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CONTRIBUTION OF PUERTO RICAN'S TOWARDS THE SOLUTION OF ENERGY PROBLEMS

By

Dr, Juan A. Bonnet, Jr.

Director CEER-UPR

Presented at

U.S. Department of Energy

14 September 1981

Hispanic Heritage Week

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On behalf of the Puerto Ricans who form a vital part of the hispanic heritage of this Nation of Ours, I would like to thank you for inviting me here today.

I am sure that everyone in this room knows that Puerto Rico is an Island 100 miles long by 35 miles wide, about halfway down the Caribbean between North and South America; that Puerto Rico is a self-governing commonwealth of the United States, where our elections for everyone from governor down to municipal assembly persons coincide with national elections here on the mainland; that we have an elected Resident Commissioner here in the Congress; and that we have the world's best rum, best beaches, tastiest food, liveliest music and prettiest women.

?At last count there were three million two hundred thousands of us on the Island. That comes to about a thousand people per square mile. It's a good thing that we are gregarious.

Our birth rate has been declining in recent years, coinciding with higher education levels, urban growth, and the desire of a lot of our young women to have a career outside the home.

Puerto Rico in the 1980's is a vastly different place from the Puerto Rico of the 1930's and 40's. ?Then, most of our people lived in rural areas and

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the economy depended principally on a few crops such as sugar and tobacco. To put it bluntly, we were very poor.

Today, Puerto Rico has what probably is the highest standard of living of any Latin people outside the U.S. mainland in this hemisphere, with the exception of Venezuela. Our income per capita is over \$3500. We are an urban, middle class, industrial and commercial society today. Also we enjoy an average life expectancy longer than our fellow continental citizens.

We are very much a part of national life, although most of us do our living mostly in Spanish, most of the time. We travel frequently between the Island and the mainland, some of us coming up to look for work and others coming up to visit family and relatives.

While during the 1950's a lot of our people migrated north to the mainland, hoping to find work and escape from rural poverty, now the trend has reversed itself and every year more Puerto Ricans who came north, got jobs, saved some money and their families are returning to the Island either to work or enjoy retirement.

As you might suppose, our transformation from a Poor agrarian society to a middle class urban community with an economy based on increasingly advanced industry and commerce has enormously increased our consumption of energy.

Although we started by generating power from hydroelectric sources, we have no long, large rivers

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and very soon we began developing what today is an almost total dependence on imported petroleum.

Right now, our electric power authority is gearing

up to adapt some of our plants, or build new ones, so they may burn coal, with, of course, proper environmental safeguards.

At the same time, we are trying to look beyond coal into the day when our energy will come from renewable sources.

For those of you who are new here at DOE, or who may not know about your agency's involvement with Puerto Rico, I should add that our search for renewable energy sources in Puerto Rico today is the current phase of a quarter of a century of joint effort between DOE and its predecessors and the scientific community of Puerto Rico.

I want you to know that everyone involved in energy in Puerto Rico is aware of that tradition of mutual cooperation, and that we appreciate the stimulus and support given by the Department of Energy.

Today, energy-wise, Puerto Rico is facing severe

problems. We are at the mercy of the oil cartel as 99 percent of our energy comes from foreign, imported oil. More than \$1.5 billion left our Island to buy petroleum last year. We are the 26 country in petroleum per capita consumption.

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Apart from the high cost of energy this produces for us both in our homes and our businesses, we also face the problem any island would have: if anything goes wrong with our system, as happened in lower Manhattan last week, we are stuck and this is despite the fact that Puerto Rico has the second-largest electric publicly-owned power utility -- second only to Los Angeles light and power -- under the U.S. flag.

?As you may know, in the Continental U.S. when one system undergoes a severe breakdown in general only there are methods of connecting up to surrounding grids. But in Puerto Rico our grid stops at our shoreline.

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The Center for Energy and Environment Research of the University of Puerto Rico has devoted itself for close to its 25 years of existence to the development of alternate sources of energy for our tradewinds-blessed, ocean-surrounded and sun-kissed island in the Caribbean.

These adjectives, I am sure, tell you pretty much what we are up to at the Center, which is known in Puerto Rico -- and also here at DOE -- as CER.

