

Come live in the electric climate.

There's less housecleaning there.



Flameless electric heat. That's the heart of the most comfortable and work-free home environment there is... *the electric climate.* You see, when everything in your home is electric, starting with the heat, there's no combustion. That helps keep your house really clean! Result? You'll find you have more

time for pleasant and constructive things you really like to do.

And there's more! Flameless electric heat also gives you a new kind of comfort. Temperatures are even from floor to ceiling. It's a gentle warmth without hot blasts or sudden chills.

So if you're planning to modernize,

or buy, or build... get all the facts about *the electric climate.* It can't be beat in homes, apartments and mobile homes. Your electric utility company heating specialist will be glad to help you.

"Awarded to homes exemplifying electrical excellence"



Live better electrically / Move toward a cleaner world.

Edison Electric Institute, 750 Third Avenue, New York, N.Y. 10017

"The Electric Climate" will be featured in all consumer and trade ads of the Live Better Electrically Program for 1971. The schedule will focus on electric heating to provide electric utilities with a balanced load.

LBE Ad Program for 1971 to Give Support to Local Marketing Efforts as It Focuses on 'Load Balancing' Electric Home Heating

Theme will be "The Electric Climate." Electric heating and water heaters will be featured in the campaign; billion and a half consumer impressions are scheduled.

THIS year's Live Better Electrically Program—the advertising, publicity, and promotion—will feature "The Electric Climate." Accent in the consumer ads will be on electric heating.

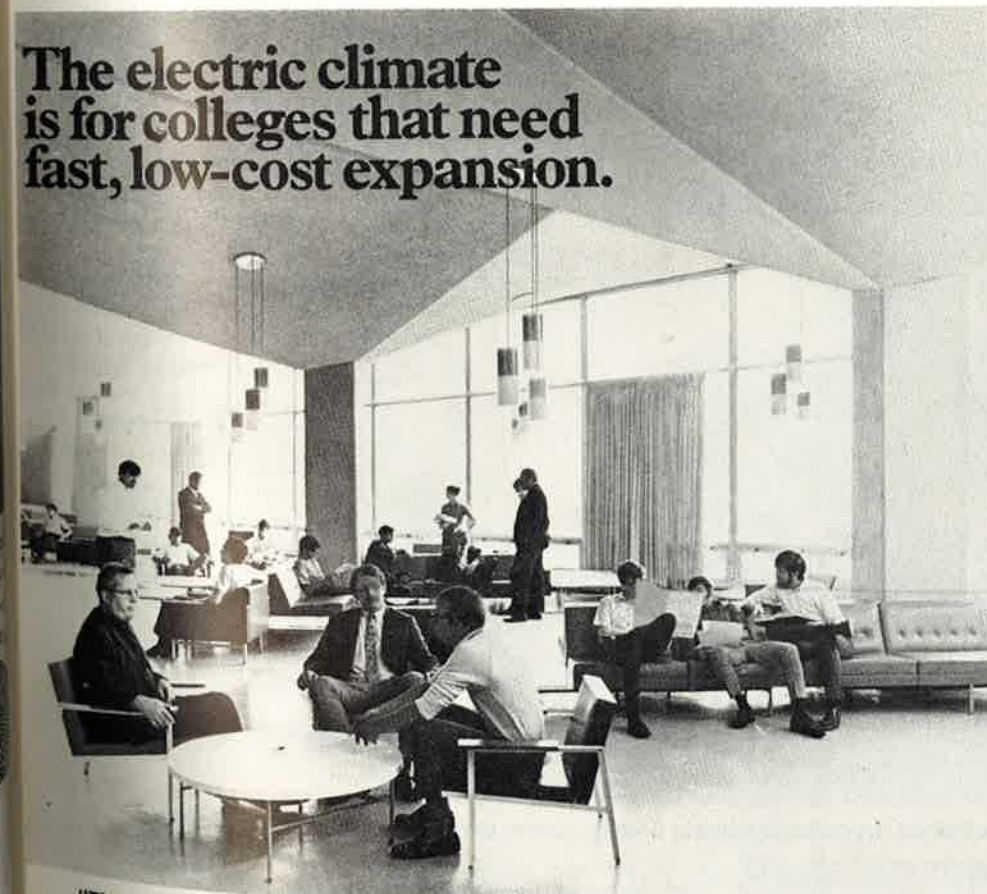
The theme, "The Electric Climate," was developed from consumer research. Among many phrases tested, "The Electric Climate" brought the most significant response in terms of electric heat, humidity control, air purification, modernity, cleanliness and simplicity. Eighty-two percent of all those interviewed related this theme to all or total electric.

This theme will be featured in all LBE consumer and trade advertising. It is ideally suited to local company advertising programs. It also lends support to industry efforts to demonstrate that electricity is the answer to many environmental problems.

The program will help to influence the kind of selective growth electric utilities need to:

- Provide service at the most reasonable cost.
- Secure revenues needed for development of a better environment.

The electric climate is for colleges that need fast, low-cost expansion.



Saint Vincent College and Archabbey in Latrobe, Pa., needed a new teachers' residence. One that would allow for future expansion as well as take care of present needs. The environmental system chosen was all-electric.

Why? Saint Vincent's treasurer, Reverend Conall M. Pfister, gives the reason: "Two all-electric dormitories and a student center we built back in 1963 gave us such impressive first-oil savings, efficiency, economy and minimal maintenance that it was easy to decide for another all-electric building." Since everything's electric, including the heat, the term *the electric climate* perfectly describes the superior environment in the new residence.

Another big reason for choosing all-electric was that each room in the new residence could have its own temperature control. And since the teachers range in age from 30 to 75, they're delighted to be able to control room temperature to suit their individual tastes.

Before planning your next campus building, talk to your electric utility company and find out what the unique advantages of *the electric climate* can do for you.

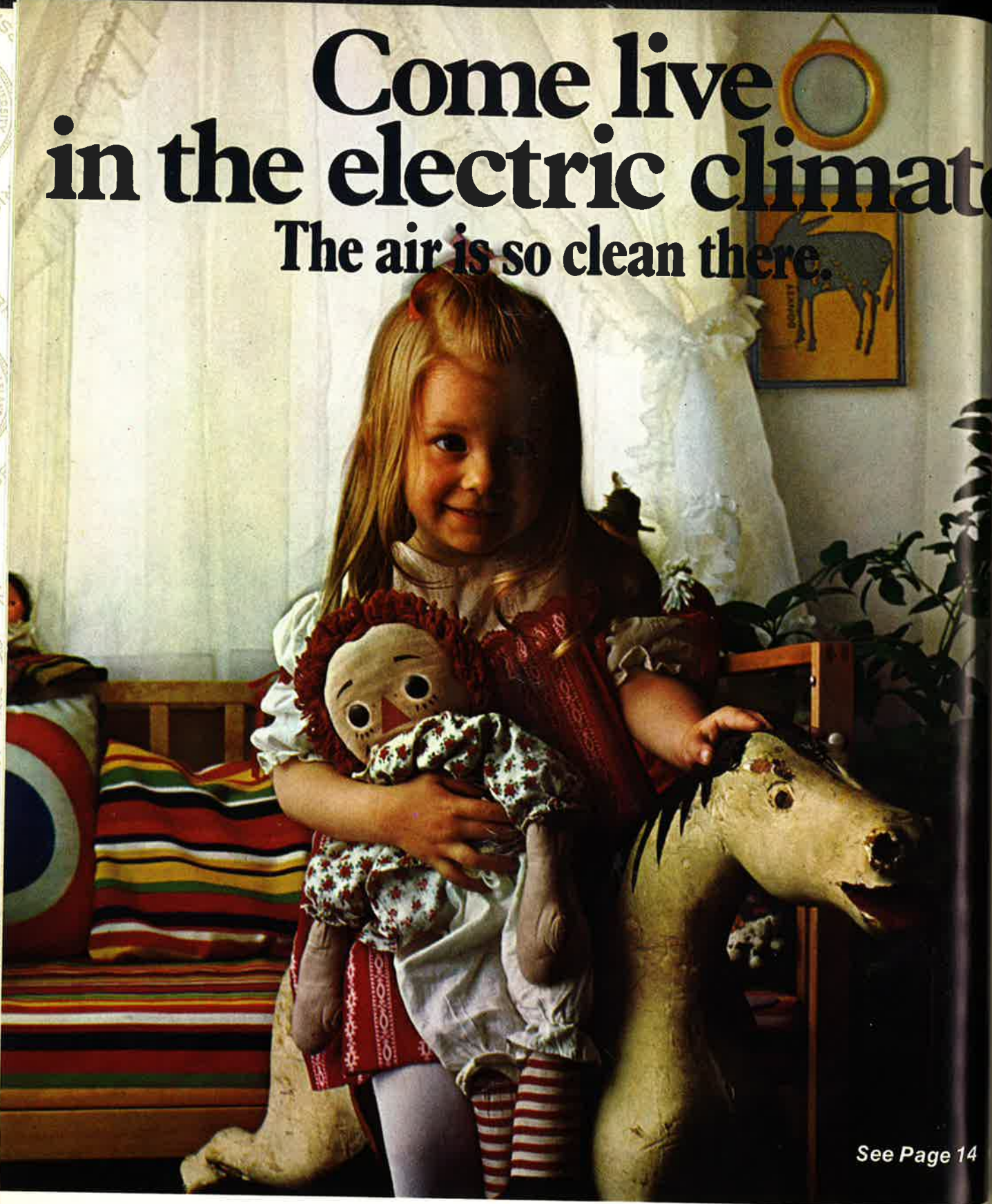


"The Electric Climate"—with electric heating—will also be featured in this ad which will appear in college publications.

JANUARY/FEBRUARY, 1971

Come live in the electric climate

The air is so clean there.



See Page 14

Flameless electric heat is the heart of the most comfortable and clean home environment there is... *the electric climate*. For when everything in your home is electric, starting with the heat, you enjoy a unique kind of warm comfort.

You start your days brighter and live every day more enjoyably. The air in every room feels

clean and fresh with electric heat. Why? Because instead of being heated by combustion, rooms are warmed flamelessly, by dependable electricity. Result — everything stays cleaner!

That also means temperatures from floor to ceiling are even. No hot blasts. No sudden chills.

Whether you plan to modernize, buy or build,

it will pay you to learn more about *the electric climate*. The heating specialist at your electric utility company will give you all the facts — for homes, apartments, mobile homes, too.

"Awarded to homes exemplifying electrical excellence."



Live better electrically / Move toward a better world.

Edison Electric Institute, 750 Third Avenue, New York, N.Y. 10017

IN TH
T
HERE
percent
D. Bruce
ciety of
ford, Ins
lysts tha
research
The a
high of
an increa
man of th
ment on
The 19
Ohio, Jur

Be
F
L
a

Ele
i
F

Ins
C
N

low
G

197
it
T

Ele
G
a

Top
C

LBE
S
E
B

Inst
H

197
2
S

The
W

The EDISON
of electric II
North, Centra
public service
making avail
members to
of consumer
ence relating
Institute doe
indexed by S

STANFORD

LIBRARY
UNIVERSITY
OF CALIFORNIA
STANFORD

Mobile home dealer, right, is reminded of "The Electric Climate" through ads geared to the mobile-modular home market. There are 5 million mobile homes in use in America today.

LBE ads are nationwide in scope, local in impact. They sell selectively to help the company improve the load factor.

Consumer magazines in which LBE ads will appear are: *Life, Look, Better Homes & Gardens* and *American Home*. These ads will feature only electric heating, and there will be a total of nearly 1½ billion impressions.

In addition to the consumer magazines, ads will be used in *Time, Newsweek, U.S. News & World Report* and *Business Week*. For the first time, the schedule includes *Harper's, The Atlantic* and *Saturday Review*. These three magazines were added for their balanced readership by those who are most aware of community problems and their responsibility to solve them.

Electric Water Heaters

Most electric water heaters are sold as replacements for old units, and frequent reminders are important to keep the advantages of electric water heaters constantly before home owners.

Water heater ads will appear in *Better Homes & Gardens* and its *Home Improvement Ideas, American Home, House Beautiful* and its *Home Remodeling, House & Garden*, and its *Remodeling Guide, Time, Newsweek, U.S. News & World Report*, and *Living Now*.

The LBE advertising program is also designed to reach architects-engineers, schools and colleges, builders, mobile home consumers, restaurants, farms, and owner-managers. The publications which will be used for these efforts are:

Architects-engineers—*Architectural Record, Architectural Forum, Building Design & Construction, Consulting Engineer, Actual Specifying Engineer, Heating, Piping & Air Conditioning*.

Schools and colleges—*Nation's Schools and College and University Business*.

Builders—*House & Home, Professional Builder, NAHB Journal*.

Mobile Homes—*Mobile Home Park Management* and *Mobile Home Recreational Vehicle Dealer*.

Restaurants—*Fast Foods, Nation's Restaurant News, Food Service*.

(Continued on page 40)

Electric water heaters also will be a major part of the LBE campaign. The successful LBE-manufacturer program will also be continued.

The electric climate is for mobile home dealers who want faster, trouble-free sales.



C. Maurice Johnson likes it because he seldom gets service call-backs. At his cost of \$25 a call-back, that's reason enough.

Clean, quiet. That's what Mr. Johnson of Raleigh, N.C., gets from his all-electric mobile home. And because flameless electric heating requires no moving parts, his customers get built-in dependability. Since everything's electric and operates without combustion, the electric climate in each mobile home provides superior comfort, the most unobtrusive living and is virtually service-free in operation.

All-electric mobile homes are the only

kind that has exclusive features like steady, even heat, unbeatable cleanliness and whisper-quiet operation. What's more, mobile homes with the electric climate can have the most modern flameless electric appliances. Like the self-cleaning electric range, electric dryer and an electric water heater that delivers plenty of hot water.

See your electric utility representative for further information about how you can profit from the electric climate.

Live better electrically

Edison Electric Institute, 750 Third Avenue, New York, N.Y. 10017



Get ready for cold feet...or get a flameless electric water heater

- All the hot water you want
- Quiet. No flame. No pilot. No flue
- Fits almost anywhere

Change to an electric water heater now—before it's too late.

