

million or two barrels to the supply side will have more than \$3 a barrel dampening effect on the world price of oil.

As I said earlier, the drop in Iran production, affected the world supply of oil by only something like 4 or 5 percent and it increased the price by 50 percent. As that New York Times editorial said, it is that last barrel of oil on the demand side, when you are missing the one on the supply side, that is a \$100 barrel of oil. That is the basic economics of this problem.

Senator PERCY. Thank you. I appreciate your testimony very much.

Chairman RIBICOFF. Thank you very much. I hope you will take a few minutes from your labors, Mr. Cutler, that you and your associates can assist us in putting this together.

Mr. CUTLER. If I had only this panel to worry about, I would feel more comfortable.

Chairman RIBICOFF. I know. Also keep in mind this is one opportunity to really put regulatory reform into action.

Mr. CUTLER. Yes, sir.

Chairman RIBICOFF. Just put that in the back of your mind. You might ask some of your friends to get to work on it now.

Mr. CUTLER. Thank you, Mr. Chairman.

Chairman RIBICOFF. Thank you very much. Our next witness is Gordon MacDonald. Mr. MacDonald, an essential ingredient here is the protection of the environment. Additional carbon dioxide emission is an alarming prospect. Water pollution is another hazard.

So is the solid waste problem. Yet energy self-sufficiency is absolutely essential for the good of this Nation and the future of this Nation. Are the goals of producing synthetic energy and environmental protection contradictory?

**TESTIMONY OF GORDON T. MacDONALD, DARTMOUTH COLLEGE, FORMER MEMBER OF PRESIDENT'S COUNCIL FOR ENVIRONMENTAL QUALITY**

Mr. MACDONALD. That is precisely the problem I would like to address this morning. First I really applaud the attention that the Committee on Governmental Affairs has given this problem.

It is particularly important I think that a committee with a new perspective examine not only the energy but also the environmental aspects of the various suggested solutions to the energy problem. But I want to first describe the most important environmental issue associated with the major commitment to synthetic fuels. The worldwide change of climate resulting from the loading of the atmosphere with carbon dioxide.

Next I will touch on the instrument the Government has now to deal with this environmental problem and briefly discuss alternative approaches to alleviating the energy shortage which has given rise to the proposals that we have heard about this morning for a massive use synthetic fuels program.

My thesis is simply that before we commit ourselves to the construction of a major synthetic fuel infrastructure involving investment of tens or hundreds of billions of dollars, we should make every effort to understand not only the short term benefits and costs, but the longer term consequences to the generations that must live with the decisions taken today. Proponents of synthetic

fuels recall the success of the synthetic rubber industry in World War II.

They fail to remind us of the disastrous long-term impact of that synthetic industry on the natural rubber economies of Southeast Asia and the consequent flow of events in Vietnam, Malaysia, Cambodia, and Laos.

Man, through the burning of carbon-based fuels, is setting in motion a series of events that seem certain to cause a significant warming of world climates over the next decades. The use of synthetic fuels will accelerate and intensify these climatic changes. Such changes will have far reaching implications for human welfare in an ever more crowded world, will threaten the stability of food supplies and will present a set of intractable problems to organized societies.

The basic scientific problem is easily understood. Carbon based fuels, when burned, produce carbon dioxide. Incidentally, this is one of the reasons why the cost of synthetic fuels keeps going up and up. It is because you have to use energy to make the fuels and as the cost of energy increases the cost of the synthetic product also increases.

That use of energy produces carbon dioxide as does the burning of the final synthetic product. The net result is that synthetic fuels produce two to three times as much carbon dioxide as do the natural fuels.

Carbon dioxide, in contrast to oxygen and nitrogen, the major atmospheric components, absorbs the heat that the Earth would otherwise radiate back into space. Carbon dioxide acts as a blanket keeping the Earth warm. Increasing the carbon dioxide content of the atmosphere will increase the number of blankets and raise the temperature at the surface of the Earth.

The consequences of the resulting change in climate are difficult to predict in detail, but it is highly improbable that the changes on the whole would be beneficial.