Some of you, I noticed, looked surprised when I mentioned 25 years. Although our emergence from an underdeveloped to a developed country in Puerto Rico has been relatively recent we have been among the fore-runners in the field of energy and environment research.

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Consider the following, Puerto Rico, which had one of the first offices of energy in the U.S., also was one of the first among the States to have an Energy-Conservation Plan and its own Energy Policy Document.

Puerto Rico also was one of the first sites in the U.S. where demonstrations of nuclear power were carried

out at the Bonus Nuclear Power Plant. Our government-owned Electric Authority, back in 1960, was one of the first places in the U.S. to consider the possibility of Ocean Thermal Energy Conversion, or OTEC as it is known today.

Other interesting facts are that on our small off-shore island of Culebra, which is halfway between

Puerto Rico and the Virgin Islands, we have a windmill to generate energy for that island's close to 800 inhabitants. The 200 kilowatts windmill is part of the NASA/U.S. Department of Energy demonstration projects. Puerto Rico today is almost completely electrified in our rural areas, thanks to the U.S. Rural Electrical Administration something that is not true Practically anywhere else in the world. We in Puerto Rico had one of the first nuclear research and training centers in 1957.

But this is all existing and part history. What I would like to tell you about today is what we are doing at CEER in efforts to meet the energy needs of the future head on.

Our scientists, 2 mix of Americans and Puerto Ricans, are dedicating their time in the 1980s to find-

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ing the answers to a better energy system for our Island; a system that will take advantage of the natural resources that we have and that are there -- free -- for the asking. A system that will both be reliable and less costly for our children and our children? children.

Our areas of study and investigation at CEER can be broken down into the various natural resources that we enjoy.

?Thanks to being surrounded by the ocean and having almost a full year of sun, we are able to experiment year-round in Ocean Thermal Energy Conversion on the only fixed platform laboratory in the U.S. Our Laboratory platform which is a converted Landing Craft Utility anchored only a bare 2.5 kilometers offshore where our insular shelf falls off abruptly to some 1,800 meters. It is interesting to note that it is the deepest moored ship in the world -- in 3,400 feet of water.

OTEC, as you know, is a form of solar energy which is based on the difference in temperature water drawn from the ocean's depths -- in this case at some 1,000 meters where the temperature is about 5°C -- and the surface water, which varies from some 26°C in Winter to 29°C in late Autumn,

Although experimental OTEC plants were constructed as long ago as 1861 -- 100 years back -- in essence what is known today is that in a closed-cycle system

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warm sea water evaporates a high-pressure working fluid similar to that used in refrigerators, while the cold water from the ocean floor recondenses the fluid. This Process of evaporation and condensation in a closed eyele then turns a turbine, creating electrical energy

which can be transmitted to shore for distribution.

Puerto Rico, the Gulf Coast and the whole Caribbean basin have a large interest in OTEC because of its great potential to solve the energy problem of this part of the world.

Another way we in Puerto Rico are hoping to make use of our natural resources to produce electricity is through tropical grasses -- mainly sugarcane -- which we believe will become a source of solar-dried fuel in the future and enable us to reduce our dependence on petroleum by about 15 percent,

In our initial field harvest, a leading short-rotation grass produced the equivalent of one million BTUs of energy at a cost of only around \$1.60. In the second year of production, sugarcane yields amounted to \$1.70 per million BTUs as compared with the \$4 per million BTUs that Puerto Rico pays today in the form of imported bunker C residual fuel.

And that's not all. Not only would production of biomass lower our imported oil bill but it would also make a very important side contribution to our economy.

We Puerto Ricans are famous for many things --
from west side story to our being considered the best

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diamond polishers in the world, And one other thing everyone knows us for is our rum, most notably Don Q and Bacardi. Well, as our sugar cane lands have declined during recent decades so has the amount of molasses we have been able to produce, to the point where nearly all of it is currently imported, taking away needed jobs and raising our balance of payments. Biomass, however, in addition to producing low-cost energy, also produces molasses; enough, we believe, to serve our billion-dollar rum industry internally.

A third area where we are actively engaged in contributing to energy research at CEER is solar energy.

