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Webb Center, Old Dominion University
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Hearing on Renewable Ocean Energy: Tides, Currents and Waves
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I am Neil Rondorf, from Science Applications International Corporation (SAIC). I have a 30 year background in maritime work and oceanography. For the past 10 years I have been working in maritime cables systems, ocean surveillance, observation and ocean environmental monitoring projects. For the last several years as an Executive Committee member of the International Cable Protection Committee I have observed first had the growth of maritime renewable energy projects around the world. I want to thank you for the opportunity to appear before this Committee to testify on a subject that I believe holds great promise for the future of our country and the world. I would like to review the basic principles of maritime renewable energy technologies, provide a summary of what I see happening in this field around the world, point out the need to develop this resource and how this could potentially benefit the management of other natural resources.

The maritime energy environment consists of four physical ocean characteristics that can be harvested by mechanical devices that convert motion into useable electrical energy. These characteristics are (1) wind, (2) waves, (3) tides, and (4) currents. These sources of energy are interrelated in the ocean environment and all four should be considered in evaluating this developing industry, although their predominance is localized.

Previous engineering concepts and designs focused on harvesting energy with a mechanical device optimized for a single ocean characteristic. The engineering concepts being evaluated today propose hybrid devices that capture energy from multiple sources in the ocean environment. This new approach creates methodologies that are more efficient, and that reduce the physical footprint for commercial maritime energy projects. It promotes cooperation among users of our ocean space and respects the communities multi-use view of the environment.

Of these marine renewable energy generating technologies, offshore wind energy is the most mature, with its basis in the established terrestrial wind power industry. European nations have aggressively moved the wind energy industry offshore and have successfully deployed and are operating commercial-scale installations. Europeans view these offshore wind farms as progressive and positive examples of their environmental consciousness.

The next applicable maritime renewable energy technology is wave generation, based on the principle of converting wave motion through a floating device such as a buoy or other mechanism. The mechanical device converts the wave motion into electricity by one of several technologies that have already been developed for commercial products. Several devices are currently or will be installed along the coasts of the United Kingdom and Portugal to supply commercial quantities of electrical power.

Finally, there are strong efforts to develop and prove underwater turbine devices for conversion of tidal energy and for deep ocean currents, such as the Gulf Stream off the eastern continental shelf. These same concepts can be applied to converting river streams to useable energy.

Global energy demands continue to increase as nations modernize and their economies expand. The Japanese Agency for Natural Resources and Energy recently forecast a 21% increase in world energy demand between 2010 and 2020. Numerous published reports predict similar increases in the world energy market. The numbers vary and time scales differ, but the magnitude is similar. According to the BP Statistical Review of World Energy 2006, China's energy demand averaged a greater than 10% annual increase in each of the last three years. That's more than a 30% increase in less time than my son can complete college.

There are 14 countries worldwide that are now operating, installing or developing maritime renewable energy projects (Australia, Canada, China, Denmark, France, Germany, India, Japan, New Zealand, Norway, Portugal, Spain, Sweden and the UK).

The energy pressures on our economy, assuring energy security for our homeland, and realizing energy independence for our country demands that we develop the full spectrum of energy sources. Just as a good financial planner recommends diversification in any investment portfolio, the same principle applies for energy development. Recent events have demonstrated vulnerabilities in our energy infrastructure, with associated widespread economic and political issues. A diverse energy portfolio including marine renewable energy sources reduces risk from natural and other disasters, and addresses the economic and societal obstacles that would stem from single point failure in the energy sector.

Clean energy is a hot topic, and clean air is a national and global concern. The development of maritime renewable energy technologies provides a viable means of increasing our energy resources without an associated increase in air pollution, and in fact, capitalizes on the natural characteristics of the atmosphere. There are no known negative environmental by-products from marine renewable energy production.

Presently, the less-polluting fuel resource of choice is natural gas, which is still a carbon-based fuel, and in the last 5 years the price per cubic foot of has nearly doubled. This not only economically impacts the cost of cleaner energy, but has put tremendous pressure on sectors of the manufacturing industry where certain processes and chemical elements of natural gas are essential for product lines. The development of non-polluting ocean renewable energies has the potential to take some pressure off of the natural gas industry and use that resource where it is essential for product development.

A strong example of a country with energy diversification is Brazil. The national goal was to institute energy policies that brought the nation energy independence. Their strategy included a full spectrum of energy generation technologies from offshore oil and gas to ethanol and other biofuels. The US energy future should also institute a full spectrum of technologies, including offshore renewable energy development.

Several key factors are necessary for establishing an environment that will support the effective development of marine renewable energy technologies. Regulation of the

marine renewable energy industry needs to be flexible to allow for early growth and modernization. This industry is in an early technological development stage, and significant engineering advancements can be anticipated. If offshore regulation is too narrow in scope or shortsighted in vision, it would greatly hinder the effective and efficient development of these technologies.

A favorable investment climate is necessary as investors will not be willing to back projects that are deemed too risky. This requires full engagement of all the stakeholders during device demonstration and testing. Such stakeholders include coastal communities, offshore industries, local ports, federal and state regulators, to name just a few. Incentives must be created to stimulate investment as well as education and engineering innovation that will help shape a secure energy future.

The emerging science and application of ocean observatory technology can be developed in parallel with maritime renewable energy technologies. The U.S. National Science Foundation, Canadian, European and Japanese science agencies, and the United Nations have all supported ocean observatory development. The idea is to install long-term environmental monitoring systems in areas of specific scientific interest to monitor the unique biological, chemical and geophysical characteristics of the ocean environment. Offshore renewable energy structures could easily provide a long-term platform for hosting environmental monitoring systems, providing an informational baseline and allowing comparison of environmental factors over time and space.

There are many areas of maritime renewable energy research that need to be initiated, from assessments of marine biomass to marine geophysical evaluations. Maritime renewable energy technology development should be engineered to match the environment to ensure efficient use of technology in the ocean space. Other ocean stakeholders should also be involved in planning and development to ensure the most effective co-use of ocean space.

The state of Virginia has created the Virginia Coastal Energy Research Center (N\VCERC) to begin to address these kinds of questions and issues. With such an approach to engineering solutions, the United States could become a leader in maritime renewable energy technology development. In order to attract the talent and leadership necessary to be a world leader in energy for the future, R&D dollars need to be directed at these fields along with a long-term strategy for success.

The increasing global demand for energy will require additional energy production. The advent of affordable, reliable maritime renewable energy technologies for export to a hungry world market is very attractive. The potential to boost US energy technology exports could provide a very strong future stimulus for US industry. In addition, these new fields of renewable energy technology will have a positive impact on colleges and universities, stimulating new fields of study on college campuses across the nation.

When comparing the renewable energy industry to an industry such as gas, oil or nuclear power, it is a disadvantaged point of view. Although the capital costs of these mature

industries are significant, the oil and gas industries have been developing for over 100 years, and nuclear power was developed as a defense program long before it had commercial application. Yet today, with the first offshore wind farms only a few years old, they are being compared to industry sectors that are well developed, heavily subsidized, and use mature technologies. This is about more than profitability of future energy projects and includes ensuring energy sources are available for future generations.

The energy future in now. I sincerely hope Congress recognizes the need for investment in this promising energy source.