After 80 years of study on this problem by scientists throughout the world, the present day consensus is that doubling the carbon dioxide content of the atmosphere will increase the average surface temperature by 2 to 3 degrees Celsius and that the temperature change will be amplified by a factor of 2 to 5 degrees in higher latitudes. Put simply, a doubling of carbon dioxide would raise the average maximum temperatures in Washington, D.C. in the summertime from the low 90's to the high 90's or into the low 100's.

The significant scientific advance of the past few years is that the uncertainty of what will happen to world climate as carbon dioxide increases, has been substantially reduced. We can now, with confidence, predict that the Earth will warm and the warming will be greater at high latitudes and less in the tropics. What remains uncertain are the important details of weather, such as changes in the amount of precipitation and its distribution over the years.

Also uncertain are the impacts on society of a warming Earth. For example, warmer temperatures in the higher latitudes will shift to the north the geographic regions that can support wheat production, but that shift would place the optimal climatic condi-

tion for wheat in areas where the soils have been depleted of nutrients by ancient glaciations.

The net impact of a warming trend may also lead to a melting of the ice sheets flooding the coastal regions of the world.

When will the doubling of the carbon dioxide content of the atmosphere take place? If the world continues along the lines of the past 30-year period, increasing carbon fuel usage by 4.3 percent per year, and if the current mix of fuels is maintained, the carbon dioxide content of the atmosphere will double in 2030. If we move from the present fuel economy to one based upon coal and synthetics, the date could be 30 years from now, 2010. This is because synthetic fuels, in their production and use, generate two to three times more carbon dioxide than do the natural fuels.

With high year to year variations in weather, we may not be able to detect with absolute certainty these long-term changes before the year 1990-95. By that time, if the synthetic fuel investment and infrastructure are in place, it will be extraordinarily costly in economic and social terms to move away from a synthetic fuel economy.

I will now discuss certain of the policy and institutional aspects of the carbon dioxide issue. Despite congressional mandates, this and previous administrations have failed in developing energy policy, to consider the long-term impacts on the environment of burning coal or synthetic fuels.

The National Environmental Policy Act of 1969 requires environmental impact statements for proposals for legislation and other major Federal actions significantly affecting the quality of the human environment. I have studied dozens of the EIS's from numerous agencies on subjects such as coal leasing from the Department of the Interior, and synthetic fuel demonstration plants from the Department of Energy, and nowhere have I found an analysis on the environmental impacts of carbon dioxide.

The Environmental Protection Agency, under the Clean Air Act Amendments of 1972 is required to comment on the environmental impact statements as to their adequacy in meeting the requirements of the National Environmental Policy Act and nowhere have I found EPA raising the point that the EIS's fail to analyze the carbon dioxide issue.

While the environmental impact statement process may have deficiencies, it can alert Government officials to potential problems. The responsible agencies have clearly failed to do this in the case of carbon dioxide.

The Clean Air Act Amendments of 1972 and 1978 require that the Environmental Protection Agency set standards for pollutants which may not have direct health effects but, still, adversely affect the environment. EPA has not considered the carbon dioxide issue, nor does EPA have a program of research to quantify the long-term consequences of increasing carbon dioxide.

In view of the neglect of the carbon dioxide problem by the responsible agencies, it is not surprising to learn that in the administration's consideration of energy policy, it has completely neglected the carbon dioxide problem.

The National Energy Plan II issued this year contains only one paragraph discussing carbon dioxide and its impacts. The Presi-

dent, in 1977, established an office on carbon dioxide within the Department of Energy. That office is so deeply buried in the Department's bureaucracy and is so understaffed that it has not only had no voice in policymaking, it has not been able to develop an adequate research program.

Congress further complicated matters by establishing, through the National Climate Act, a National Climate Office within the Department of Commerce, so that the executive responsibilities for examining the carbon dioxide issue are splintered, with the resulting confusion.

The congressional committees with oversight responsibilities for the National Environmental Policy Act and the Clean Air Act amendments have also failed in their duty to see that the responsible agencies conduct their affairs in accordance with the laws that they are supposed to administer.

