

The Energy Crisis: An AEC Overview

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FEW MEN SPEAK more straightforwardly about the nation's rising energy needs than James R. Schlesinger, the 42-year-old chairman of the Atomic Energy Commission. He briefs the White House, lectures the Treasury Department, scolds industry and testifies before Congress on it. He's concerned with all forms and aspects of energy—not just atomic energy. He speaks openly, for instance, about the possibility of rationing electrical energy.

"I think we're going to want to slow down the demand for electric power, if only for good environmental reasons," Schlesinger said not long ago. "We may have to have laws that restrict the way in which power can be used."

If Schlesinger is nothing else, he is candid and direct. When he took over as AEC chairman he brought in a retired Air Force colonel to study a branch of the AEC for a possible overhaul. A month later, the colonel walked into Schlesinger's office with charts and graphs to dress up his report.

"Let's cut out that Pentagon bologna," Schlesinger said abruptly. "Just give me the facts."

His knowledge of the Pentagon was at least part of the reason Schlesinger was appointed AEC chairman by President Nixon. He had spent six years as director of strategic studies for the Rand Corp. and two years as assistant director of the Budget Bureau in charge of, among other things, military spending. His friends say he was personally responsible for cutting \$6 bil-

lion from the Pentagon request in the first year of the Nixon administration.

"He had the hammer on the defense guys for more than a year," recalls a high-ranking Nixon appointee. "He made very few friends in the Pentagon."

There's more to Schlesinger than directness. He has a Ph.D. from Harvard, taught economics for eight years at the University of Virginia and wrote a book on foreign economic policy that many economists regard as a bible. He's regarded on Capitol Hill and in the White House as a man who's truly interested in finding the right solutions to our energy problems.

"What impresses me about Schlesinger is that, while he's scowling at you, he'll still listen to you," said a man who served President Johnson and President Nixon. "He's even capable of changing his mind."

While he's been chairman a little less than a year, Schlesinger has made some dramatic changes in the AEC. He's certainly altered its image, which had been one of secrecy and resistance to change. He's also changed its mission, making the commission more a regulator than a promoter of nuclear power and pushing the AEC for the first time into research on non-nuclear energy.

"I think the strength of the AEC lies in technology," he said in explaining the move into battery and geothermal energy research. "We must have a balanced technology if we're to get the most out of our energy resources."

To the chagrin of many in private industry, Schlesinger has also turned out to be something of an environmentalist. He listens to ecologists' com-

plaints about nuclear plant sites and worries actively about what he considers nuclear power's most serious impact on the environment.

"Thermal pollution of our streams and rivers by a power plant's heated discharge is the most complicated of all our questions," he said once. "Heating things up doesn't have to be bad, but it can be bad for small bodies of water, for upwater streams, for shallow bays. There's no easy solution to this question."

One of Schlesinger's serious hobbies helps to explain his naturalist instincts. He's a bird watcher and often gets up before 5 a.m. to get in two hours of watching before going to his office. He also composes and sings political folk ballads, accompanied by his own guitar.

The father of eight children, Schlesinger has little time for social life. He shuns the cocktail circuit and turns down almost all political dinner invitations. In his office—where the interview excerpted below was recorded—he's seen in his shirtsleeves, his tie askew, his shirttail out. He is almost always seen smoking a pipe, a habit he's had for the last 24 years.

A man of professorial charm, Schlesinger has no time for ceremony. Before becoming AEC chairman, he drove an old blue car that had a Blue Book value of \$50. Now he's driven by a chauffeur in a limousine, which he openly dislikes. The limousine broke down once and he happily walked the half mile back to his home, got into his beat-up car and drove his chauffeur and himself to the office.

Q: The whole country talks as if the United States is in the midst of an energy crisis. The White House says it, the Congress says it and the press says it. What do you think?

A: I would prefer to avoid the general term "crisis." Clearly we have a problem with regard to fuels. We have topped out, in terms of oil production in the lower 48 states, at about 10 million barrels a day. Assuming Alaska comes on, that will provide an additional 2 million barrels a day. If you consider prospective demands for 1980, it lies somewhere between 22 million and 28 million barrels a day. If one took the immediately prospective oil prices for 1972, and we're talking about importing as many as 16 million barrels a day in 1980, the cost of that would be in excess of \$15 billion a year.

