MARINE ENERGY RESEARCH AND DEVELOPMENT ACT OF 2019

OCTOBER 23, 2019.—Ordered to be printed

Ms. MURKOWSKI, from the Committee on Energy and Natural Resources, submitted the following

R E P O R T

[To accompany S. 1821]

[Including cost estimate of the Congressional Budget Office]

The Committee on Energy and Natural Resources, to which was referred the bill (S. 1821) to amend the Energy Independence and Security Act of 2007 to provide for research on, and the development and deployment of, marine energy, and for other purposes, having considered the same, reports favorably thereon with amendments and recommends that the bill, as amended, do pass.

AMENDMENTS

The amendments are as follows:

On page 6, line 14, strike “and”.
On page 7, line 2, strike “abroad.” and insert “abroad; and”.
On page 7, between lines 2 and 3, insert the following:

“(14) to assist in the development of technology necessary to support the use of marine energy—
“(A) for the generation and storage of power at sea, including in applications relating to—
“(i) ocean observation and navigation;
“(ii) underwater vehicle charging;
“(iii) marine aquaculture;
“(iv) production of marine algae; and
“(v) extraction of critical minerals and gases from seawater;
“(B) for the generation and storage of power to promote the resilience of coastal communities, including in applications relating to—
“(i) desalination;
“(ii) disaster recovery and resilience; and
“(iii) community microgrids in isolated power systems; and
“(C) in any other applications, as determined by the Secretary.

On page 9, line 17, strike “$150,000,000” and insert “$160,000,000”.

On page 9, after line 18, insert the following:

SEC. 7. STUDY OF ENERGY INNOVATION IN MARINE TRANSPORTATION AND INFRASTRUCTURE RESILIENCE.

(a) In General.—The Secretary of Energy, in consultation with the Secretary of Transportation and the Secretary of Commerce, shall conduct a study to examine opportunities for research and development in advanced marine energy technologies—
(1) to support the maritime transportation sector to enhance job creation, economic development, and competitiveness;
(2) to support associated maritime energy infrastructure, including infrastructure that serves ports, to improve system resilience and disaster recovery; and
(3) to enable scientific missions at sea and in extreme environments, including the Arctic.

(b) Report.—Not later than 1 year after the date of enactment of this Act, the Secretary of Energy shall submit to the Committee on Energy and Natural Resources of the Senate and the Committee on Science, Space, and Technology of the House of Representatives a report that describes the results of the study conducted under subsection (a).

PURPOSE

The purpose of S. 1821 is to amend the Energy Independence and Security Act of 2007 (EISA, Public Law 110–140) to provide for research on, and the development and deployment of, marine energy.

BACKGROUND AND NEED

Marine energy, as defined in S. 1821, is a form of hydropower that generates energy from free-flowing waters, such as waves, currents, estuaries, or tidal areas, as well as from the free-flowing water in a river, lake, stream, or manmade channel. Marine energy differs from conventional hydropower in that it generates electricity without the use of a dam or other impoundment.

The United States has significant wave, tidal, current, and in-stream energy resource potential. Marine energy could provide a renewable, clean source of energy to the nearly 30 percent of the population living in coastline counties. According to resource assessments in the Department of Energy’s (DOE or Department) 2015 Quadrennial Technology Review, the total U.S. technical re-
source potential for marine energy is 1250 to 1850 terawatt-hours of generation per year.

Research and development (R&D) into these technologies is still in its early stages. The first grid-connected wave energy technology is located in Hawaii at the Navy’s Wave Energy Test Site, off the coast of Marine Corps Base Hawaii at Kaneohe Bay, which is run in collaboration with DOE’s Hawaii National Marine Renewable Energy Center.

In addition, a consortium of universities is developing a test site to facilitate the advancement of wave energy converters off the coast of Newport, Oregon, as part of DOE’s Northwest National Marine Renewable Energy Center. The project consists of two sites—PacWave North, located in State waters, and PacWave South, located in Federal waters. Oregon State University submitted a final license application to the Federal Energy Regulatory Commission on May 30, 2019, for the PacWave South facility.

S. 1821 is intended to help commercialize marine energy technologies through an R&D program to accelerate the role of marine energy production in domestic energy supply and the establishment of National Marine Energy Centers, which advance research, development, and demonstration of marine energy technologies.

LEGISLATIVE HISTORY

S. 1821 was introduced by Senator Wyden, for himself and Senators Merkley, King, Schatz, and Reed, on June 12, 2019. Senator Hirono was later added as a cosponsor. The Subcommittee on Energy held a hearing on the measure on September 11, 2019.