In considering new organizational initiatives, such as those introduced by Senator Domenici and the President, it is essential that the lessons of the past be taken into account.

With respect to the currently proposed legislation, I would strongly oppose any provision for Presidential override of applicable regulations. Such authority would vastly complicate the management and performance of the regulatory bodies and make it even less likely that they would consider and devote their resources to long-term issues, such as carbon dioxide. The independence and integrity of the regulatory bodies must be maintained.

The energy challenge is obviously worldwide. The problem cannot be resolved by one nation acting alone. However, the United States provides leadership on many international issues.

The elements of policy I propose here in outline are for the United States. They apply as well to the world.

One, acknowledgment of the problem: The CO<sub>2</sub> problem is one of the most important contemporary environmental problems, is a direct product of industrialization, threatens the stability of climates worldwide and, therefore, the stability of all nations, and the problem can be controlled, not technically but by policy.

Steps toward control are necessary now and should be a part of the national policy in management of sources of energy.

Two, conservation of fossil fuels: The first element of any policy that offers the hope of being effective is conservation. Limitation of the rate of exploitation of fuels is possible. The rate is controlled currently by price, taxation, and regulation. It can be controlled as a matter of policy.

All actions of government should be reviewed to determine effects on the total use of carbon-based fuels.

Three, choice of fossil fuels: The choice of fossil fuels and the use made of them bears heavily on the amount of CO<sub>2</sub> released to produce a unit of energy. Natural gas is by far the best carbon-based fuel for limiting carbon dioxide production. Synthetic fuels and fuels derived from shale oil are, by far, the worst.

The proposals for a massive synthetic fuels program arise from the misconception that the United States is running out of natural carbon-based fuels. This assumption is wrong.

Let me give you one example.

I have studied over the past few years, with colleagues, the probable reserves of natural gas. I am convinced, from my work and that of my colleagues, that in the continental United States, there exist vast resources of natural gas in both shallow and deep basins that have not been exploited.

The lack of exploitation flows from the fact that historically, in terms of constant dollars, the energy content of natural gas has been underpriced by 10 to 30 percent with respect to coal, 100 percent with respect to domestic oil, and 200 percent with respect to imported oil. As a result, there has been little economic incentive to develop this resource, which in burning produces less carbon dioxide than any of the other carbon-based fuels.

The scientific basis for my optimistic views on natural gas is based on new geologic understanding of gas deposits. Advances in the science of seismology lead me to believe that there are extensive natural gas reserves in the overthrust belt extending from the Dakotas to Arizona, in the Delaware basin of west Texas, in the Anadarko basin of Oklahoma, and in other regions, such as the gulf coast and the Eastern United States.

The production and use of these abundant domestic resources should be the responsibility of the industry. However, these reserves will not come into the market unless the Government removes price controls on natural gas, permits gas exploration in environmentally delicate areas, reduces the barriers to obtaining approval on pipeline construction, and permits the opening of new markets for natural gas.

With appropriate legislative action, natural gas could become the transitional fuel of the future at an environment and economic cost that is far less than that of synthetic fuels.

I am opposed to any program in which the Government subsidizes a synthetic fuels industry. My reasons include the following:

Synthetic fuels accelerate the climatic changes by increasing carbon dioxide content of the atmosphere and may produce irreversible changes on the planet that could endanger the human species.

We have fuels in the United States, particularly natural gas, that can be produced at lower cost than synthetic fuels provided that Government regulations, particularly price controls, are eased.

Synthetic fuel plants will require for their construction, additional imports of energy.

Synthetic fuel plant construction will be inflationary.

Our current problems with energy have in large part evolved, in my view, because of Government involvement in the energy business. Getting the Government into the commercial synthetic fuels business will only worsen the problem.

Let us not repeat the mistakes of the past.

Thank you, Mr. Chairman.

I would be delighted to answer any questions the committee might have.

Chairman RIBICOFF. Mr. MacDonald, for the record, will you tell us your credentials?

Mr. MACDONALD. I obtained my doctorate in geology at Harvard University in 1954, having graduated summa cum laude in 1950 from the university. I have taught at the University of California,