The U.S. balance of payments is in a rather parlous condition, and it's not clear that additional outpayment of \$15 billion a year for foreign oil is something we can support. And that is only assuming a static situation. The trend in oil prices is up, and one can anticipate they will continue upward. So that the burden on U.S. balance of payments, unless we're able to substitute other fuels for oil, could be on the order of \$30 billion a year.

Beyond the question of fuel supply, there is a seemingly chronic problem with respect to electric service reliability. In the near term, there has been concern regarding regional shortages of electric power supply with the resultant possibilities of brownouts and even blackouts.

Q: Can we substitute gas and coal for oil?

A: The further development of gas in sizable amounts seems out of the question—at least until we have gas from coal. The annual demand for gas could be greater than 35 trillion cubic feet by 1980, but the supply we anticipate will be little if any in excess of the 22 trillion cubic feet we produce today. There can be some supplement from imported liquefied natural gas, but it will be limited. We have enough coal to go for a century or more, but utilities have tended to shift away from coal because of its sulfur oxides and other pollutants. We have not developed a way of readily and economically getting rid of the

sulfur in coal. There is a fair amount of low-sulfur coal in the West, but it's fairly expensive to transport. We will require an extensive national effort either to achieve coal gasification or otherwise to convert the coal to a form where it can be used in abundance within environmental constraints.

Q: The country wants power, but it wants clean, cheap power. How can it go on getting clean, cheap power in view of the fuels crisis you've just described?

A: The trend in power costs is upward. One reason it's upward is the introduction of environmental regulations. Another reason is the rising cost of fuel. As we clean up our fuels, as we prevent noxious combustion products from getting into the air, or as we limit the discharge of heat into the water, this will cost money. Consequently, the price of power will rise but it will be cleaner power.

Q: How much more expensive will it be?

A: The cost per kilowatt probably will be something like 40 per cent higher in 1980 than it is today, largely reflecting the higher cost of construction, the rising cost of fuels and environmental requirements. Through greater efficiencies we hope to limit the rate of increase in power costs. How? The construction of a nuclear plant now requires on the order of eight years—in other countries, half that time. If we can cut the time for construction, we can do much to limit the increase in the cost of power.

Q: What happened to put this country in the fix it's in today with regard to energy?

A: The driving force behind the problem has been the enormous increase in energy demand, so that we have outstripped our own oil production at the same time that environmental considerations put limits on the strip mining of coal and the burning of coal. It all reflects the higher aspirations of America and it has all come together at the same time.

Q: Do you think there was a lack of foresight in government and industry as far as anticipating the demand for power, anticipating the environmental revolution and even in anticipating what could have been done in technology to offset the problems we have today?

A: There is something in that, though, it's very difficult to anticipate a relatively sudden development like the thrust toward

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higher environmental standards. There have been new findings with regard to the physical and health impact of combustion products that have, I think, reinforced the esthetic or quality-of-life aspect of the environmental movement.

Most of the technology you've referred to has primarily been the responsibility of industry. The one exception was nuclear energy. As a result of the government monopoly in nuclear energy, the total energy research and development budget for civil application tended to be funded in a lopsided manner: most of the money into nuclear, relatively little into other energy sources. We can see this in retrospect.

One of the things you have to keep in mind is that the utility industry is a regulated industry, and even though it receives impressive revenues, nearly \$25 billion a year, it has rarely put significant money directly into research and development. This is partly because it's a regulated industry, partly because it's fragmented and partly because of reasons of its own historical perspectives and its role relative to the manufacturers. The utility industry should have been a major source of funding for technology development but it has not been. However, we now see clear signs of change.

Q: Congress has criticized the executive branch for scattering energy policy throughout as many as 61 federal agencies, which suggests that if the United States has an energy policy it isn't a coherent one. What is your feeling? Does the country have what you would call a coherent energy policy?

A: We need a far more coherent energy policy than we have at present. President Nixon's proposal for a Department of Natural Resources would help solve these problems, but I believe we should have review of our fuel policies in one place. At present, the Interior Department has responsibility for coal and oil, the AEC has responsibility for uranium, the Federal Power Commission licenses hydropower facilities and regulates the price of gas. I believe all these fuel policies should be under one roof, so there can be a more consistent treatment of fuels. As a member of the executive branch, I would say that one of the problems there is not only the fragmentation of responsibilities within the Executive but the fragmentation of assignments on Capitol Hill. In some sense, that may be a more difficult problem to deal with than reorganization within the executive.