Companion legislation, H.R. 3203, was introduced in the House of Representatives by Representative Deutch (D–FL) on June 11, 2019, and referred to the Science, Space, and Technology Committee.

During the 115th Congress, Senator Wyden introduced similar legislation, S. 1036, on May 3, 2017. Senators Hirono, King, Merkley, Schatz, and Reed were cosponsors. Similar language was included in S. 1460, the Energy and Natural Resources Act of 2017. S. 1460 was introduced by Senators Murkowski and Cantwell on June 28, 2017, and placed directly on the Legislative Calendar (Cal. 162).

During the 114th Congress, Senator Wyden introduced similar legislation, S. 1058, for himself and Senators King, Merkley, and Schatz, on April 22, 2015. The Committee on Energy and Natural Resources held a hearing on the bill on May 19, 2015 (S. Hrg. 114–118). A similar measure was included in S. 2012, the Energy Policy Modernization Act of 2016. An original bill, S. 2012 was reported by the Committee on Energy and Natural Resources on July 30, 2015—and passed by the Senate, as amended, on April 26, 2016, by a vote of 85–12.

Companion legislation, H.R. 2220, was introduced in the House of Representatives by Representative Deutch (D–FL) on May 1, 2015, and referred to the Science, Space, and Technology Committee.

During the 113th Congress, Senators Wyden and Murkowski introduced similar legislation, S. 1419. Senators King, Merkley, and Schatz were later added as cosponsors. On August 1, 2013, the Subcommittee on Water and Power held a hearing on the bill on
February 27, 2014 (S. Hrg. 113–284), and the measure was reported from the Energy and Natural Resources Committee on November 13, 2014 (S. Rept. 113–294).

Companion legislation, H.R. 5335, was introduced in the House of Representatives by Representative Deutch on July 31, 2014, and referred to the Science, Space, and Technology Committee and the Energy and Commerce Committee.

The Senate Committee on Energy and Natural Resources met in open business session on September 25, 2019, and ordered S. 1821 favorably reported, as amended.

COMMITTEE RECOMMENDATION

The Senate Committee on Energy and Natural Resources, in open business session on September 25, 2019, by a majority voice vote of a quorum present, recommends that the Senate pass S. 1821, if amended as described herein. Senators Barrasso, Risch, and Lee asked to be recorded as voting no.

COMMITTEE AMENDMENTS

During its consideration of S. 1821, the Committee adopted several amendments. The amendments add generation and storage of power at sea as an authorized activity for the marine energy R&D program at DOE, and requires the Secretary of Energy (Secretary) to conduct a study to examine the opportunities for research on maritime energy and transportation infrastructure. An amendment was also adopted to increase the authorization amount for fiscal years (FYs) 2020 and 2021 from $150 million to $160 million.

SECTION-BY-SECTION ANALYSIS

Section 1. Short title

Section 1 sets forth the short title of the bill.

Section 2. Purpose

Section 2 states that the bill’s purpose is to support marine energy programs that promote R&D of increased marine energy at reduced costs and improved environmental outcomes, as well as grid stability and job creation.

Section 3. Definition of marine energy

Section 3 amends section 632 of EISA to replace the defined term “marine and hydrokinetic renewable energy” with a new definition of “marine energy.” It also makes conforming changes to EISA.

Section 4. Marine energy research and development

Section 4 amends section 633 of EISA to replace the existing marine and hydrokinetic renewable energy R&D program with the new marine energy R&D program.

The revised subsection 633(a) directs the Secretary, acting through the Director of the Water Power Technologies Office, to carry out a program to accelerate marine energy production in the U.S. energy supply. The subsection specifies that the program shall also foster research, development, demonstration, and commercial application of technology, including programs to accomplish the fol-
The revised subsection 633(b) requires the Secretary to carry out the program in accordance with the cost sharing requirements of sections 988 and 989 of the Energy Policy Act of 2005 (EPAct '05, Public Law 109–58).

Section 5. National marine energy centers

Section 5 amends section 634 of EISA to authorize the Secretary to establish National Marine Energy Centers (Centers).

The revised section 634(a) directs the Secretary to award grants to institutions of higher education to maintain existing Centers and establish new Centers. This section further specifies criteria for the Secretary to consider in selecting locations for new Centers, including hosting an existing marine energy R&D program in coordination with an engineering program and having access to marine resources.

The revised section 634(b) states that the Centers will coordinate with the Department, the National Laboratories, and other Centers to advance research, development, and demonstration of marine energy technologies, support testing of such technologies, and disseminate information on best practices for marine energy resources.