Live better electrically

Edison Electric Institute
750 Third Avenue, N.Y., N.Y. 10017

e necessary
o reinforce an
e main concern
ell the "great
me heating.
l deliver near
It will sell busi
country. It wi
he Electric Cl
s as the archi
n Chicago, th
nd the mobile
ana.
med at major
ncreasing share
industrial con
ld be expensive
r electric com
BE advertising
or electric uti
tant audience
for "The Elec
n the company
e.

Electrically

The Electric Climate is for farmers who want better living, more income.



It's a whole new way of life for the Frank Wolffs. It doubled their comfort at home and their milk production on the farm.

When the Wolffs of Great Barrington, Mass., converted to electric living, "lots of nice things began to happen," says Mrs. Wolff. "For one thing, I discovered I didn't have to clean house nearly as often as I used to. There's plenty of hot water all the time, and the heat is smooth and steady. Quiet as a kitten, too!"

"On the farm," says Mr. Wolff, "we handle 70 cows now instead of 40. And we've doubled our milk production to an average of 2700 pounds a day—without hitting me help! That means more money in

the bank. Everything's done by electricity—milking and feeding the cows, storing feed, the heating—you name it. No wonder the electric people call it the Electric Climate. It's a whole new way of life in our home and on the farm. My whole operation's more efficient and operating costs are low. Never knew we could have it so good for so little!"

Check with your electric utility company today. See how little it costs to convert your home and farm to the Electric Climate.

Live better electrically

Edison Electric Institute, 750 Third Avenue, New York, N.Y. 10017

The slogan appears again in farm ads.

The electric climate is for engineers who want unlimited design flexibility.



This builder ad shows the all-electric Eastern Airlines terminal in Chicago.

Here's how it helped deliver important first-cost savings on an 83,000 square foot reservation center for Eastern Airlines near Chicago.

Eastern Airlines' new reservation center in Oak Brook, Illinois, had to be heated and comfort-conditioned for round-the-clock operation. First-cost savings were crucial. Feasibility study findings of architects-engineers Holabird & Root of Chicago, Illinois, showed that all-electric design was the way to go.

With all-electric design, the architects and engineers saved Eastern more than 10% first-cost savings.

They saved time and money—Electrical equipment is easier and faster to install than other systems. And it continues to save money yearly since electrical equipment doesn't require a large maintenance staff.

They saved space—Electrical equipment is so compact it fits almost anywhere. It takes up less space than other systems because there are no bulky furnaces.

Talk to your electric utility company and find out how the electric climate can add new flexibility to your next construction assignment.

Live better electrically

Edison Electric Institute, 750 Third Avenue, New York, N.Y. 10017

• Maintain the investor confidence necessary to provide needed capacity.

The primary objective of LBE is to reinforce and help the local marketing program. The main concern of this year's advertising is to sell the "great equalizer"—load balancing electric home heating.

However, LBE advertising also will deliver meaningful messages to "the influentials." It will sell business and civic leaders throughout the country. It will carry the story of the benefits of "The Electric Climate" to such diverse decision-makers as the architect in Los Angeles, the engineer in Chicago, the fast-food executive in Kentucky, and the mobile modular home manufacturer in Indiana.

LBE advertising also will be aimed at major builders, who are cornering an ever-increasing share of local, residential, commercial and industrial construction. This kind of coverage would be expensive and difficult—if not impossible—for electric companies to sponsor individually.

With companies sharing the cost, LBE advertising provides the most economical way for electric utilities to communicate with important audiences wherever they are. LBE advertising for "The Electric Climate" is a good investment in the company's future in the new marketing climate.

Mobile home dealer, right, is reminded of "The Electric Climate" through ads geared to the mobile-modular home market. There are 5 million mobile homes in use in America today.

LBE ads are nationwide in scope, local in impact. They sell selectively to help the company improve the load factor.

Consumer magazines in which LBE ads will appear are: *Life*, *Look*, *Better Homes & Gardens* and *American Home*. These ads will feature only electric heating, and there will be a total of nearly 1½ billion impressions.

In addition to the consumer magazines, ads will be used in *Time*, *Newsweek*, *U.S. News & World Report* and *Business Week*. For the first time, the schedule includes *Harper's*, *The Atlantic* and *Saturday Review*. These three magazines were added for their balanced readership by those who are most aware of community problems and their responsibility to solve them.

Electric Water Heaters

Most electric water heaters are sold as replacements for old units, and frequent reminders are important to keep the advantages of electric water heaters constantly before home owners.

Water heater ads will appear in *Better Homes & Gardens* and its *Home Improvement Ideas*, *American Home*, *House Beautiful* and its *Home Remodeling*, *House & Garden*, and its *Remodeling Guide*, *Time*, *Newsweek*, *U.S. News & World Report*, and *Living Now*.

The LBE advertising program is also designed to reach architects-engineers, schools and colleges, builders, mobile home consumers, restaurants, farms, and owner-managers. The publications which will be used for these efforts are:

Architects-engineers—*Architectural Record*, *Architectural Forum*, *Building Design & Construction*, *Consulting Engineer*, *Actual Specifying Engineer*, *Heating, Piping & Air Conditioning*.

Schools and colleges—*Nation's Schools and College and University Business*.

Builders—*House & Home*, *Professional Builder*, *NAHB Journal*.

Mobile Homes—*Mobile Home Park Management* and *Mobile Home Recreational Vehicle Dealer*.

Restaurants—*Fast Foods*, *Nation's Restaurant News*, *Food Service*.

(Continued on page 40)

Electric water heaters also will be a major part of the LBE campaign. The successful LBE-manufacturer program will also be continued.

The electric climate is for mobile home dealers who want faster, trouble-free sales.



C. Maurice Johnson likes it because he seldom gets service call-backs. At his cost of \$25 a call-back, that's reason enough.

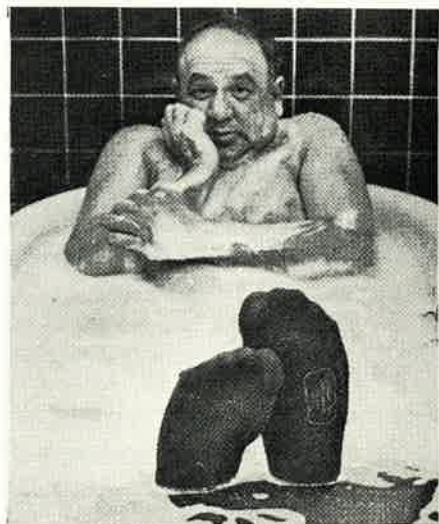
That's right! That's what Mr. Johnson of Raleigh, N.C., gets from his all-electric mobile home. And because Mr. Johnson's heating equipment has fewer moving parts, his customers get built-in dependability. Since everything's electric and operates without combustion, the electric climate in each mobile home promises superior comfort, the most interesting living and is virtually service-free in operation.

An all-electric mobile home is clearly the kind that has exclusive features like steady, even heat, unbearable cleanliness and whisper-quiet operation. What's more, mobile homes with the electric climate can have the most modern flameless electric appliances. Like the self-cleaning electric range, electric dryer and an electric water heater that delivers plenty of hot water.

See your electric utility representative for further information about how you can profit from the electric climate.

Live better electrically

Edison Electric Institute, 750 Third Avenue, New York, N.Y. 10017



Get ready for cold feet...or get a flameless electric water heater

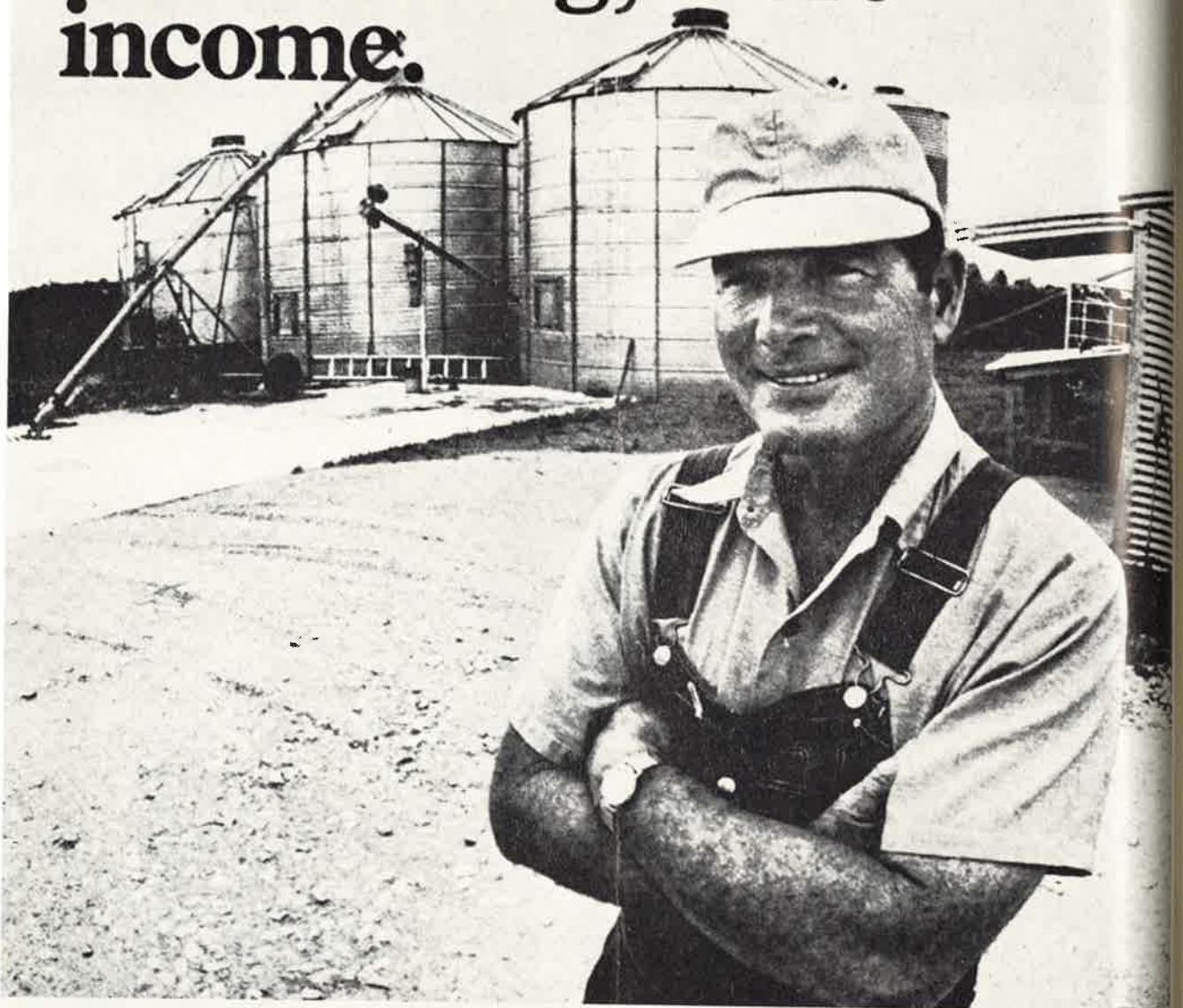
- All the hot water you want
- Quiet. No flame. No pilot. No flue
- Fits almost anywhere

Change to an electric water heater now—before it's too late.

Live better electrically

Edison Electric Institute
750 Third Avenue, N.Y., N.Y. 10017

The electric climate is for farmers who want better living, more income.



It lets Clyde Smith milk and feed 75 cows unassisted, and Mrs. Smith enjoys a more comfortable home life, too!

Three years ago, milking and feeding 75 cows was a mighty big job for Mr. Clyde Smith of Alvort, Texas. But since he switched to *the electric climate* (that means everything's electric including the heat), he single-handedly completes the milking and feeding in two hours. *The electric climate* saves him money, too, besides time and effort.

And Mrs. Smith? She's tickled pink over their new flameless electric home. It has steady, even heat, lots of hot water, and the whole house stays cleaner than ever before.

Call your local electric utility and let them show you how *the electric climate* can make your farm operations more efficient.

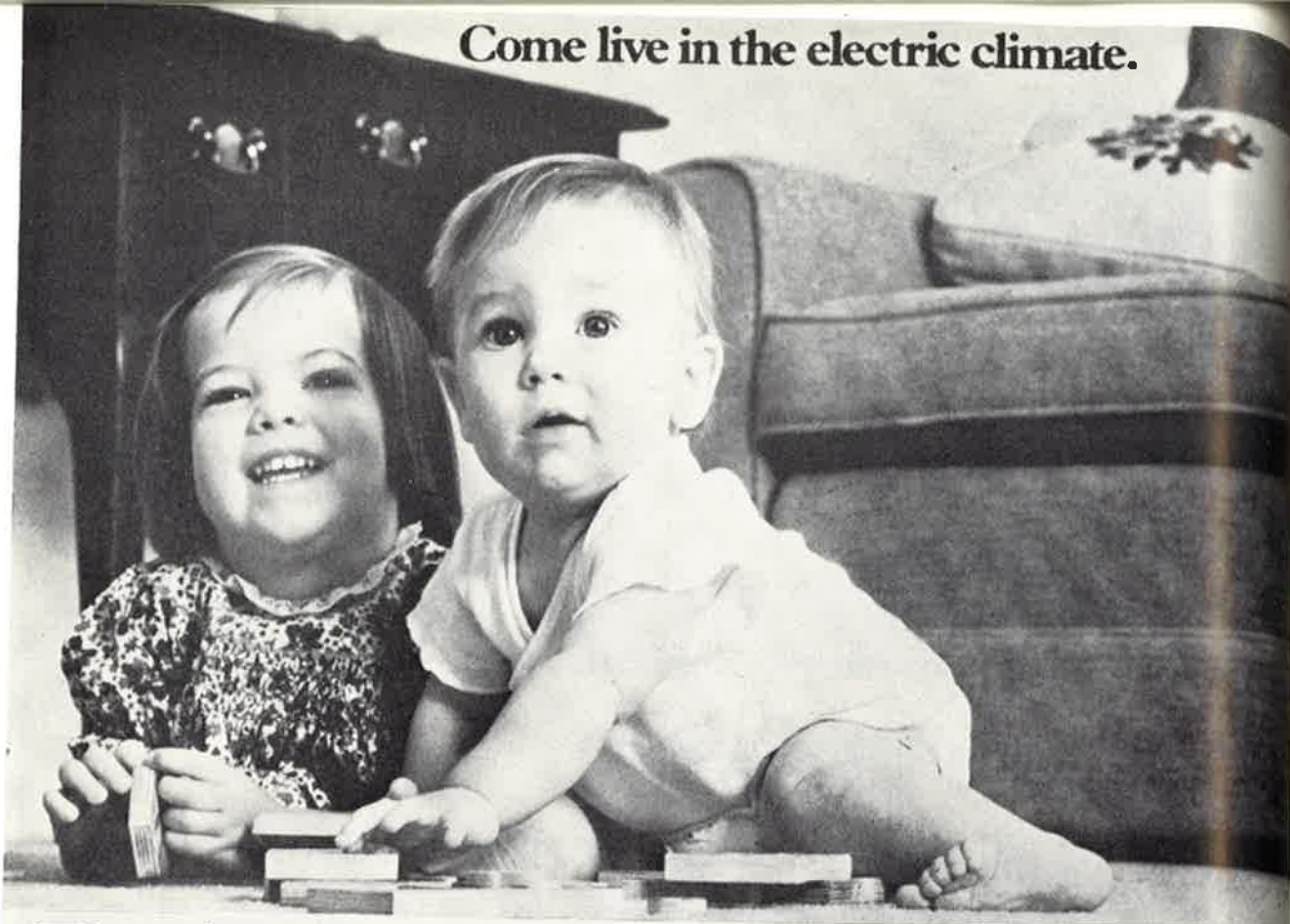
"Awarded to homes exemplifying electrical excellence."