Q: One aspect of our energy dilemma is the environmental movement, a movement that has forced considerable change on energy policy. What kind of impact do you think this

movement has had — mostly positive or largely negative?

A: In some respects it has aggravated the dilemma because environmental regulations limit the use of fuels and technologies, but I think that in the large it has focused attention on the energy problem and in the long run that focusing of attention may be more valuable than the short-run impediments. Is it necessary for total energy demand to grow at a rate of 4-5 per cent a year? This is the fundamental issue that the environmental movement has raised, and it is a good issue. Of course, it can be said that a fair number of environmentalists have been rather contentious, but this should not distract attention from the movement's fundamental contribution, which is to focus on what we can do about ever-growing energy use.

Q: How much good or ill effect has the environmental movement had on the atomic energy program in the United States?

A: Well, a minority in the environmental movement just do not like nuclear energy. The primary reason may be a fear of the unknown — neophobia. But all in all, the environmental movement has made a major contribution to nuclear energy. The reason is quite clear — the chief advantage of nuclear energy from an environmental standpoint is that there are no combustion products and therefore essentially no air pollution. There has been a push in the direction of nuclear power because of the low availability of fossil fuels that meet our environmental standards. I'm not sure that was the objective of the environmentalists, but that's the way it has worked out.

Q: How can you say the environmentalists have helped nuclear power that much? They've held up licensing permits on countless nuclear plant projects, which doesn't seem like much help.

A: Hearings by licensing boards have been far more extensive than necessary. Delaying tactics have been deliberately employed in some cases, and I don't believe that's in the public interest. However, we should all be careful not to blame environmentalists. Many

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plants, both fossil and nuclear, were behind schedule even before the upsurge of interest in environmental matters. The schedule slippage of most nuclear plants is due to inadequate planning, the slow pace of construction, labor disputes, the late delivery of equipment, and prolonged test programs. There are a fair number of plants which have elicited no protests from environmentalists that are two or more years behind schedule. The United States has turned out to be a country of relatively low efficiency in the construction of nuclear power plants. Until we've improved our efficiency, we should all be careful not to put too much blame on the environmental movement.

Q: Nuclear power generates less than 2 per cent of all the electricity produced in the U.S. today, but is a growing fraction of the total. Could you tell us what your latest projections are for nuclear power?

A: We're still projecting 25 per cent of total capacity in 1980 in nuclear plants. That would be approximately 150 million kilowatts. Construction lags might slow it down. By 1990, our estimate rises to almost 50 per cent of total power, something on the order of 600 million kilowatts. Changes in national energy and fuel policy could speed that up. It is useful to reflect on those numbers. When the United States entered the Second World War, the generating capacity in the country was 42 million kilowatts. So the nuclear power estimate for 1990 is almost four times the total generating capacity of the U.S. at the start of the Second World War. For the next few years, the annual additions to nuclear capacity will represent about 50 per cent of all the power we had prior to World War II. Roughly 50 per cent of all the capacity being ordered today is nuclear and in the years ahead it will probably be closer to 65 per cent.

One reason for hesitancy in ordering nuclear plants is the congestion in the regulatory process, delays in hearings, delays in licensing. But despite these delays, I think utilities recognize that nuclear plants meet

environmental standards and provide a ready source of fuel. They look to the future and they probably see fewer uncertainties with nuclear power than they do with fossil fuels. In the long run, the extensive public debates about nuclear power will seem secondary. There is no alternative to substantial use of nuclear power.

Q: But right now there is a lively debate about the future availability of uranium with some people suggesting we won't have enough cheap uranium to fuel the nuclear plants we'll be building in the next 10 years.

A: It's hard to anticipate just how long low-cost uranium reserves will last. The estimates of uranium reserves in the United States are made on a quite conservative basis. Much of the world has not been explored, and even in the United States there are areas that have not been explored. There was a find recently along the Santa Fe Railway in New Mexico. I think we can count on having plenty of uranium to meet our needs.