The revised subsection 634(c) requires the Secretary to carry out the program in accordance with the cost sharing requirements of section 988(b)(4) of EPAct '05.

Section 6. Authorization of appropriations

Section 6 amends section 636 of EISA to authorize $160 million for each of FYs 2020 and 2021 to carry out the activities in this bill.

Section 7. Study of energy innovation in marine transportation and infrastructure resilience

Section 7(a) directs the Secretary, in consultation with the Secretaries of Transportation and Commerce, to conduct a study to examine opportunities for R&D in advanced marine energy technologies to enhance economic development, support infrastructure development, and enable scientific missions at sea and in extreme environments.
Section 7(b) requires the Secretary to submit a report to the Senate Energy and Natural Resources Committee and the House Science, Space, and Technology Committee describing the results of the study within one year of enactment.

COST AND BUDGETARY CONSIDERATIONS

The following estimate of the costs of this measure has been provided by the Congressional Budget Office:

S. 1821, Marine Energy Research and Development Act of 2019
As ordered reported by the Senate Committee on Energy and Natural Resources on September 25, 2019

<table>
<thead>
<tr>
<th>By Fiscal Year, Millions of Dollars</th>
<th>2020</th>
<th>2020–2024</th>
<th>2020–2029</th>
</tr>
</thead>
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<tr>
<td>Direct Spending (Outlays)</td>
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<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Revenues</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Increase in the Deficit</td>
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<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Spending Subject to Appropriation (Outlays)</td>
<td>32</td>
<td>299</td>
<td>320</td>
</tr>
</tbody>
</table>

S. 1821 would reauthorize a Department of Energy (DOE) program aimed at accelerating the introduction of marine energy into the U.S. energy supply and fostering the research, development, and testing of marine energy technologies. Sources of marine energy include energy from waves, tides, currents, free-flowing hydrokinetic water, and differentials in ocean temperature. The bill also would expand a DOE-sponsored grant program that provides funding to institutions of higher education for performing research, development, and testing activities at National Marine Energy Centers. For those programs, S. 1821 would authorize the appropriation of $160 million annually for fiscal years 2020 and 2021. In 2019 the Congress appropriated $70 million to research marine and hydrokinetic technologies.

Based on historical spending for similar activities, and assuming the appropriation of the authorized amounts, CBO estimates that implementing S. 1821 would cost $299 million over the 2020–2024 period and $21 million after 2024. The costs of the legislation (detailed in Table 1) would fall within budget function 270 (energy).

**TABLE 1.—ESTIMATED INCREASES IN SPENDING SUBJECT TO APPROPRIATION UNDER S. 1821**

<table>
<thead>
<tr>
<th>Authorization</th>
<th>160</th>
<th>160</th>
<th>0</th>
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<th>0</th>
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<th>0</th>
<th>320</th>
<th>320</th>
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<tbody>
<tr>
<td>Estimated Outlays</td>
<td>32</td>
<td>80</td>
<td>88</td>
<td>64</td>
<td>35</td>
<td>16</td>
<td>5</td>
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<td>0</td>
<td>299</td>
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</table>
The CBO staff contact for this estimate is Aaron Krupkin. The estimate was reviewed by H. Samuel Papenfuss, Deputy Assistant Director for Budget Analysis.

REGULATORY IMPACT EVALUATION

In compliance with paragraph 11(b) of rule XXVI of the Standing Rules of the Senate, the Committee makes the following evaluation of the regulatory impact which would be incurred in carrying out S. 1821. The bill is not a regulatory measure in the sense of imposing Government-established standards or significant economic responsibilities on private individuals and businesses.

No personal information would be collected in administering the program. Therefore, there would be no impact on personal privacy.

Little, if any, additional paperwork would result from the enactment of S. 1821, as ordered reported.

CONGRESSIONALLY DIRECTED SPENDING

S. 1821, as ordered reported, does not contain any congressionally directed spending items, limited tax benefits, or limited tariff benefits as defined in rule XLIV of the Standing Rules of the Senate.

EXECUTIVE COMMUNICATIONS

The testimony provided by the Department of Energy at the September 11, 2019, hearing on S. 1821 follows:

TESTIMONY OF UNDER SECRETARY OF ENERGY MARK W. MENEZES, U.S. DEPARTMENT OF ENERGY

INTRODUCTION

Chairman Cassidy, Ranking Member Heinrich, and Members of the Subcommittee, it is a privilege and an honor to serve at the Department of Energy (DOE or the Department), which is tasked with, among other important responsibilities: overseeing the Nation's nuclear energy research and development programs; creating and sustaining American leadership in the transition to a global clean energy economy; working effectively with the States on our Nation's energy challenges; and supporting our current, and developing our Nation's future, energy workforce.