Live better electrically

Edison Electric Institute, 750 Third Avenue, New York, N.Y. 10017

Come live in the electric climate.



The electric climate can do more than help make your home less drafty...

It's a superior indoor environment that can make any kind of building cost less to own...and it can help the outdoor environment, too!

Consider what the benefits of *the electric climate* can mean to you as a homeowner. And as a cost-conscious, people-conscious executive. And as a civic-minded citizen.

The human benefits of the electric climate:

Flameless electric heat is the heart of *the electric climate*. It fills rooms with a soft, even warmth that can't be matched for comfort. No drafty corners. No sudden chills. Except for the comfort, you hardly know it's there—whether you're in your electrically heated home or office or church or school. Think how

much better people live and play and learn and work in such a pleasant environment.

The dollar value benefits of the electric climate:

The initial cost of flameless electric equipment that results in *the electric climate* is comparable to or *lower* than other types. Requires little or no maintenance. And the *cost* of electricity remains a real bargain!

The environmental benefits of the electric climate:

Buildings with *the electric climate* put nothing into the air around them...because electricity is the cleanest source of energy

there is at its point of use. Generation of electricity by combustion methods produces by-products that cause pollution, but these by-products can be controlled at modern power plants. In fact, the electric utility industry is a pioneer in the development and installation of pollution control devices and, of course, is actively engaged in even further improving the techniques of control efficiency.

The electric climate promises a better future. Find out more from your electric utility. You, your company and your community will benefit.

Live better electrically / Move toward a better world.

IN THE
THE
from
Joint
Energy
Fancil
Reg
carrie
Su
Elect
clude
equity
The
annual
comp

The E
of ele
North,
public
makin
memb
of cor
ence
Instit
Index



Incoming Edison Electric Institute Chairman Shearon Harris (center) is congratulated by outgoing Chairman D. Bruce Mansfield (right) as Frank M. Warren, the new EEI Vice Chairman, looks on. Mr. Harris, who is President and Chairman of the Board of Carolina Power & Light Co., and Mr. Warren, President of Portland General Electric Co., were elected by the Institute's Board of Directors at the EEI 39th Annual Convention in Cleveland.

nating Co. The speakers included: First General Session, Monday afternoon, June 7—D. Bruce Mansfield, EEI Chairman and President of Ohio Edison Co.; Thomas G. Ayers, President, Commonwealth Edison Co., and Chairman, EEI Research Division Executive Committee; and John W. Simpson, President, Power Systems Co., Westinghouse Electric Corp.

Second General Session, Tuesday morning, June 8—William F. Butler, Vice President and Chief Economist, The Chase Manhattan Bank; Paul Hallingby, Jr., Vice Chairman, White, Weld & Co.; and the Hon. John A. Carver, Jr., Commissioner, Federal Power Commission.

Third General Session, Wednesday morning, June 9—Professor Carroll L. Wilson, Sloan School of Management, Massachusetts Institute of Technology; Sir Stanley Brown, C.B.E., Chairman, Central Electricity Generating Board, London, England; Dr. Edward E. David, Jr., Science Adviser to the President and Director, Office of Science and Technology.

Fourth General Session, Wednesday afternoon, June 9—Miss Patricia Carbine, Editorial Director, *McCall's Magazine*; and William F. Buckley, Jr., Editor-in-Chief, *National Review*.

In his keynote address, Mr. Mansfield said, "If

our environmental problem is so serious that simple survival dictates no growth whatever, then simple survival may be the best we can expect—along with a declining standard of living and a loss of hope for a better future among millions of people."

"But if living on this earth is to be the rewarding experience it can be for increasing numbers of people," Mr. Mansfield said, "we must pursue technological solutions and we must know with much greater accuracy the real environmental parameters within which we may safely conduct continuing progress for humanity."

"This," he explained, "means that adherence to the concept of no growth is just as pernicious and ultimately damaging as following a theory of growth for its own sake."

"While solutions must be found for environmental problems," Mr. Mansfield said, "the solutions should not involve curtailment of the use of electricity. Quite to the contrary, more, not less, electric energy is the answer to environmental problems. There is increasing recognition in government and elsewhere of the growing need for more electricity for recycling waste products, sewage treatment, water pollution control, stack emission controls, and alternatives to the internal combustion engine."

Intensified Research and Development

Mr. Ayers, second speaker on Monday afternoon, called for intensified electric utility research and development to safeguard air, water, and land resources. "Environmental pressures are upon us now," he said. "By being leaders both in cleanup and research, we will gain public confidence and support. In so doing, our industry stands to become the future energy managers of society."

The Chicago utility executive said, "Traditionally, we have had a pluralistic approach to R&D. Research has been conducted independently and in various combinations by the equipment manufacturers, utilities, and the Federal government. It is estimated that research expenditures by utilities and manufacturers related specifically to electric utility equipment are running at more than \$150 million a year."

"I suggest that the electric utilities must start thinking in terms of an R&D commitment that represents a much larger cost of doing business. We must continue to improve present methods and achieve new methods of generating and transmitting electric power economically and reliably. And all of our facilities must be engineered and built with an eye to minimizing the impact on the natural environment. Only in this way can we expect to become the energy managers for the future."

Mr. Ayers pointed out that the six-year-old Electric Research Council established an R&D Goals Task Force last fall and said "a clear definition of research goals and priorities will put our industry in a

better position to plan a long-range program of financing."

Mr. Simpson, in the third address of the afternoon, said that the growth of electric power demand is an "irresistible force" over which we have little control. "By 1980, almost half the families in the U.S. will have an income of more than \$17,000 a year and this will rise to an even higher level by 1990. This certainly means more air conditioners, washers, dryers, television sets, and other appliances creating a greater demand for electricity."

"I believe that in the long run this conflict between the demand for power and our environmental goals will be resolved mainly by the use of nuclear energy," Mr. Simpson said. "However, we also will have to depend upon fossil fuels for a long time to come, and these fuels present special problems of price, supply, and environmental effect."

He went on, "Our energy situation is receiving considerable attention these days, especially from the government. It has been made abundantly clear that there is an urgent need for a coherent policy to govern our use of energy fuels." He cited the Senate Interior and Insular Affairs Committee Task Force which is investigating such a policy, and predicted that some kind of energy policy will be formulated for this country.

Mr. Simpson summed up by saying, "I expect that we will lessen our dependence upon oil and gas because of supply problems. Coal production must increase in the face of all the problems that now beset this industry. But above all, nuclear power is the most important source of an adequate supply of electricity with minimal environmental effects for this nation in coming decades."



The first speaker Tuesday morning, Mr. Butler, said that the economic situation for the next 12 to 18 months is better than it now seems. He explained, "The major change next year will be a pickup in business investment with a 12 to 15 percent recovery in profits this year, a better balance between capacity and output by the end of this year, and the continued need for modernization. All of these should combine to produce at least a 10 percent rise in capital expenditures next year."

He added, "This, along with the continued strength in consumer markets, housing starts, state and local government spending, should make 1972 a good year for business, with real growth of 5 percent or so, as against less than 3 percent this year."

The bank economist predicted that short-term interest rates will fluctuate around current levels in the near future, followed by a firming trend, while long-term rates will fluctuate around a moderate downward trend from recent unusually high levels.

Looking ahead at the remainder of the decade, Mr. Butler said, "We see, generally, a balance in long-term interest rates over the second half of the 1970's, and something in the range of, say, 6 to 6½ percent."

Hallingby Speaks

Mr. Hallingby was the morning's second speaker. Referring to the longer-range market, he said, "I think the long rate will center around an 8½ percent level, with occasional swings into the 9 percent area when inflationary pressures are strong and into the seven-ish area when price structures seem to be relatively more stable."

He said that the common-stock market for electric utilities recently has been quite good, and that some very large new issues have been sold successfully at or even above last-sale prices. He added, "So, all things considered, the capital markets seem to be giving quality issuers, such as your industry, a pretty fair shake. You just have to accustom yourselves to widely fluctuating markets and to the costs of capital that prevail and make sure that investors have confidence in the financial integrity of your enterprise."

Commissioner Carver, the last speaker of the morning, discussed his belief that "one-stop" certification procedures for plant siting may not work out in practice. He predicted that companies will come to see that there remains an advantage in dealing with people familiar with local needs. He said that hard as it may be to get a final decision in Albany, Raleigh, or Sacramento, it is likely to be quicker than getting one in Washington.

Ashton B. Collins, left, Chairman of Reddy Kilowatt, Inc. presents the top award in the annual report competition to Herbert B. Cohn, Executive Vice President, American Electric Power Co., Inc.

NEW MEMBERS OF THE EEI BOARD OF DIRECTORS



K. E. BOWEN
President, Central Illinois
Public Service Co.



J. E. CORETTE
Chairman and
Chief Executive,
The Montana Power Co.



F. E. DRAKE, JR.
Chairman of the Board,
Rochester Gas and
Electric Corp.



R. F. GILKESON
Chairman of the Board,
Philadelphia Electric Co.



SHEARON HARRIS
Chairman/President,
Carolina Power &
Light Co.



A. V. HARTL
President,
Otter Tail Power Co.



CARL HORN, JR.
President,
Duke Power Co.



B. S. JEFFREY
President, The Kansas
Power and Light Co.



R. G. MACDONALD
Senior Vice President,
Allegheny Power
Service Corp.



W. G. MEESE
President,
The Detroit Edison Co.



H. W. PIRKEY, JR.
Chairman and Chief
Executive, Southwestern
Electric Power Co.



J. G. QUALE
President, Wisconsin
Electric Power Co.



J. F. RICH
President,
New England Gas and
Electric Association



B. W. SCHOTTERS
Chairman of the Board,
Indianapolis Power &
Light Co.



F. R. SMITH
President, Gulf States
Utilities Co.



W. R. THOMPSON
President, Potomac
Electric Power Co.

"It may take experience to teach them, but the mischief which I find to exist in the Administration's siting bill of committing Federal functions to state agencies under Federal guidelines and subject to Federal vetoes will eventually be recognized by the utility industry as being quite antithetical to their interest in quicker decisions," Mr. Carver said.

"Although by the year 2000 we expect global thermal power output to be six times the present level, we do not expect it to affect global climate," Professor Wilson said in Wednesday morning's first address.

He added, however, that power output over cities "does already create 'heat islands' and, as these grow larger, they may have regional climatic effects and they should be studied."

The MIT professor said, "It is likely that the principal impact in terms of climate change will arise, if it does, from the combustion of hydrocarbons. If a consensus arose that we had to limit or curtail the use of hydrocarbons because of their impact on the climate, the implications would be enormous. Our only present alternative would be nuclear power and an electric energy society."

In his discussion of carbon dioxide in the atmosphere, Professor Wilson said that all combustion of fossil fuels produces carbon dioxide. He observed that "if we had to stop producing carbon dioxide, no coal, oil, or gas could be burned, and all modern societies would come to a halt."

"It does seem to me an era both of problems and special opportunities for this great industry. New options will open up as fuel costs and environmental constraints change your choices. Gas turbines, d-c transmission lines, and off-shore power stations on the surface or submerged must enter your planning," Professor Wilson declared.

Experience in United Kingdom

"Experience in the United Kingdom demonstrates to my mind quite emphatically that with proper care there is considerably less unfavorable impact on the environment by the provision of necessary energy via the electrical route than by any other," the morning's second speaker, Sir Stanley Brown, said.

"Electricity is in fact the only totally non-polluting fuel other than pure hydrogen," he emphasized, "and opponents to the changes involved in its increased generation should remember that the use of the electricity so generated must be less polluting than any alternative fuel."

The British utility executive stated that provision of electrical energy at the increasing levels demanded by an advancing civilization is not incompatible with avoidance of pollution and the reservation of "amenity," which he defined as the pleasantness of surroundings in all aspects, including visual beauty, landscape value, and architectural merit.

Providing electricity "necessarily involves some changes in the total environment," he said, "but this is almost a definition of civilization, and the changes are not necessarily unacceptable to an enlightened public—even those with the highest standards—provided always that sufficient care is taken."

In his address to the Convention, Dr. David referred to President Nixon's message on energy. By joining the President's programs, he pointed out, the utility industry can continue to play its part in improving the quality of American life in the years ahead. He explained that the President's message looks to an acceleration of R&D programs which are the key to both adequate power and clean air and water in the decades ahead.