Eventually the price of uranium would begin to rise and then the economics of light water reactors would start to suffer. We would begin to run out of low-cost uranium, but that is where the fast breeder reactor would prove its merits, because the price of electric power in the breeder is essentially insensitive to the price of uranium. The breeder will exploit about 70 per cent of the energy content in uranium, whereas the light water reactors built today exploit only 1 per cent of the energy content. In fact, the breeder will permit us to use what is a major potential asset in the United States and that is the vast amounts of depleted uranium left over from our weapons program, which could fuel breeders for almost a century.

Q: The United States has spent more than 20 years and about \$800 million on breeder research. The AEC is about to enter into a contract for the first breeder demonstration plant, which is to be located in the Tennessee Valley. When can the country expect to see commercial electricity from the breeder?

A: President Nixon has indicated that we should have an operating "demo" plant by 1980, and that continues to be our objective. We will be very close to that and I hope we beat it. We've ironed out all the outstanding problems except for the site, which we're now looking at. There are four or five sites under consideration. There will be a second demo plant located outside the Tennessee Valley. Our best judgment is that the first commercial breeders would be coming in after 1985.

Q: Few Americans understand the concept of the fast breeder. Can you describe how it would work and can you discuss its safety aspects?

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A: The fast breeder is just what the name suggests. Fast or highly energetic neutrons are produced in the fission process, and are absorbed by the fertile uranium-238. The absorption of neutrons converts the uranium-238 into plutonium-239, which can be used as fuel. We anticipate that in 10 years' time a fast breeder would produce twice as much fuel as was consumed.

On the safety aspects, a better understanding seems to be developing. For example, the power densities will be about six times higher in the breeder than they are in the light water reactor. That means that if all of the coolant were lost from around the fuel, it is more difficult to dissipate the leftover heat to avoid melting the fuel. But in the breeder there is far less likelihood of losing the coolant even in the case of an instantaneous double-ended major pipe rupture. The reason is that liquid sodium is used to cool the hot reactor core instead of water. One of the most important things to remember about sodium as a reactor coolant is that its boiling point is about 1,600 degrees F., and consequently it does not have to be pressurized like water. Because it won't be pressurized, one avoids any chance of a major loss-of-coolant accident through blow-down, when loss of pressure turns very hot cooling water instantaneously into steam. That can't happen with a liquid metal coolant, because the coolant won't be under significant pressure.

It has been pointed out that hot sodium is tricky to handle, that it reacts rapidly on contact with air or moisture. The design calls for the steel coolant system to be surrounded by nitrogen, so that if there are leaks of sodium there won't be any serious reaction of the hot liquid metal with oxygen. I should also point out that liquid sodium is not a new coolant. We and others throughout the world have used it in reactor plants safely for over 20 years. More than a dozen sodium-cooled reactors have operated over this period of time. Sodium has been used in the EBR-II [an experimental breeder reactor in Arco, Idaho] for over eight years, and it was used for three years as the coolant in the world's second nuclear submarine, the Seawolf.

Q: Once nuclear power becomes really big business the question of the disposal of radioactive wastes comes up. How does the AEC plan to store its wastes once the nuclear garbage begins to pile up?

A: Since the quantities of accumulated wastes are small, we do not have to begin storing high-level wastes from the commercial power reactors in a separate repository until about 1980. What we plan to do is to develop surface storage facilities at the same time that we continue to investigate geologic storage in a variety of configurations. We have put off any decision to move into underground geologic storage because the decision seemed to be an irreversible one. There has been concern about the effects of the long-term dissipation of heat from the solid wastes on salt formations. There is also concern that once placed underground, the wastes could become irretrievable. I think further experimentation will resolve these uncertainties, but until such time as these uncertainties are resolved we plan to have an acceptable alternative — the capability for storing such high-level solid wastes safely above ground.

One of the problems in salt storage is that you must dissipate heat by natural means in a relatively confined area, with the salt closely packed around the cylinders, where one would want to watch what the dissipated heat might do to the salt and to the other geologic structures adjoining the salt. At the surface we can use methods by which the heat is readily dissipated, we're able to cool the cylinders and we're able to watch them for leaks. We're also able to move these wastes from one storage vault to another or re-can them if a leak should occur. Don't forget, these wastes will be solidified. There will be no liquids to worry about.

The amount of wastes will be very small when the waste storage program begins, no matter where we're putting it. A 1 million kilowatt plant will produce about a cubic meter of high-level waste per year. All of the high-level wastes that will be generated by the year 2000 will require no more than 30 acres of total storage area, even if we store the wastes above ground.