Dr. Patrick G. Hatcher

Batten Endowed Chair in Physical Sciences, Professor of Chemistry and Biochemistry

Old Dominion University

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Renewable Energy in the Coastal Environment

The era of increased consumption of fossil fuels brought about by increasing energy demands of a global economy is upon us. Associated with this increased global appetite for conventional fuels is the realization that the environment cannot longer sustain rising carbon dioxide levels. Aside from the increased costs of a dwindling supply of fossil fuels, our dependence on unstable governments for supplying many of these fuels, and the nearly complete dependence on non-renewable fossil energy, it is time to seriously examine, with the commitment like that of the Manhatten Project, the feasibility of developing an energy policy that incorporates more renewable resources. One can make analogies to economic investment strategies where a balanced portfolio helps to mitigate economic downturns due to unstable investments. A balanced energy portfolio would serve to prevent an energy “disaster” should the source of a conventional fossil fuel be shut down or depleted. Thus, increased reliance on renewable energy and diversification of energy sources is a policy which provides the greatest degree of stability and self-sufficiency. Brazil is country that has implemented this policy successfully and is making great strides towards economic growth. The United States and the State of Virginia need to consider seriously the steps towards a diversified energy portfolio- the purpose of this hearing.

The US coastal zone and, in particular, that of Virginia offer many attractive aspects for energy production, both fossil fuel-related and renewable. The State of Virginia has approved legislation creating the Virginia Coastal Energy Research Consortium (VCERC) whose mission is to be a Center of Excellence for research in the development, use, and impact of expanding coastal energy resources. Old Dominion University will serve as the lead institution for VCERC which includes other Virginia Universities as partners (Virginia Tech, Norfolk State, James Madison, William & Mary). Efforts are underway to launch VCERC activities. The following is taken from the approved legislative amendments to the 2006 budget document for the State of Virginia:

§ 67-701. Functions, powers, and duties of the Research Consortium.
The Coastal Energy Research Consortium shall serve as an interdisciplinary study, research, and information resource for the Commonwealth on coastal energy issues. As used in this chapter, "coastal energy" includes wave or tidal action, currents, offshore winds, thermal differences, and methane hydrates. The Research Consortium shall (i) consult with the General Assembly, federal, state, and local agencies, nonprofit organizations, private industry and other potential users of coastal energy research; (ii) establish and administer agreements with other universities of the Commonwealth to carry out research projects relating to the feasibility of recovering fuel gases from methane hydrates and increasing the Commonwealth's reliance on other forms of coastal energy; (iii) disseminate new information and research results; (iv) apply for grants made available pursuant to federal legislation, including but not limited to the federal Methane Hydrate Research and Development Act of 1999, P.L. 106-193 and from other sources; and (v) facilitate the application and transfer of new coastal energy technologies.

There are numerous offshore energy resources that will become the focus of VCERC in years to come and the current strategy is one consistent with a diversified portfolio of energy generation.

Fossil energy:
Offshore drilling for natural gas and the presence of gas hydrates on the Blake Ridge are two fossil-related energy sources near the Virginia coastal zone. The methane gas hydrates are estimated to harbor sufficient energy to sustain the entire US energy consumption in 1989 seventy times over. There are some significant issues associated with recovering these resources for energy production but research is desperately needed to evaluate the feasibilities associated with recovery of methane gas hydrates. Knowledge of the stability of the seabed for offshore platforms, the wave and current regimes on the VA continental shelf, and development of technology that allows exploration for oil and gas and for recovery of methane gas hydrates are but some of the research areas anticipated.

Wind energy:
Perhaps the most promising energy technology that is feasible for development is wind-driven turbines located on fixed or moored platforms in offshore areas. Others at the hearing will provide more detailed testimony regarding the details of this technology. However, what is envisioned is offshore wind farms capable of generating sufficient energy to provide 20% of Virginia's electricity consumption needs. What makes this renewable energy alternative attractive is the existence of favorable sustained offshore wind and the fact that wind turbine technology is quite mature.

Waves and Current energy:
Researchers have long recognized that a mass of water, either from wave activity or currents, can be used to drive submerged turbines and generate electricity. With the recent development of efficient water turbines, development of this type of energy production has become quite feasible. Furthermore, the activity takes place in the sub-surface, providing for less objectionable invisible structures. Research is needed to determine the feasibility for implementing such technology in VA.

Tidal energy:
Harnessing tidal energy has long been a subject of research and development, especially in areas of the world possessing large tidal amplitudes (e.g., Bay of Fundy). VA is not particularly attractive as a region for development of tidal energy production because it does not possess tidal excursions of the minimum 16 ft required for efficient harnessing of tidal energy.

Coastal Biomass energy:
Perhaps the least publicized form of biomass energy is that which can be obtained from algae, both microalgae and macroalgae. The biomass can be efficiently converted to biodiesel and utilized for internal combustion engines. One attractive feature of algal biomass over conventional higher plant biomass is that algal production rates can be more than 5 times those of land plants. Other features are that one need not sacrifice crop-producing land for biomass production as the algae are grown in ponds. Virginia is ideally suited for coastal pond algal production as there are vast areas of coastline where suitable sites could be located. Furthermore, one could combine algal production with electric power generation, using the waste carbon dioxide to fuel algal production.

Finally, along the coastline there is an abundant supply of another critical ingredient for algal biomass- sunlight.

Estimates have been made for the cost of algal biomass production and they range from $60 to $100 per barrel of oil equivalent. They require substantial amounts of pond areas. For example, generating 7.5 billion gallons of biodiesel requires approximately 500,000 acres of pond surface area. What really makes algal biomass feasible for biodiesel production is the high hydrocarbon contents of many forms of algae, some up to 50% of their dry weight, and much of the biomass is convertible to biodiesel by a pyrolytic scheme. Research is needed to evaluate algal biodiesel as a viable renewable energy source for coastal areas of Virginia.

In summary, it is appropriate to re-emphasize that a diversified portfolio of energy production alternatives are needed for the future sustainability of Virginia's and the nation's economy. Promoting the development of renewable and non-renewable resources in Virginia's coastal zone through research is a timely topic that will be the focus of VCERC activities.