New Federal Initiatives

Dr. David outlined a range of new Federal initiatives and commitments to help insure clean energy supplies, contained in the President's message. He cautioned that it implies reliance on private industry for major contributions. The message provided for:

1. New leasing programs to make available the resources on Federal lands.
2. Initiation of the Cascade Improvement Program at AEC's gaseous diffusion plants to insure an adequate supply of nuclear fuel.
3. New measures for energy conservation.
4. A call for prompt action on the Administration's power-plant siting bill.
5. A reaffirmation of the desirability of the sulfur oxide emission charge.
6. A request for support of the Department of Natural Resources, which will consolidate all important energy resource development programs.

"The President's energy message," Dr. David said, "commits the nation in three priority energy R&D areas—sulfur oxide control technology, the liquid-metal fast breeder, and coal gasification. In this effort, the government's participation will be greatest in the research and pilot plant stages. Industry's share will increase as commercial demonstration approaches. Industry must provide the major support for demonstration plants."

Miss Carbine reviewed the changes in employment and education among women as reflected in the 1970 Census. "A more educated consumer, be it of ideas or appliances, is going to ask tougher questions. She needs straight, lucid information. She needs to understand possible malfunctions, as well as the functions of a product. She parts with her dollar more carefully as inflation trims its value. And as her daily life becomes more and more complex, she thinks of respite and rightly deepens her concern for our natural environment, our battered planet," Miss Carbine said in describing consumerism.

She suggested explaining to the press and the



HARRIS' Acceptance Remarks

LIFTING INDUSTRY PERSPECTIVE IN RESEARCH AND DEVELOPMENT CALLED PRIMARY MISSION

FOLLOWING in the footsteps of such illustrious men as Bruce Mansfield, Al Aymond, Bob Gerdes, and those before them is a tremendous responsibility which I undertake with considerable—even if uncharacteristic—humility.

I cannot accept this chairmanship from Bruce without first using the occasion to pay my most sincere personal tribute to Bruce for his indefatigable energy, his superb appreciation for the humanities involved in this assignment, his understanding of the issues, his unshakable courage, and the intellectual erudition of a true scholar. His demonstrated devotion during a year as Chairman of EEI sets a truly challenging example.

It would be redundant indeed to review the Convention or repeat the consensus of high appreciation for a wisely conceived and skillfully executed program. I simply salute one and all who had a hand in its planning and execution.

Keen Awareness of Problems

Needless to say, we are keenly aware of the problems confronting us. Hopefully, this Convention has made us more determined than ever to find their solutions.

Perhaps we will arrive at some new variations on the old themes, but basically the coming year within Edison Electric Institute will be devoted to striving for and realizing goals that have already been clearly set by past deliberations.

One of the great strengths of the Institute is continuity. While the Chairman may change, we are fortunate to have a continuing staff, headed by Pres-

ident Don Crawford, coordinating today's effort with yesterday's policy that will be tomorrow's goals. During my in-training period as Vice Chairman, I have had occasion to observe from a closer vantage point the good fortune of our industry to have the services of an extremely competent and devoted Institute staff.

Priority on Unity of Purpose

A great industry needs a great trade organization, and we have it in the Institute. The job of enlisting the diverse attributes of individual members into a united front, speaking with a single voice, is a task which, in my opinion, we are handling with increasing success year after year. Our future challenges put a high priority on unity of purpose.

During the next Institute year, we will be working on many major challenges and a myriad of lesser ones. All of this effort will be directed toward our basic objective: an abundant electric energy supply at reasonable cost and compatible with appropriate environmental considerations. Of course, we must find the magic solutions to such opportunities as siting problems and everybody else's attempt to "solve" those problems, tight capacity positions, staggering construction and financing programs, fuel supply, adequate earnings during inflation's onslaught—and on and on—we all have some of them. However, lest we become so distracted by putting out brush fires on a daily crisis basis that we devote too little effort to some of our big long-range opportunities, I have concluded that the mission of my leadership period should be an attempt to lift the

perspective of our industry in the field of research and development.

Our minds and imaginations have been stimulated by presentations at this Convention, particularly on Monday by Tom Ayers and this morning by Dr. Edward David. Allow me to lead you through another step in reflecting on some of the major inhibiting or retarding forces and how we may unlock a powerful forward thrust in R&D.

In the American free enterprise industrial framework, the most powerful force for stimulating R&D has been the incentive of profit. In the case of regulated utilities no such incentive is present. To the contrary, due to the emphasis on our national policy expressed in the concept of "low-cost electric energy" there has been at least a counterproductive atmosphere, or, as my engineer associates have recently taught me to say, there has been a negative incentive.

Who Profits from R&D?

Who profits from R&D that makes better use of fuel resources, that reduces the environmental impact of electrical facilities, or that improves the quality of life? Not the common stock investor or the management of the company. The one who gains is the user, the consumer, our public.

We must find an acceptable way to let those calculated to enjoy the benefits of R&D in the production, transmission, and distribution of electricity claim those benefits which are rightfully theirs. A significant beginning has been made in the work of the R&D Goals and Finance Task Forces of the Electric Research Council. The concept of a surcharge, which has been suggested, to be applied voluntarily by each electric supplier with approval of regulation is a sound approach and I shall give it my most enthusiastic and dedicated support.

We do not need to be apologetic about our past level of commitment to research and development. The issue is not whether we should have done more but the issue is what needs to be done *now* and how should we do it.

The electrical equipment manufacturers have performed important R&D which has been supported by our equipment purchases and this should continue. The Electric Research Council does not and should never displace their work. I suggest that the function of the ERC is in that part of the field that involves undertakings requiring resources beyond the interest and capability of individual manufacturers or companies.

I do suggest that there are four specific areas requiring attention now that will make claim upon the united effort of the utility industry, manufacturers, and government:

- Desulphurization of fossil fuels, the near-term route to making 1,000 years' supply of coal available for use without ecological degradation.

- The fast-breeder reactor, a longer-range route to energy conversion efficiencies on the order of 50 to 75 times today's light-water reactors.
- A significant step forward toward achieving useful power from thermonuclear fusion. This technology holds promise for solution of many of our fuel and environmental problems of the future and deserves commitment *now*, if we want to have it ready for use 30 years from the time we make such a commitment.
- Underground transmission technology, a need that becomes increasingly pressing as power requirements grow.

This by no means completes the catalogue of our research and development goals. These are areas in which we should succeed eventually in balancing the economic needs for electric energy with the environmental ideals of the Good Life.

While such efforts move toward realization, we need also to perfect communications which convince the public—all our customers—that we are the heroes, not the villains, of this ever-so-popular environmental scenario. We will deliver all the electricity this and future generations need, with a sane energy-environment balance.

On Monday, Tom Ayers termed R&D a modern equivalent of one of the labors of the mythical hero Hercules. R&D will be indeed a Herculean task, but we will eschew the methods of our hero of old. We will clean whatever Augean stables need cleaning, but we will not flush the pollution into any River Alpheus. To be a hero today, Hercules would need a new approach!

Clear and Convincing Communications

Until we have the job completed, we must rely upon clear and convincing communications with the public to refute today's ill-advised, emotionally charged alarmists. Some of them would have us stunt the growing boy for fear he will outgrow his present pants!

"Zero growth" calls for ignoble retreat into the primitive past. Our commitment is made not only to today's America, but, more important, we are obligated to the millions of new Americans of tomorrow. Even conservative demographers estimate that our population will grow to at least 265,000,000 by the year 2000. At the population growth rate of the Sixties, we would pass the 300,000,000 mark *before* the year 2000.

Rather than deny these Americans the comforts and conveniences of clean energy, our industry is obligated to provide the supporting power for their economic, social, and physical well-being.

Earlier I said unity of purpose deserves a high priority. The position in which our industry stands today leaves us little occasion to indulge in "prima

(Continued on page 206)

cedures being formulated for developing and financing new research, and with the cooperative efforts through the Electric Research Council of both the investor-owned and government sectors, it seems clear that the motivation and framework exist to finance and carry out many of the increasing research requirements of our industry.

What Benefits Might Be Expected?

Now let's examine the fifth question—what benefits might be expected from an intensified R&D program?

There are three broad areas in which a greater commitment to R&D promises to pay off.

The first is environmental compatibility—that is, in improving the advantage which electricity already holds as the cleanest form of energy.

The economics and technology of controlling pollution favor large, centrally located generating facilities. Accelerated R&D will further enhance the environmental compatibility of central station power. This will occur as research overcomes such problems as sulfur removal from stack gases, coal gasification, improved thermal efficiencies, better ways of dissipating waste heat, and cleaner methods of production, including fuel cells, breeder reactors, and fusion.

The second major category in which intensified R&D promises dividends is in making optimum use of our limited fuel resources, both fossil and uranium.

It appears that nuclear power offers the best opportunity for reconciling our nation's energy needs with its environmental goals. It also appears that the fast breeder reactor will be essential to achieving the full potential of nuclear power. The late Commissioner Theos Thompson of the AEC used to say that there is enough uranium in this country to keep water reactors going for 40 years, but, with the breeder, the same uranium resources will last a thousand years. This, to our way of thinking, should place breeder development in the forefront of national research priorities.

Looking at the near term, the liquid-metal fast breeder holds the most promise. With over six years of successful operation of EBR II, with SEFOR at full power, with the operations at Fermi, with parallel achievements abroad, and with the Atomic Energy Commission component development and testing program, adequate technology and experience exist to warrant going ahead with the liquid-metal breeder. The next step, it seems to me, should be the construction of at least two and preferably three demonstration plants in the 300-megawatt electrical range, with the first plant committed for construction in the immediate future. The feasibility and timing of the second and third plants depend primarily on the availability of adequate funds. The step up from the 300-megawatt level to a commercially feasible breeder in the 1,000-megawatt size is

a reasonable one. Two or three demonstration plants would promote efficiency through competition and help build a viable industrial fast-breeder capability in the United States. This would also spread the technical risk and see that the job is done right and done on time.

The biggest obstacles to going ahead with the demonstration plants are raising the money, allocating the financial risks, and satisfying environmental requirements. I am not optimistic about the utilities and manufacturers by themselves closing the gap between promised funds and projected costs. The huge initial cost estimates for the demonstration plants, together with the risks of cost overruns and capacity unavailability, impose special problems for the breeder demonstration plants. The Federal government will have to provide a much larger share of the funding, if these plants are to be built in the near future, and must take responsibility for environmental compliance.

Looking toward the end of this century, intensified R&D should lead to new and more efficient methods of generation. For example, new strides are being made in controlled fusion. Chairman Seaborg of the AEC has said: "Because fusion power plants (will) operate at high conversion efficiencies—60 percent or higher—they will greatly reduce problems associated with waste heat... (and) what waste heat they do produce could be more readily used because such plants could be located in the very center of urban complexes." Fusion also would provide an unlimited source of power and greatly minimize the problem of radioactive waste disposal.

The third area of expected R&D payoff is in getting answers to some of the difficult high-technology engineering problems. This might include higher-capacity overhead and underground a-c and d-c transmission, miniaturized T&D components, cleaner fossil fuel boilers, and possibly cryogenically cooled generators. Such advances would minimize the environmental impact and improve the efficiency and economics of our systems. The benefits would accrue to all utilities, large and small alike.

Why Commit Now?

Turning to the final question—why commit now? Why is this the time of decision for intensified R&D?

First, with a 7 percent compound growth rate of electric energy expected over the next 10 to 20 years, more research needs to be done on new and improved ways of generating, transmitting, and distributing power. Our industry must meet its responsibility to provide an adequate supply of reliable electricity. We simply cannot afford to defer R&D lest we find ourselves in the position of doing "too little, too late."

Second, our nation now has to face up to the finiteness of its fuel reserves. We must do our utmost not

(Continued on page 168)

ELECTRIC POWER—SINNER OR SAVIOR?

By John W. Simpson

President, Power Systems Co., Westinghouse Electric Corp.

We must pursue the philosophy that electric power is a resource vital to our social and economic well-being; we must use wisdom in the management of our fuel supplies; and the industry and the manufacturers that serve it must take steps to keep the costs of this important resource to the ultimate consumer as low as possible.

WE'VE all heard a lot of talks about the future of electric power—some of them at EEI conventions in the past. But I think today, in the light of 1971, we can take another look at electric power's future, and perhaps the crystal ball will tell us a few things we couldn't have seen last year.

I believe that all of us here—most of us, anyway—are dedicated to the proposition that growth is not a dirty word. But some people in this country believe otherwise.

Those notorious "doubling decades"—1970 to '80; 1980 to '90. Twice the kilowatt-hour consumption in 1980 than last year; four times the consumption in 1990. One billion, three hundred million kilowatts of electric capacity in 1990. These are "horror statistics" to those kinds of people who think that all power pollutes. There have been solemn recommendations that we must slow down on the use of electric power and other forms of energy before our little planet becomes unlivable.

But the growth of electric power demand is an irresistible force over which we have little control. Our population will grow by 55 million between now and 1990. Many of those who will be getting jobs and setting up homes in the decades ahead are already born. Their standard of living will be considerably higher. By 1980, almost half the families in the U.S. will have an income of more than \$15,000 a year and this will rise to an even higher level by 1990. This certainly means more air conditioners, washer-dryers, television sets, and other appliances creating a greater demand for electric power.

Electricity powers industrial output. The nation absolutely cannot expand the economy and reduce unemployment without a corresponding increase in

An address before the 39th Annual Convention of Edison Electric Institute, Cleveland, Ohio, June 7, 1971.



power consumption. Increased farm and crop production will demand more electric power because, as someone said recently, they're just not printing any more land.

A host of other forces in the category of national social goals also will push up the demand for power: a cleaner environment, redevelopment of blighted areas, expanded and improved health services, full employment, mass rapid transit, cleaner air, pure drinking water, streams and rivers free from wastes, and the recycling of waste products.

