace until the thermostatic set point is reached. Clearly, considerable energy, in the form of fuel oil, could be saved if our once-through heating systems could be shut down after working hours and over the weekend. Achieving energy conservation in this fashion was somewhat more



The five Opel brothers on their bicycle (circa 1900). [The Bettman Archive]

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complex, in that volatile and toxic chemicals are often stored in hoods for health and safety reasons. After a survey was made of the air-handling systems in our laboratories, the following steps were implemented by the facilities department:

1) Hot-air systems, representing 55 percent of the once-through air, were shut off at the end of each day and were started up 1 to 1½ hours before the work day began.

2) Exit air temperatures were reduced from 55° to 50°F, and the hot water used in reheat coils to heat the air to local thermostatic set points was reduced from 200° to 140°F.

After all of the above steps were taken, a series of meetings, involving groups of from 20 to 40 people, were held to explain in detail the extent and implication of our monthly fuel oil allocations, our fuel handling and inventory capability, and the nature of our heating systems and to solicit further energy-savings ideas. These ideas included selective utilization of storm windows, installation of additional insulation, and reduction in use of certain exits to conserve heated air. Several suggestions regarding working hours and days were made. With few exceptions, most employees worked a 5-day week, 8:30 a.m. to 5:00 p.m., with an hour for lunch. A 4-day work week was suggested, but, after considerable thought, this was found not to be feasible. However, suggested changes in work hours were feasible and did offer worthwhile opportunities to save energy. The specific suggestion of reducing the lunch hour to half an hour would provide a direct reduction in the total work day and was accepted for further consideration. We studied the commutation and work habits of employees who live in 40 surrounding communities. We also checked with other Celanese locations with whom we have close business interactions and obtained their agreement to the new hours. We then implemented the plan early in January, enabling the shutdown of our heating systems half an hour earlier each day.

Energy Savings Achieved

Overall savings since the above program was initiated in November are shown in Fig. 1. Fuel oil savings from December through February, with the full plan in effect, have varied from 31 to 33 percent. Savings in electricity have been 23 to 30 percent. In January, a copy of Fig. 1 was given to everyone whose cooperation, patience, and endurance—particularly on some cold Monday mornings—made the savings possible. Monthly updates are posted on all of our bulletin boards, and this feedback has heightened interest in our conservation efforts and has strengthened motivation to cooperate, as well as to suggest additional ideas.

Another area in which we became involved, even though it did not specifically involve energy savings at the laboratories, was the formation of car pools. Early in the program, there were several requests from employees to assist them in forming car pools. The personnel department promptly obtained several large maps of the area and displayed them in the cafeteria lobby. Using the traditional pin-in-a-map technique, rather than a complex computerization, we were able to put potential carpoolers in touch with one another. While we do not have the before and after statistics for car pooling, it is clear from the sudden availability of choice parking spots that a greatly increased number of our employees are involved in a car pool.

Further, because of the gasoline shortages, many of our employees started to take the train and were interested in means to get from the Summit railroad station to the STC, which is located about a mile from the station. Since many of our employees pass close to the railroad station, a memo was distributed asking for volunteers to go slightly out of their way in order to pick up their fellow employees. The positive response greatly exceeded our needs, and, as of this writing, the voluntary plan is working satisfactorily.

Our energy conservation plan is under continuing review, and we also exchange information with other laboratories in this area. We have all found that the crisis has brought out genuine cooperation and effort by most people. It is significant that a laboratory of this kind can conserve as much energy as STC has by the steps taken here. It is important that the discipline of saving engendered during this period not be dissipated as energy becomes more available in the future—and that will be our challenge. We have also found in the past 3 months, during which the regular annual performance reviews were under way, that technical people did not feel their individual performance was deleteriously affected by the conservation measures taken. And laboratory management feels that productivity has not decreased as a result of our efforts—if anything, the warm and cooperative spirit engendered has been a stimulus to all of us.

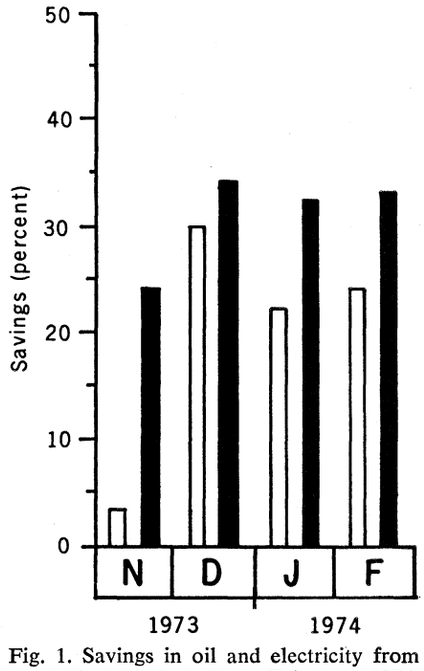

Fig. 1. Savings in oil and electricity from November 1973 through February 1974. Solid bars represent gallons of oil (1 gallon = 3.78 liters); open bars represent kilowatt-hours of electricity.

Note

1. 1 square foot = 0.09 square meter; 1 acre = 0.405 hectare.