As any of you who have vacationed in Puerto Rico know, we are blessed with having sun practically every day of the year. As a result, our scientists have spent the last two years working on solar industrial process heat for industrial applications, testing the weatherability of various solar device materials, constructing a solar data network, doing comparison testing of commercial solar water heating units and taking a look at solar space cooling, air conditioning, solar agricultural applications, and photovoltaics. We are designing an energy integrated poultry farm and also developing a mathematical model of a demonstration solar pond. All these projects are funded at present by the U.S. Department of Energy.

It is important to mention here that there are more than 15,000 solar water heaters installed in Puerto Rico.

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And then there's the Ocean.

Our Marine Ecology Division spends long days and nights trying to uncover its secrets. Among the things we are attempting to determine is how do Puerto Rico's marine -- oceanic, estuarine and brackish -- ecosystems really work. And, most important, what are the effects of man-made contaminants on the ocean itself and the fish that live in it.

This type of investigation, while not directly involved with energy, is crucial to determining just how far man can go in using natural resources both

for energy and for production of needed materials.

Still another area that we at CEER concern ourselves with is Terrestrial Ecology where we believe our main function is to gain a fuller understanding of tropical ecosystems energy management, pest and pollution control and the ability of different ecosystems to assimilate perturbing elements and forces.

And to do this we have our own beautiful natural laboratory -- our rain forest at El Verde in the mountainous area in eastern Puerto Rico which, pride aside, is indeed gorgeous. Actually we have six different climatic regions in our Island.

We also spend our time trying to help others in environmental health through studies we have done, one, with the World Health Organization, resulted in ways of eliminating the schistosomiasis host. We

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have also worked with the government of the Dominican Republic on several occasions, have just recently concluded an energy study for the government of Panama,

and at present are conducting studies for the Caribbean Development Bank. We are also organizing a series of seminars: one will be held on Nuclear Energy in November, 1981; a Wind Seminar will be held in Barbados in December, 1981; and a Biomass Seminar is planned for April, 1982. In August 1 to 7, 1982, the Second National Conference on Renewable Energy Technologies will be held in San Juan. The meeting will be held as part of the XVII Conference of the Pan American Union of Engineering Societies. More than 2,000 participants are expected. The II Meeting of the Pan American Conference on Ocean Engineering will be held concurrently.

We at CEER have our own Training and Education

Division, and each year we take several groups of students under our scientific wings and train them in the sciences with an eye toward having them choose this career route. And, I'm proud to say, we seem to be succeeding. Of the group of high school juniors we trained two summers ago and who entered college last fall, 100 percent of them opted to begin a career in some branch of science, The Summer Science Student Program held at CEER in the last three years has been a complete success. Also the Summer Research Apprenticeship Program and Oak Ridge Associate Students have been outstanding. All of this directly or indirectly funded by DOE.

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If this brief summary of our activities at CEER seems like @ lot, I need only say that we hispanics are indeed an energetic people. Termed the poorhouse of the Caribbean just a scant few decades ago, Puerto Ricans have raised themselves by the bootstraps to where today many of our leaders in business, politics and academia are the offspring of people who perhaps did not even have a grade school education.

Our Universities are jammed full of young people actually more than 150,000, who are on their way to becoming the next generation's leaders, many of them in science and energy research. More and more top level jobs in our banking, manufacturing and science fields are being held by young, well-trained Puerto Ricans, and it has all happened in just a few, brief decades

I hope this has given you a quick overview of who we are and what we are up to in Puerto Rico both in general and specifically in terms of energy and environmental research.

Unlike our fellow hispanics on the mainland, we are not a minority on our Island but a majority, and our aim is to work together to turn Puerto Rico into

a showcase of scientific research that can be admired and looked to with pride by our fellow hispanics and all americans.

Before finishing, I would like to give special thanks to the U.S. Department of Energy for its con-

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tinued support of CEER, and especially to thank DOE officials of the Offices of Energy Research, Health and Environmental Research, Conservation and Renewable Energy, Industrial Relations, Minority Economic Impact, and the Oak Ridge Operations Office. I also want to thank other collaborators from NSF, EPA, DOA, AID, NASA,

ete. who have helped us through the years.

We have a good start on our journey and, hopefully with the continued moral and financial support of you people here at the Department of Energy, we will, in hispanic heritage weeks in the future, be known as the group which has helped solve all people's energy problems.

MUCHAS GRACIAS, SALUDOS AND THANK YOU

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