We know that the demand will rise tremendously, and we know we must supply the power to keep this country on an even social and economic keel. Yet as the pendulum of environmental and ecological activism swings further from the equilibrium of reasoned approaches to the problem, we are finding it increasingly difficult to meet that demand for power.

Environmental Evangelists

Those environmental evangelists who fret about how electric carving knives and toothbrushes are adding to pollution think they can curb the demand for power by cutting down on the supply. Thus you have intervenors causing extended and expensive delays during hearings, or calling for moratoria on nuclear plants or promoting legislation to curb the use of electric power.

In some cases, utilities have been pushed by environmentalists to installing costly equipment to reduce radionuclide emissions or thermal effects whether such equipment is actually needed or not. It was recently calculated that as a result of installing cooling towers at a typical nuclear plant we could justifiably assign a value of about \$1,200 per pound to protect the fish in the cooling lake. That makes for very expensive fishing.

Those who advocate that we freeze electric power

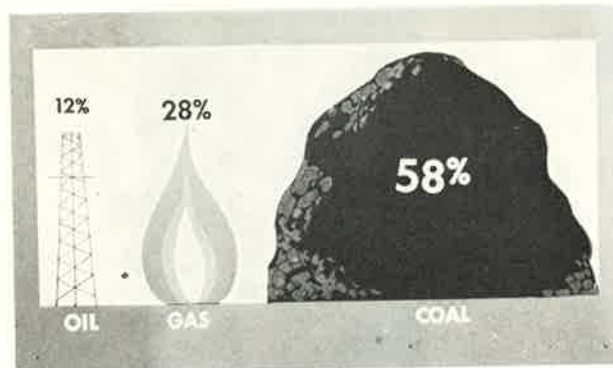


Figure 1

consumption or cut back on its use haven't considered all the implications. Do they realize that such measures would constitute economic and social repression? Freezing our consumption or cutting back would be tantamount to sentencing the millions of disadvantaged and underprivileged people in this country to those very conditions they are struggling to rise above. Freezing electric power use would freeze the number of jobs in the economy; with no more power, we could buy no more appliances; without additional power, we cannot clear away the ghettos and develop adequate low-cost housing, and we could not provide the schools and services we must have to achieve our social goals.

These limousine liberals apparently aren't aware that such conservation measures would repress and discriminate against those millions of people whose lot in life they should rightly be trying to improve.

I propose that electric power—in increasing amounts—is essential to maintain and improve not only the natural environment in this country, but our total environment—the total environment reflecting such things as our standard of living, the quality of our housing, the comfort of our surroundings, freedom from time-consuming chores, the quality of our leisure, proper health care, and modern transportation and information systems.

Technology as a Villain

Technology has come under attack as a villain that is despoiling our planet, but technology is not a force that can be made subject to moral judgments of good or bad, right or wrong. Technology is only a tool, and it is a tool that has served mankind well. More than anything else, technology sets man free. It frees us from constant preoccupation with the search for food and the battle against the elements. In setting us free, it has allowed us at the same time to elevate to the highest levels those social and human values that so many people seem to believe are lacking in today's society.

Some currents of opinion condemn the generation of electricity for its alleged sins against the environ-

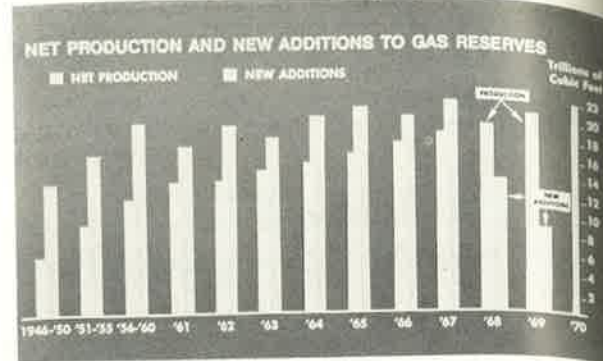


Figure 2

ment. Rather than allow electric power to be adjudged a sinner, we must promote its message as a savior, which has played a major role in bringing to mankind a new freedom and the resulting possibilities for further enhancement of the cultural and humanistic aspects of our society.

I believe that in the long run this conflict between the demand for power and our environmental goals will be resolved mainly by the use of nuclear energy. However, we also will have to depend upon fossil fuels for a long time to come, and these fuels present special problems of price, supply, and environmental effect. There is an impending energy fuels crisis. We don't face the crisis now, in 1971, but if steps aren't taken in '71 and '72 and '73 to formulate our fuels policy, serious deficits between the demand and the supply of fuels for power generation could develop in the latter 70's and in the 1980's.

At present, coal accounts for 58 percent of all steam electric power generation in this country; the share for natural gas is 28 percent, and oil's share is 12 percent (Fig. 1). But we can look for dramatic changes to take place in this fuel mix in the coming decades.

We have abundant reserves of coal, in the ground. The problems at the present with coal, as you know, lie in the areas of transportation, production, and environmental effects. We are largely dependent upon railroads for the transportation of coal, and the problems that face this industry will certainly affect the cost and availability of coal in the future.

The Mine Health and Safety Act of 1969 is beginning to have far-reaching effects within the industry, with the result that prices and production are seriously affected. Demands for higher wages and a declining labor force will further push up prices and affect availability. We have projected a price of \$10.90 a ton in 1985 compared to \$3.92 in 1968.

But the price delivered to the power plant does not reflect the true cost of using coal to generate electric power. The public has long been paying the hidden costs of the environmental effects of mining

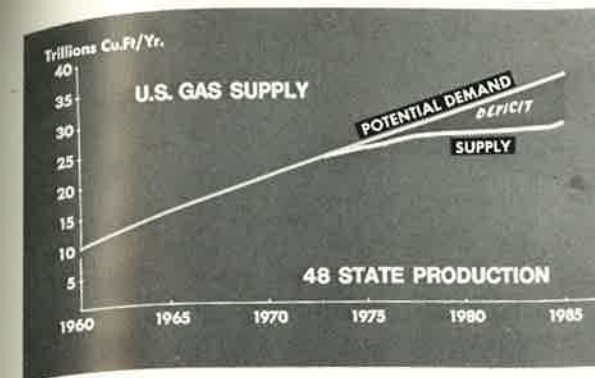


Figure 3

and burning coal, and now this cost is being transferred to the utility in the form of emission control equipment. Ultimately the cost shows up in the consumer's monthly electric bill.

To meet air quality regulations, many utilities have scrambled for residual oil and natural gas. But each of these alternatives is faced with serious supply problems in the future.

I believe that there is unanimous agreement within the gas industry that there is a serious shortage of natural gas production in the country. Figure 2 shows total net production as compared with new gas additions from 1946 up to the present. Note that in 1968 production began to substantially exceed new additions as the discovery rate sharply declined. Figure 3 shows gas demands projected over domestic production and imports up to 1985. The deficit in 1985 is about 10 trillion cubic feet a year.

The importation of liquefied natural gas and imports from Canada and Alaska cannot solve the supply problem, because demand will be even greater than total supply including these sources.

Figure 4 shows our projections of the price of gas to utilities, and it doubles between 1970 and 1985, assuming the producers would be willing to take on new utility customers. There are exceptions, however, in the states of Texas and Oklahoma.

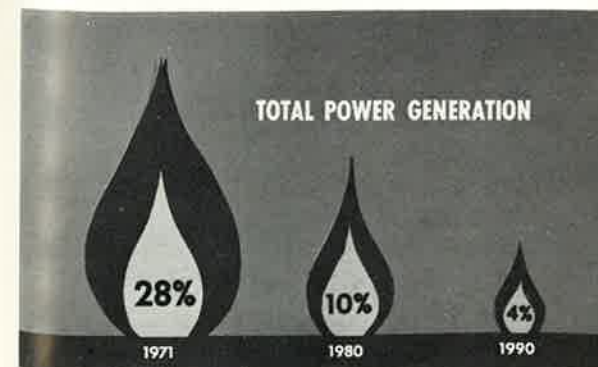


Figure 5

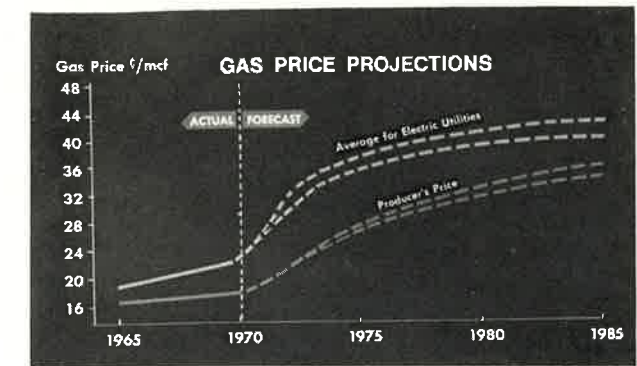


Figure 4

With demand for natural gas growing at a yearly rate of 4.2 percent, double the growth in production, with discovery rates at disastrously low levels, with prices to utilities expected to double, and the demand for gas in more essential applications growing, we have concluded that natural gas will not be a significant boiler fuel for future generation additions and will cease to be a factor altogether in the utility industry by 1990. Our projections indicate gas dropping from 28 percent of total power generation today to 10 percent in 1980 and down to about 4 percent in 1990. (Fig. 5).

What, then, is the outlook for oil? Total demand for petroleum in the U.S. will rise steeply between now and 1990, with transportation and industrial demands accounting for the large majority of total consumption. Consumption now is 15 million barrels a day; by 1990 it may be as high as 32 million barrels a day (Fig. 6).

Figure 7 compares domestic spare capacity and total imports in the U.S.—and it shows that, for many years, we had sufficient spare capacity to take care of whatever contingency arose with petroleum imports. Since 1967, however, we have been importing more petroleum to meet our demand with the result that there is a widening deficit between productive capability and total consumption. Domestic

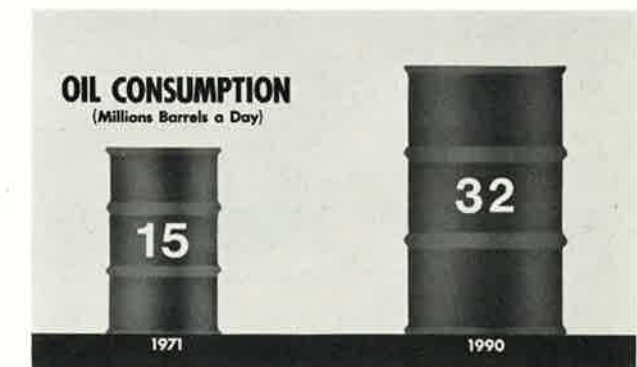


Figure 6

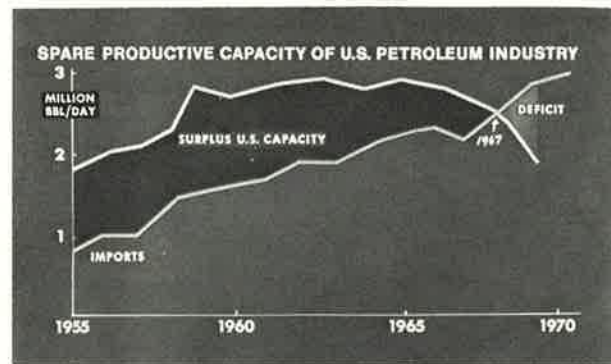


Figure 7



Figure 8

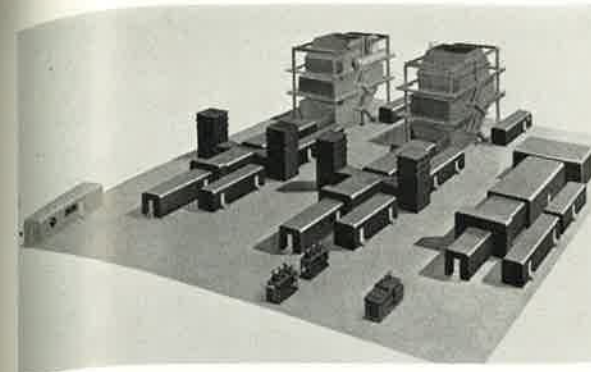


Figure 11

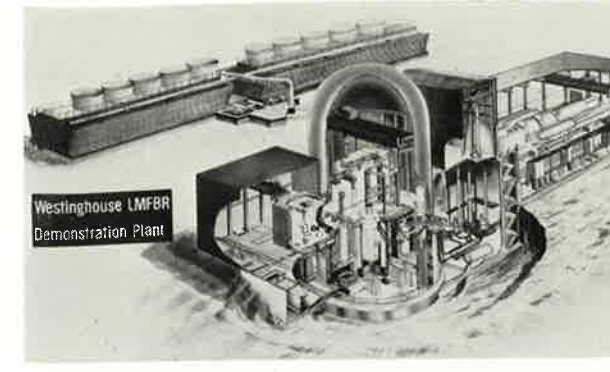


Figure 12

production cannot meet total demand, and we must rely upon imports.

Let's look at one facet of the petroleum picture—residual oil, which is important as a fuel for electric power generation. With no import restrictions on residual oil on the east coast, utilities have turned to imported low-sulphur residual to meet ever-tightening air quality standards.

Residual fuel oil consumption by U.S. utilities increased 190 percent from 1965 to '70 and is forecast to increase 103 percent over the period 1970 to '75, leveling off with an 18 percent rise between 1975-80 to a total consumption of 800 million barrels yearly (Fig. 8). This represents generating capacity equivalent to over 100,000 megawatts, about two-thirds of which will be located along the eastern seaboard. I question the wisdom of allowing that much capacity to become dependent upon foreign sources for its fuel.

Our energy situation is receiving considerable attention these days, especially from the government. It has been made abundantly clear that there is an urgent need for a coherent policy to govern our use of energy fuels. The Senate Interior and Insular Affairs Committee, for instance, has established a special task force to investigate such a policy and

determine what direction it might take. I think we can predict safely that some kind of energy policy will be formulated for this country, and I further believe that it is possible to at least outline the overall direction of such a policy.

Looking into the crystal ball, I see four major steps that could be taken.

One: Strong encouragement will be given to increased production of natural gas, because demand for this fuel is rising steeply in such essential uses as residential heating and industrial processes. The increased use of natural gas to generate electric power will not be encouraged because alternative fuels are available, and gas will be out of the market as a boiler fuel.

Two: In the interest of national security, steps will be taken to curb our dependence upon imports of petroleum from foreign sources, especially from countries with immature or unstable governments. Domestic production of oil will be stepped up to make the country as self-sufficient as is possible. However, in the case of power generation, the economics of domestic refinery production and the lack of adequate desulphurization facilities in the U.S. prevent domestic sources from supplying anywhere near the demand for residual oil that we have

projected. At the present, east coast utilities depend on foreign sources for 93 percent of all residual oil consumed for power generation. Residual oil will diminish in importance as restrictions grow tighter on such imports. The same probably will hold for imported low-sulphur crude oil.

The next two points involve, of course, nuclear power and coal. Figure 9 is our latest projection of generating capacity additions by fuel type from now to 1990. Note that the intermediate-type generation accounts for about 40 percent of total additions or about 400 gigawatts. Also note that coal takes a major share or 258 gigawatts of the intermediate total. This estimate differs substantially from other projections, which assign a much greater share to gas and oil. This projection indicates to me that coal, contrary to what many have said, has a very bright future before it—if, however, the industry can solve its production problems and make coal meet air quality standards (Fig. 10).

New Technology for Coal

I believe that there is a tremendous opportunity for the development of new technology for mining and transporting coal (Fig. 11). One of the solutions to fossil-fuel environmental problems—and Westinghouse projects a tremendous market here—is the use of combined-cycle intermediate load plants used in conjunction with a coal gasifier. We are presently developing such a concept, and we believe that such plants can all but eliminate the problem of gaseous and particulate emissions and reduce thermal effects substantially as compared with a conventional coal plant on a kilowatt basis.

The point to be made with respect to a coal policy in our future energy mix is that we should look for ways to improve the combustion of coal to remove stack gases, or to develop the concept of gasification, and for ways to increase production. We must have more coal and cleaner coal.

Now we come to nuclear power. Westinghouse, in just the last month, increased our estimate of nuclear's share of total additions in the next two

decades by some 140 gigawatts because of our analysis of these problems with fossil-fuel supply and production.

You have heard warnings that uranium may be in short supply in the decades ahead. Westinghouse's assessment of the uranium reserve and supply situation is that this fuel will be available in sufficient quantities well up into the 1990's when we expect the fast breeder reactor to come into play as a source for nuclear fuel. The breeder reactor, which produces more fuel than it consumes (Fig. 12) will save the industry an estimated \$21 billion over a 35-year period, assuming introduction of the breeder in 1985.

But if we are to realize the tremendous benefits of the breeder reactor, we must move quickly to begin construction of competitive breeder reactor demonstration plants. Adequate funding must be secured for at least two such plants, and these funds must be committed soon. A national energy policy with regard to nuclear power would stress the great importance of the breeder reactor program and the necessity of keeping nuclear power on its timetable. If nuclear power is allowed to slip, we will face serious energy deficits that cannot be met with alternate fuel sources.

And speaking of nuclear power, Westinghouse recently announced a new development that I feel will help keep nuclear on its schedule—the platform-mounted nuclear reactor (Fig. 13). We have formed a division to develop this concept, in which a full-size nuclear power plant would be built on a concrete and steel barge and towed to an offshore location for installation in a utility's specially constructed site. A breakwater would be built to protect the plant, and power would be transmitted to shore—a couple of miles—by underwater cable. The platform reactor, I am confident, will help tremendously with the siting problem, and will contribute to significant nuclear capital cost reductions.

To sum up, then, I expect that we will lessen our dependence upon oil and gas because of supply problems (Fig. 14). Coal production must increase in the

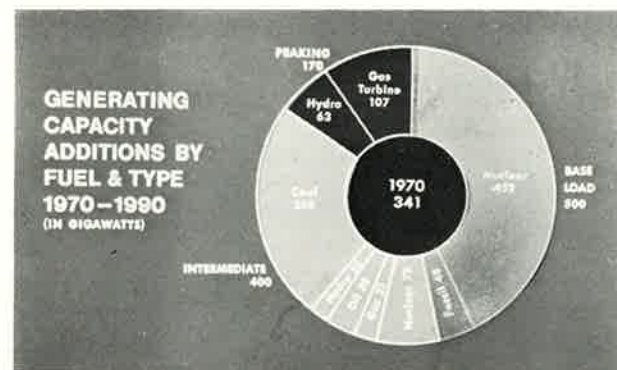


Figure 9

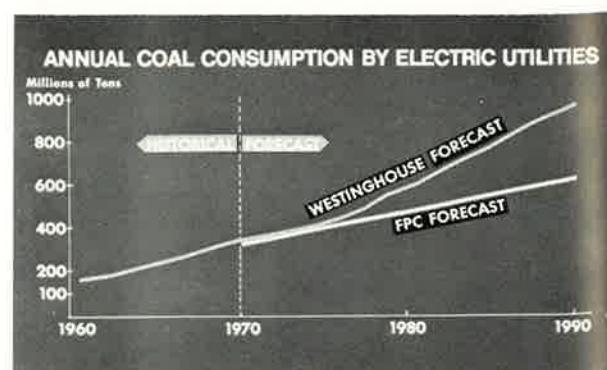


Figure 10

them from anarchy... All the particular circumstances which tend to make the state of a democratic community agitated and precarious enhance the general propensity and lead private persons more and more to sacrifice their rights to their tranquility."

Another thread, or common theme, is that there has been no settling-in, no shaking-out, no process of accommodation and adjustment. Social Security, Agricultural Adjustment, Resettlement, even NRA, and a lot of other new and untried programs were added to the responsibilities of the Federal bureaucracy in an earlier decade, with less disruptiveness. Jet transportation, national press and national TV, the Xerox machine, and national, electromagnetic synchronization of power systems hadn't yet come about, so things had a better chance to adjust.

Proposed laws then tended to be more brief, and one had the impression then, as one does not have now, that witnesses advocating legislation had read and understood it. Congress itself was less likely, then, to pass bills which were mutually contradictory. Administrations seemed more chary of recommending that some bills be supported on exactly the same grounds urged for the defeat of others. I speak, in this connection, of the underlying philosophy of the plant siting bill of the Administration as wholly inconsistent with its attitude about the Congressional alternative to its own revenue-sharing proposal.

Reliability, Environment, Siting

It was a utility executive, as I've already indicated, who simplified the issues accurately to three—reliability, environment, and expediting siting decisions. Reasonable men differ about the two substantive issues. In the case of reliability, you and I have both argued that in the last five years—and the subject was barely recognized as a problem before November 1965, and the Northeast blackout—the industry has an outstanding record using the voluntary route. As to environment, we have both argued that special environmental rules for the electric utility industry are not needed, and would be counterproductive.

The matter of delay presents not a substantive, but rather an adjective, issue. There, your shoes pinch, and you are willing—some of you—to seek government help. How many examples have you outlined in your testimony tending to show that Federal regulatory activity can speed state decisional processes? I can name examples where quick-taking and eminent domain legislation can supplant state action, but even there it would have to be admitted that the social pressures for getting on with a war effort probably deserved more of the credit than the Federal legislation. In more recent years, the laws, rules, and regulations under the Federal interstate highway program have had to step in to resolve some

state siting impasses, but the fall-out of ill-will in such cases deserves to be evaluated by those who would rely on that precedent.

All this boils down to my telling you that "one-stop" certification procedures may not work out in practice. I was rather blunt about it in a speech I recently gave to a utility executives' conference in Chicago, so I see no reason to be less so here.

In that speech, I predicted that companies will come to see that there remains an advantage in dealing with people familiar with local needs. Translated, this means that as hard as it may be to get a final decision in Albany, Raleigh, or Sacramento, it is likely to be quicker than getting one in Washington. It may take experience to teach them, but the mischief which I find to exist in the Administration's siting bill of committing Federal functions to state agencies under Federal guidelines and subject to Federal vetoes will eventually be recognized by the utility industry as being quite antithetical to their interest in quicker decisions.

The head of the Committee on Power Plant Siting of the National Academy of Engineering testified before the House Committee on May 12th. The Committee program, he said, was to help resolve the conflict between those who wish to increase the production of power and those who wish to preserve the environment. Passing the opportunity to use that sentence as an excuse to quote again the aphorism attributed to Paul Appleby to the effect that it is the mark of the public man to see the essential ambiguity in every public question, I can accept Dr. Deming Lewis's next sentences with more grace:

"We fully recognize that the resolution of this conflict must involve many processes including those of law, education, public discussion, and legislation. *But the process of resolution must be based upon what is technologically and economically feasible, in other words, upon matters intrinsic to engineering.*" (Emphasis mine.)

Here, again, I will quote myself:

"It is possible that the ecological crusade has caused us to take our eyes off the main target. Concern with only one aspect of the problem—the location of generating and transmission capacity—diverts attention from such issues as transmission technology, industry structure, intercorporate relationships, and public-private cooperation which lie at the root of service reliability."

In Dr. Lewis's frame of reference, looking to the Federal government as a broker to resolve the difficulties associated with obtaining an adequate power supply, as well as protecting our environment, has a cost, too.

I have believed, and said, that a collegial body like the Federal Power Commission can handle the con-

(Continued on page 198)

POLLUTION AND THE WORLD Fuel Choices in the 21st Century

By Professor Carroll L. Wilson

Sloan School of Management,
Massachusetts Institute of Technology



Although by the year 2000 we expect global thermal power output to be six times the present level, we do not expect it to affect global climate. It is likely that the principal impact in terms of climate change will arise, if it does, from the combustion of hydrocarbons to which our only present alternative would be nuclear power.

It is a privilege and pleasure to have the opportunity to speak again to the representatives of this great industry. My last appearance before you was in 1948. My topic then was the prospects for nuclear power. I was at that time General Manager of the Atomic Energy Commission. It was a time when there were many estimates of the advent and cost of nuclear power. In 1948 the General Advisory Committee to the Atomic Energy Commission felt pressed to make their forecast of the prospects as they then saw them. They said at that time that they expected that at the end of 20 years perhaps as much as half of the new electric generating capacity being ordered would be nuclear.

You can judge how accurate this forecast was. If we imagine the end of their 20 years to be in 1967, perhaps their estimate was fairly close. The position, however, may be less optimistic in 1971.

I shall be dealing with futures again, but of a different kind. It may sound presumptuous to choose a title such as "Fuel Choices in the 21st Century," but let me remind you how near the year 2000 is. My granddaughter, born last month, will be only 29 in the year 2000. She can expect to live to the year 2050 if current actuarial expectations hold good. But will they? A planning horizon of 30 to 50 years has become essential for reasons I will try to explain.

My focus will be on global critical environmental problems. I emphasize global because however acute an environmental problem may be locally or regionally, my focus will be on environmental impacts which are global and change the climate or the oceans or terrestrial ecosystems. I shall also not be concerned with the direct effects on man's health.

An address before the 39th Annual Convention of Edison Electric Institute, Cleveland, Ohio, June 9, 1971.

My reason for a focus on global questions is that many others have been much concerned and devoting great attention to local and regional problems but relatively little attention has been put on global changes as a result of man's activities.

Again turning to the time horizon, let us suppose that the combustion of hydrocarbons had a high probability of producing major climate changes in the next 30 to 50 years, let's say, if we projected hydrocarbon usage at a 4 percent compounded growth rate. Such changes might, for example, be the result of carbon dioxide heating up the globe through the greenhouse effect or a cooling-off as a result of an increasing particle load in the atmosphere. Also, the effects might be more severe in the northern hemisphere than elsewhere because now and in this short horizon of 30 to 50 years it is likely that at least three-quarters of the hydrocarbon combustion will be in the northern hemisphere.

Another factor is that a change of only 2 degrees centigrade, 3.6 degrees Fahrenheit, if sustained, either plus or minus, can start a warming or cooling trend which over time could have substantial effects. We've heard about the icecaps melting and raising the oceans three or four hundred feet or a new ice age beginning. Such effects, even if started, will take a long time, but nonetheless we know too little about the synergistic effects of cooling once started accelerating the phenomenon or warming likewise.

It is likely that the principal impact in terms of climate change will arise if it does from the combustion of hydrocarbons. If a consensus arose that we had to limit or curtail the use of hydrocarbons because of their impact on climate, the implications would be enormous. Our only present alternative would be nuclear power and an electric energy

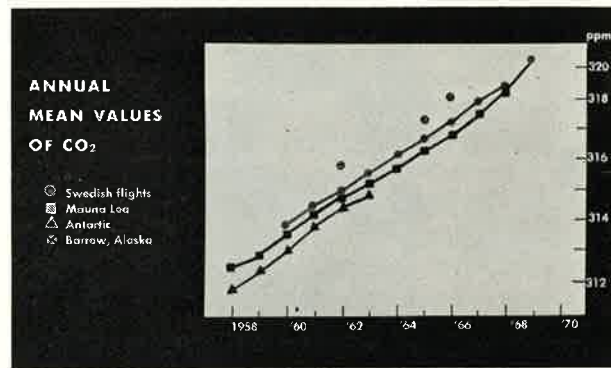


Figure 1

society. Obviously, the implications for the electric power industry are enormous.

Furthermore, this is not merely a U.S. problem, it is a global problem. Even though the U.S. in the year 1980 or the year 2000 might still account for 25 percent of the world's energy consumption, it wouldn't be enough that we switched to nuclear power to avoid producing climate change. Other users would have to do likewise. Thus, for these reasons, too, this is a global problem.

Somewhat over two years ago it seemed to some of us that it was timely to conduct a study of critical global environmental problems. This decision arose partly in anticipation of the United Nations Conference on the Human Environment scheduled for June 1972. We enlisted the support and participation of 12 government agencies, three national laboratories, six major industrial firms, and four foundations and assembled about 40 people for 30 days at Williamstown last summer under the auspices of MIT. We had atmospheric chemists, meteorologists, oceanographers, ecologists, economists, lawyers, engineers. About 40 people spent a full 30 days at this task and 40 others were there part-time.

We considered these global environmental problems:

Climatic effects of increasing carbon dioxide content of the atmosphere and of the increasing particle load in the atmosphere.

Climatic effects of contamination of the troposphere and stratosphere by subsonic and supersonic aircraft.

Ecological effects of DDT and other persistent toxic pesticides and of mercury and other toxic heavy metals.

Ecological effects of petroleum oil in the oceans and of nutrients in estuaries, lakes, and rivers.

For these topics the following general questions were addressed:

What can we now authoritatively say on the subject?

POSSIBLE ATMOSPHERIC CARBON DIOXIDE CONCENTRATIONS					
year	Amount Added From Fossil Fuel (Mt/yr) ^a	Cumulative Amount Added Over Previous Decade (Mt)	Concentration by Volume (ppm)	Total Amount in Atmosphere (Mt)	Percentage of Annual Addition Remaining in Atmosphere
1970	15,400	126,500	321	2.50 x 10 ⁶	52
1980	22,800	185,000	334	2.61 x 10 ⁶	52
1990	32,200	268,000	353	2.75 x 10 ⁶	52
2000	45,500	378,000	379	2.95 x 10 ⁶	51

Figure 2

What are the gaps in knowledge which limit our confidence in the assessments we can now make?

What must be done to improve the data and our understanding of their significance so that better assessments may be made in the future?

What programs of focused research, monitoring, and/or action are needed?

What are the characteristics of the national and/or international action needed to implement the recommendations of the study?

I shall review the findings and recommendations which are most relevant to the electric power industry. I shall indeed omit quite a few findings and recommendations that are relevant to you as global inhabitants but it will take all my time to discuss those of particular relevance to this industry. In discussing these findings I shall be quoting from the summary of the Study of Critical Environmental Problems (SCEP) Report which represented the product of much labor to condense our conclusions into a brief statement.

Carbon Dioxide in the Atmosphere

Firstly, as to carbon dioxide in the atmosphere, we had the following to say:

"All combustion of fossil fuels produces CO₂. It has been steadily increasing in the atmosphere at 0.2 percent per year. Half of the amount man puts into the atmosphere stays and produces this rise in concentration. The other half goes into the biosphere and the oceans, but we don't know the partition in uptake, as between these two reservoirs.

"The amount of CO₂ from fossil fuels is a small part of the natural CO₂ which is constantly being exchanged between the atmosphere/oceans and the atmosphere/forests. We have very little knowledge of such amounts.

"The projected 18 percent increase resulting from fossil fuel combustion to the year 2000 might increase the surface temperature of the earth 0.5 C; a doubling of the CO₂ might increase mean annual surface temperatures 2 C. Surface temperature changes

FORECASTS OF TOTAL ENERGY REQUIREMENTS FOR U. S. ONLY					
Source Document	Date of Publication	Growth Rate Base year to 1980 (%)	1980	Growth Rate 1980 to 2000 (percent)	2000
GGAEM	1968	3.7	28.6	—	—
EUS	Sept. 1967	4.2	27.4	—	—
OEU5	Oct. 1968	3.8	28.4	—	—
USP	July 1968	3.3	25.8	—	—
EMUS	July 1968	3.2	25.8	3.2	49.4
		3.2	24.6	3.2	46.5
PCCP	May 1968	3.5	26.7	3.1	45.4
TCUSEC	1968	3.2	26.5	3.3	51.0
		(3.7)	(29.2)	(3.9)	(62.5)

Figure 3

of 2 C could lead to long-term warming of the planet. These estimates are based on a relatively primitive computer model with no consideration of important motions in the atmosphere, and hence are very uncertain but they are the best we have.

"If we had to stop producing CO₂, no coal, oil, or gas could be burned, and all modern societies would come to a halt. The only possible alternative is nuclear energy, whose by-products may cause serious environmental effects. Also, we don't have electric motor vehicles to be propelled by electricity from nuclear energy.

"SCEP believes that the likelihood of direct climate change in this century resulting from CO₂ is small, but its long-term potential consequences are so large that much more must be learned about future trends of climate change if society is to have time to adjust to changes which may be necessary."

Figure 1 (refers to Fig. 1.1, page 47 of SCEP Report) shows annual mean values of CO₂ as measured in four parts of the world. The top curve is based on Swedish flights. The next lower curve is based on measurements in the Antarctic. The top three dots reflect measurements at Point Barrow, Alaska. It seems clear that the CO₂ content of the atmosphere is practically uniform around the world and that the level has been steadily rising during the decade since IGY when we first began to make measurements.

Figure 2 (refers to Table 1.2, page 54 of SCEP Report) shows an estimate of possible carbon dioxide concentrations to the year 2000. The first column is the years—1970, 1980, 1990, and 2000. The second column is the amount added through combustion of fossil fuel in millions of tons per year. The third column is the cumulative additions. The fourth column is the parts per million—rising from 321 to 379. The fifth column is the total amount of CO₂ in the atmosphere—rising from 2.50 million million tons to 2.95 million million tons. The last column to the right is the percentage of the annual addition which stays in the atmosphere—is not transferred to the oceans or forests. We are very uncertain about

this number and whether half of the annual addition of CO₂ will continue to be removed by absorption in the biosphere. If 100 percent remained in the atmosphere our forecast of a global temperature rise of 0.5 C by 2000 could become 1.0 C and amount to half of the 2.0 C change which may trigger a long-term warming trend.

Figure 3 (refers to Table 7.2, page 291 of SCEP Report) shows all of the forecasts by others which we were able to assemble last summer. There are seven shown here for the year 1980 and four for 2000. They are for the United States only. I shall not spell out what each set of initials stands for but refer you to the footnotes on page 291 of the SCEP Report. We could find only one projection for the world to 1980 broken down by types of fuel. It seems to me that the electric power industry could make a valuable contribution in this area by sponsoring studies which reach beyond the forecasts you now make both in time—at least to 2000—and in scope to include all forms of energy.

Recommendations on CO₂

Our recommendations as to what to do about CO₂ were as follows:

1. Improvement of our estimates of future combustion of fossil fuels and the resulting emissions.
2. Study of changes in the mass of living matter and decaying products.
3. Continuous measurement and study of the carbon dioxide content of the atmosphere in a few areas remote from known sources—specifically four stations and some aircraft flights. We particularly recommend that the existing record at Mauna Loa Observatory be continued indefinitely.
4. Systematic study of the partition of carbon dioxide between the atmosphere and the oceans and biomass.
5. Development of comprehensive global computer models which include atmospheric motions and ocean-atmosphere interaction to study: circulation, clouds, precipitation and temperature patterns for expected CO₂ levels; and effects of stratospheric cooling."

I should note here that the data available and the projections, let's say to the year 2000, are indeed meager and incomplete. Also, the state of existing computer models is primitive and hence our conclusions are no better really than the models now accessible.

In what I have said above about carbon dioxide and will say later about other products of combustion, one may ask why we know so little and why our models are so primitive. The real reason is that no one has cared. Meteorologists on the whole were concerned with short-term weather forecasts. Climate and its changes interested only a few, such as

paleontologists or those who study ice cores from glaciers. We know there have been swings in climate over the last thousand years and that it must be a pretty stable system; nonetheless we understand very little about the delicate feedback effect of changes, indeed changes that can be of great significance for the inhabitants of this globe. We believed that four stations are needed to monitor trends, but that 12 stations would be needed to provide data to improve our understanding.

Fine Particles in the Atmosphere

As to fine particles in the atmosphere, we had the following to say:

"Fine particles change the heat balance of the earth because they both reflect and absorb radiation from the sun and the earth. Large amounts of such particles enter the troposphere (the zone up to 40,000 feet) from natural sources such as sea spray, wind-blown dust, volcanoes, and from the conversion of naturally occurring gases—SO₂, NO_x and hydrocarbons—into particles.

"Man puts large quantities of sulfates, nitrates and hydrocarbons into the atmosphere which become fine particles and include special species, such as urban smog.

"Particle levels have been increasing as observed at stations in Europe, North America, and the North Atlantic, but not over the Central Pacific.

"We do not know enough about the optical properties (reflection versus absorption) of particles to know whether they produce warming or cooling of the earth surface."

One of the surprising discoveries was that we didn't really know whether the effect of particles was to cool or to warm the surface of the globe. It had been widely assumed that particles had a net cooling effect and, indeed, if one kept in nice balance the net warming effect from CO₂ and the net cooling effect from particles, there was nothing to worry about. We discovered that the ignorance of the optical properties of fine particles was so great that they could either have a warming or cooling effect depending upon these characteristics. This had a bearing on our recommendations which were as follows:

- "1. Studies to determine optical properties of fine particles, their sources, transport, and amounts in both troposphere and stratosphere, and their effects on cloud reflectivity.
- "2. Extending and improving solar radiation measurements.
- "3. Study of feasibility of satellite measurements of particle concentration and distribution.
- "4. Monitoring from ground and aircraft—ten fixed long-term stations and 100 stations for short-lived particles.
- "5. Develop atmospheric computer models which include particles."

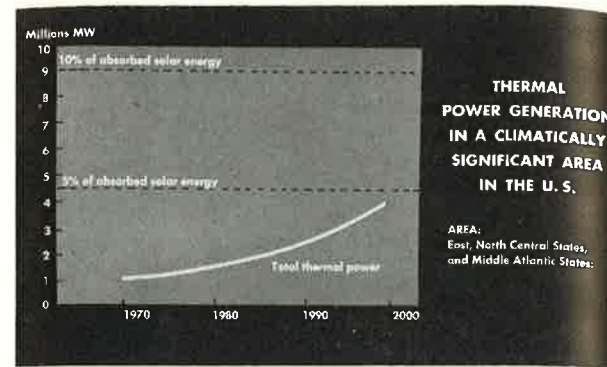


Figure 4

We considered two other questions of significance to this industry. The first was thermal pollution and we had this to say:

"Although by the year 2000 we expect global thermal power output to be six times the present level, we do not expect it to affect global climate. Over cities it does already create 'heat islands' and as these grow larger, they may have regional climatic effects and they should be studied."

Figure 4 (refers to Fig. 1.4, page 66, SCEP Report) shows an estimate of thermal power generation in climatically significant areas in the United States—the East North Central states—Michigan, Illinois, Indiana, Wisconsin and Ohio; and the Middle Atlantic states of New York, New Jersey, and Pennsylvania. The assumptions are that electric power + waste heat = 30 percent of all power; that electrical capacity increases tenfold 1970-2000; and that all other energy doubles 1970-2000. You will see that by 2000 the total thermal power produced in this region may reach 4 percent of the absorbed solar energy. We really don't know the effects this may have on climate in this region—or indeed in far larger areas of the northern hemisphere.

We also considered atmospheric oxygen and whether it might be depleted by the continued combustion of fossil fuels. We considered this a non-problem and said the following:

"Atmospheric oxygen is practically constant. It varies neither over time (since 1910) nor regionally and is always very close to 20.946 percent. Calculations show that depletion of oxygen by burning all the recoverable fossil fuels in the world would reduce it only to 20.800 percent. It should probably be measured every ten years to make sure that it is remaining constant."

These were our observations on the products of fossil fuel combustion. We had neither time nor data for a comparable examination of the environmental effects of nuclear power, including fuel processing. There is one other finding and recommendation which is relevant because it relates to oil in the oceans. Because of the importance of oil as energy

input for the electric power industry, it is appropriate to report our findings on this topic, which were as follows:

"It is likely that up to 1.5 million tons of oil are introduced into the oceans every year through ocean shipping, offshore drilling, and accidents. In addition, as much as two to three times this amount could eventually be introduced into waterways and eventually the oceans as a result of emission and wasteful practices on land.

"Very little is known about the effects of oil in the oceans on marine life. Present results are conflicting. The effects of one oil spill which have been carefully observed indicate severe damage to marine organisms. Observations of other spills have not shown such a marked degree of damage. Different kinds of damage have been observed for different spills.

"Potential effects include direct kill of organisms through coating, asphyxiation, or contact poisoning; direct kill through exposure to the water-soluble toxic components of oil; destruction of the food sources of organisms; and incorporation of sub-lethal amounts of oil and oil products into organisms, resulting in reduced resistance to infection and other stresses or in reproductive successes."

Recommendations on Oil

We then had the following recommendations to make on this point:

- "1. Much more extensive research is required to determine the effect of oil in the ocean. Future oil spills should be systematically studied beginning immediately after they occur so that a comprehensive analysis of the effects can be developed over time. Sites of previous spills should be re-examined to study the effects in sediments.
- "2. Political and legal possibilities should be explored which would accomplish the conversion to Load-On-Top techniques by that 20 percent of the world's tankers which do not use this method.
- "3. The possibility of recycling used oil should be explored."

Time will not permit me to report on what we found and could say and didn't know about the effects of subsonic and supersonic jet aircraft. It was predictable that what we would say on the SST would be of greatest interest to the press and indeed it was. Using the FAA data and estimates of 500 SST's operating seven hours a day in 1985, we tried to predict how much water vapor and particles they would dump into the stratosphere at 65,000 feet, how long it would stay there, what the cumulative build-up would be, and whether one could estimate the effects on climate change. We identified a number of areas of profound ignorance and expressed uneasiness at the prospect. It now seems likely that

other factors may affect whether we have any such fleet of SST's flying in 1985.

Having identified what we could say and what our areas of ignorance were, we devoted considerable attention to measurement and monitoring of things needed so our estimates in a few years would be much better than we can make now. We drew a clear distinction between measurements which, let's say, were one-time surveys to find out the state of affairs and monitoring, which is a long-time, continuous observation of conditions. There is need now for a good deal of survey measurement and only on a few things can we say much about monitoring today. What we did say in the introduction on this subject, written by the SCEP Work Group chaired by G. D. Robinson of the Center for Environment and Man, is worth saying here:

"When the miner's canary died, it was time to get out of the mine. The canary 'monitored' the mine air and gave an indication of potential disaster due to odorless, invisible methane. The immediate action necessary was clear; long-term solutions could be considered later.

"But when we are concerned with a global environmental problem, this type of monitoring is insufficient. Because we cannot escape from the earth, we must have more than a sentinel to sound an alarm if a critical threshold is passed; we must know what it is that kills our 'canary,' where it comes from, and how to turn it off at the source.

"Accordingly, we think 'monitoring' is best conceived of as systematic observations of parameters related to a specific problem, designed to provide information on the characteristics of the problem and their changes with time. The parameters and problems with which we have been concerned are those of the global environment. And though any monitoring program will provide information useful to dealing with local and regional problems, our concern has been with identifying existing and potential monitoring systems capable of securing the information necessary to deal with the critical global problems identified by the Study of Critical Environmental Problems (SCEP).

"For every one of the global problems that have been identified, we find we have insufficient knowledge of either the workings or the present state of the environmental system (see reports of Work Groups 1 and 2). This hinders us as we attempt to design monitoring that will not only warn us of change but also provide information upon which we can base rational and efficient remedial action. In most instances we can suggest a likely analogue of the canary, but we do not know what action would be best once our bird shows up sick. Further, we are persuaded by our colleagues that global systems both physical and biological are so complex that the ultimate consequences of any disturbance cannot at present be predicted with confidence.

"For these reasons our report is concerned not

only with monitoring in its sense of providing warning of critical changes but also with measurements of the present state of the system (the 'base line') and with measurements in support of research into the workings of the system. We mention the need for this research where it is apparent to us; we have not attempted to provide a complete assessment of research needs. In general, however, we have agreed that research is most needed in providing a closer specification of the present state of the planet and in developing a more complete understanding of the mechanisms of interaction between atmosphere, ocean, and ecosystem."

Now, nearly a year later, it is fair to ask what was the consequence of this study. First of all, we wrote a book during the four weeks of July and presented the findings and recommendations to the press and to the heads of agencies on the 30th and 31st of July. The manuscript was delivered to the MIT Press at the end of August and on the 15th of October the first printing of 10,000 copies began to come off the press. To date 16,000 copies have been sold, a couple of thousand have been given away, and there has been a Russian translation prepared by the Soviet Academy of Sciences. It has been widely used by government agencies, the President's Council on Environmental Quality and other organizations, and by parts of the United Nations system.

I should emphasize that in our findings and recommendations we focused on what should be done and what capability it took to do it and strictly abstained from saying who, that is, what organization should do what. Thus, others better fitted to make these decisions could make them and during the past six or eight months many agencies have taken steps to implement the recommendations.

The Next Step

We then considered what the next step should be. As stated earlier, the global significance of potential climate change from the combustion of fossil fuel is so significant that an international consensus is clearly needed. We therefore have organized a summer study to be held in Stockholm this June 28th for three weeks which will bring together the best atmospheric chemists, meteorologists, and climatologists in the world. They will address the same questions in terms of the effects on climate change. A report will be written which should carry global authority on these issues. In the months since last summer there has been debate about some of the findings and some of the data used in the SCEP study and we are trying to bring together in Stockholm this month critiques by those who were not there but who will take part in the study this summer of those parts of the SCEP Report dealing with climate and monitoring. Findings and recommendations of this study will be presented to the press and leading authorities on the 15th and 16th of July and again we expect a book out by the middle of

September. The study this summer will again be under the auspices of MIT, hosted in Sweden by the Swedish Royal Academy of Science—the Swedish Royal Academy of Engineering Sciences. We have had acceptances from 35 of the leading scientists in these fields from 15 countries. In addition, we expect a strong Soviet delegation in the study.

I am aware that the impact of environmental issues on the electric power industry in the last few years at the local and regional levels has been sharp and growing. This has certainly been reflected in increasing public pressure relating to power sites, SO₂, NO_x and particles, thermal pollution, and transmission lines. I am sure those here can identify other topics including those which cluster around nuclear station proposals.

It does seem to me an era both of problems and special opportunities for this great industry. New options will open up as fuel costs and environmental constraints change your choices. Gas turbines, d-c transmission lines, off-shore power stations on the surface or submerged must enter your planning.

Era of Opportunity

This era of opportunity for the electric power industry will permit you to attract into this field some of the best engineering graduates and management graduates who until very recently would have had their attention focused on other industries. Whenever there are problems and troubles it spells opportunity and I expect each member of this industry is well aware that you have troubles and problems of a new and different kind. This should also spell a special opportunity for Edison Electric Institute on behalf of this industry to support research on a wholly new scale and to give consideration to some of these long-range topics I have discussed. My closing remarks are again taken from the SCEP Report and are as follows:

"Man does not yet threaten to annihilate natural life on this planet. Nevertheless, his present actions have a considerable impact on ecosystems, and his future actions and numbers will certainly have even more. The critical issue is the danger that we may curtail an environmental service without being able to carry the loss or that we may irreversibly lose a service that we cannot live comfortably without.

"An intractable crisis does not now seem to exist. Our growth rate, however, is frightening . . . the risk is very great that we shall overshoot in our environmental demands (as some ecologists claim we have already done), leading to cumulative collapse of our civilization.

"It seems obvious that before the end of the century we must accomplish basic changes in our relations with ourselves and with nature. If this is to be done, we must begin now. A change system with a time lag of 10 years can be disastrously ineffectual in a growth system that doubles in less than 15 years."

POWER SUPPLY AND ENVIRONMENT IN GREAT BRITAIN

By Sir Stanley Brown, C.B.E.

Chairman, Central Electricity Generating Board



Experience in the United Kingdom demonstrates quite emphatically that with proper care there is considerably less unfavorable impact on the environment by the provision of necessary energy via the electrical route than by any other. Electricity is in fact the only totally non-polluting fuel other than pure hydrogen.

IN introducing this paper, I cannot resist the temptation to read the following order to the Sheriff of Surrey:

"To proclaim that all who wish to use kilns in the town of Southwark (in London) shall make their kilns of brushwood or charcoal and shall not use in any way sea coal under pain of heavy forfeiture, as the king learns from the complaint of prelates and magnates of his realm (who frequently come to London for the benefit of the commonwealth by his order) and from the complaint of citizens, that the workmen in the town aforesaid now burn them and construct them of sea coal from the use of which an intolerable smell diffuses itself throughout the neighboring places and the air is greatly infected to the annoyance of the magnates, citizens and others there dwelling, and to the injury of their bodily health."

That proclamation was made in the year 1307, so you will see that regulations on the environment and on the use of low-sulphur fuels are not exactly new.

So there is a history behind this problem of environment and, since the Industrial Revolution began in the United Kingdom in the late 18th and early 19th centuries, we possibly have the dubious honour of being in the forefront of industrial despoliation, but I think history will also show that we realised the error of our ways at an early date and at least made a start in clearing up the mess (Figs. 1 and 2).

Legislation can only cover part of the problem, but it is significant that the Act setting up my own Board in the United Kingdom puts a statutory re-

An address before the 39th Annual Convention of Edison Electric Institute, Cleveland, Ohio, June 9, 1971.

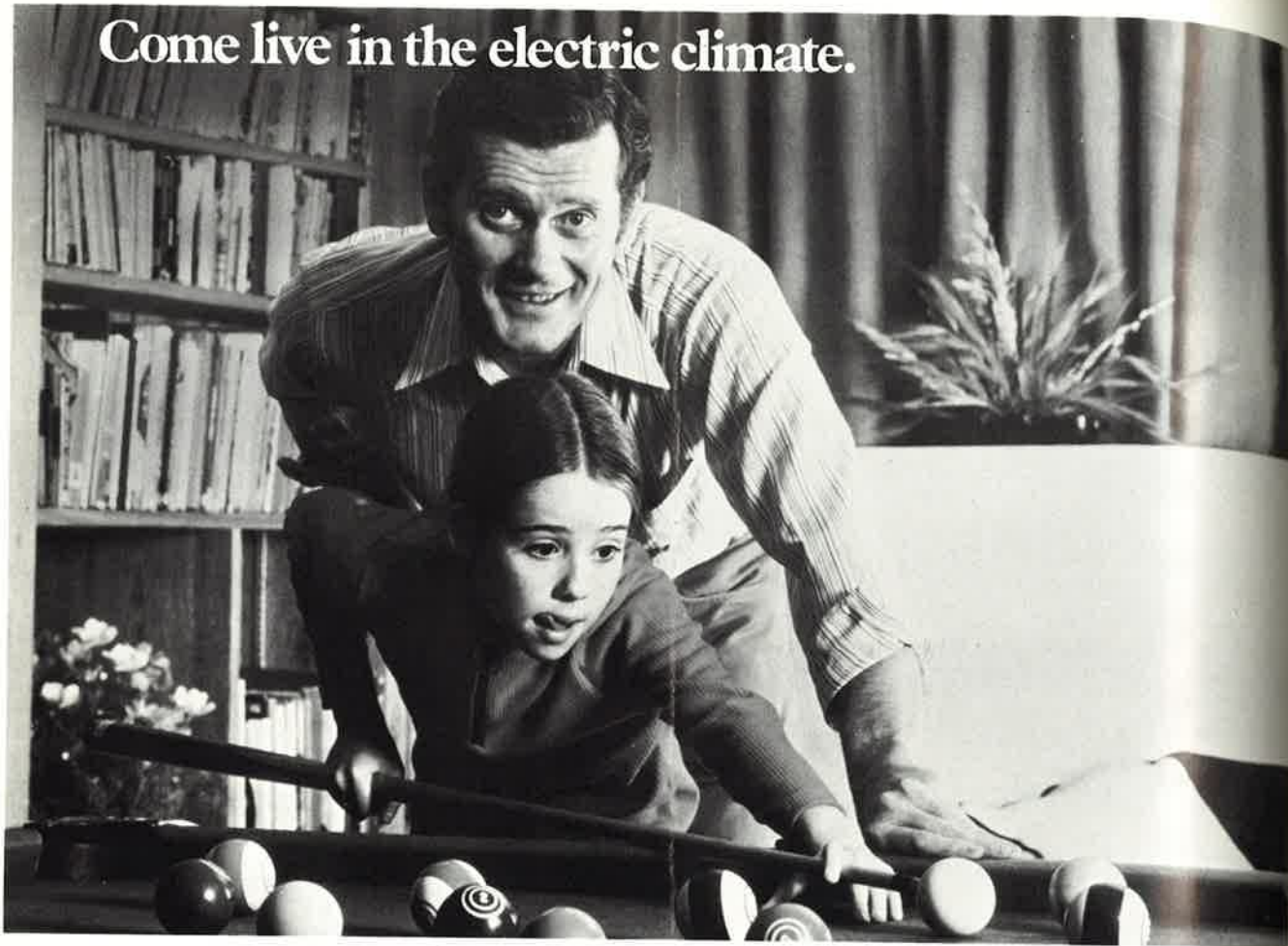
sponsibility on the Central Electricity Generating Board—not only to provide an efficient supply of electricity to consumers, but also to take into account any effect that our proposals may have on the natural beauty of the countryside, or on flora, fauna, geological and physiographical features of special interest, and so on.

Again, I think history will show that this concern has in fact been practised by the power industry in Britain well before it became a legal duty. Nevertheless, we now have a dual responsibility at law and the onus for arriving at a proper balance between economic power and environmental protection lies firmly on us. Between the two extremes of "the cheapest possible electricity" and "conservation at any price" lie a wide range of possible solutions, and the task of making the correct decisions rests in the first place with my Board, although, of course, our decisions are subject to examination by many interested bodies. The substance of this address is to explain how we have gone about the task of reconciling these two interests which so easily conflict.

Doing our main job, while having a regard for the environment, involves two distinct categories of interest. Firstly, the control of physical pollution—of air, water, and land and including control of nuisance from noise; secondly, the preservation of that which we in Britain sum up in the word "amenity," i.e., the pleasantness of our surroundings in all aspects—visual beauty, landscape value, architectural merit, and so on (Figs. 3 and 4).

The distinction between the two is that pollution control is mainly objective—a question of facts which are capable of being treated scientifically rather than emotionally. Amenity is subjective in character and concerns matters of opinion rather than fact, but in Britain is of high importance be-

Come live in the electric climate.



The electric climate can do more than help give you more room for living...

It's a superior indoor environment that can make any kind of building cost less to own...and it can help the outdoor environment, too!

Consider what the benefits of *the electric climate* can mean to you as a homeowner. And as a cost-conscious, people-conscious executive. And as a civic-minded citizen.

The human benefits of the electric climate:

Flameless electric heat is the heart of *the electric climate*. It fills rooms with a soft, even warmth that can't be matched for comfort. No drafty corners. No sudden chills. Except for the comfort, you hardly know it's there—whether you're in your electrically heated home or office or church or school. Think how

much better people live and play and learn and work in such a pleasant environment.

The dollar value benefits of the electric climate:

The initial cost of flameless electric equipment that results in *the electric climate* is comparable to or *lower* than other types. Requires little or no maintenance. And the *cost* of electricity remains a real bargain!

The environmental benefits of the electric climate:

Buildings with *the electric climate* put nothing into the air around them...because electricity is the cleanest form of energy

there is at its point of use. Generation of electricity by combustion methods produces by-products that cause pollution, but these by-products can be best controlled at modern power plants. In fact, the electric utility industry is a pioneer in the development and installation of pollution control devices and, of course, is actively engaged in even further improving the techniques of control.

The electric climate promises a better future. Find out more from your electric utility. You, your company and your community will benefit.

Live better electrically / Move toward a better world.

Edison Electric Institute, 90 Park Avenue, New York, New York 10016

IN THIS

SHEARON
man of Ca
Criticality of

EEl Pres
day in the
page 216.

The 1977
Calendar es
to our cus
Calendar of
promotional
industry.

Charles F
Edison Co.
tion "Will V
page 228.

Cover ph
of continuc
Houston Lig

The
Sh

Publi
Co
Fra

Today
W.

24th
Co
Se

Resid
Bel

Will V
Ch

Pacifi
Hel
Riv

ERC I
Res
Tra

Progr
Cat

The EDISON E
of electric light
North, Central a
public service
making availabl
members to ge
of consumer, In
stitute relating t
indexed by Scie