Thank you for the opportunity to testify today on behalf of the Department regarding legislation pertinent to DOE that is now pending in the Senate.

I have been asked to testify on nine (9) bills today. The Administration continues to review all of these bills. I appreciate the ongoing bipartisan efforts to address our Nation's energy challenges and I look forward to working with the Committee.

ENERGY EFFICIENCY AND RENEWABLE ENERGY

The mission of DOE's Office of Energy Efficiency and Renewable Energy (EERE) is to create and sustain American leadership in the transition to a global clean energy economy. EERE has, among other strategic goals, the aim
of improving the energy efficiency of our nation's homes, buildings, and industries; stimulating the growth of a thriving domestic clean energy manufacturing industry; and increasing the generation of electric power from renewable sources.

S. 1821—Marine Energy Research and Development Act

As the bill indicates, the Water Power Technologies Office (WPTO) involves the Department's program to accelerate the introduction of marine renewable energy production into the U.S. energy supply. The program's work in marine renewable energy focuses on addressing scientific and engineering challenges that facilitate breakthroughs that have broad, industry-wide benefits. WPTO has developed strategic partnerships across the industry and into other scientific, engineering, and industrial disciplines to leverage and focus resources on long-term marine renewable energy goals.

The makes provision for National Marine (Renewable) Energy Centers. The program works closely with the three existing National Marine Renewable Energy Centers (Pacific Marine Energy Center, Hawaii National Marine Renewable Energy Center, and Southeast National Marine Renewable Energy Center) and will continue to expand research, development, and testing activities for marine renewable energy.

The Department will continue to review the legislation and looks forward to working with Congress as the legislative process moves forward. At this time, the Department would like to offer one technical adjustment: The marine renewable energy industry uses the term “marine renewable energy” (MRE) as opposed to “marine energy.” The Department recommends using the term “marine renewable energy” for consistency purposes.

CONCLUSION

Thank you again for the opportunity to be here today. The Department appreciates the ongoing bipartisan efforts to address our Nation's energy challenges, and looks forward to working with the Committee on the legislation on today's agenda and any future legislation. I would be happy to answer your questions.

CHANGES IN EXISTING LAW

In compliance with paragraph 12 of rule XXVI of the Standing Rules of the Senate, the changes in existing law made by S. 1821, as reported, are shown as follows (existing law proposed to be omitted is enclosed in black brackets, new matter is printed in italic, existing law in which no change is proposed is shown in roman):
ENERGY INDEPENDENCE AND SECURITY ACT OF 2007

Public Law 110–140, as Amended

TITLE VI—ACCELERATED RESEARCH AND DEVELOPMENT

Subtitle C—Marine [and Hydrokinetic Renewable] Energy Technologies

SEC. 631. SHORT TITLE.
This subtitle may be cited as the “Marine [and Hydrokinetic Renewable] Energy Research and Development Act”.

SEC. 632. DEFINITION.
For purposes of this subtitle, the term “marine and hydrokinetic renewable energy” means electrical energy from—

1. waves, tides, and currents in oceans, estuaries, and tidal areas;
2. free flowing water in rivers, lakes, and streams;
3. free flowing water in man-made channels; and
4. differentials in ocean temperature (ocean thermal energy conversion).

The term “marine and hydrokinetic renewable energy” does not include energy from any source that uses a dam, diversionary structure, or impoundment for electric power purposes.

SEC. 632. DEFINITION OF MARINE ENERGY.
In this subtitle, the term “marine energy” means energy from—

1. waves, tides, and currents in oceans, estuaries, and tidal areas;
2. free-flowing hydrokinetic water in rivers, lakes, and streams;
3. free-flowing hydrokinetic water in man-made channels; and
4. differentials in ocean temperature or ocean thermal energy conversion.

SEC. 633. MARINE AND HYDROKINETIC RENEWABLE ENERGY RESEARCH AND DEVELOPMENT.

(a) In General.—The Secretary, in consultation with the Secretary of the Interior and the Secretary of Commerce, acting through the Under Secretary of Commerce for Oceans and Atmosphere, shall establish a program of research, development, demonstration, and commercial application to expand marine and hydrokinetic renewable energy production, including programs to—

1. study and compare existing marine and hydrokinetic renewable energy technologies;
2. research, develop, and demonstrate marine and hydrokinetic renewable energy systems and technologies;
reduce the manufacturing and operation costs of marine and hydrokinetic renewable energy technologies;
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Energy Regulatory Commission, shall carry out a program to accelerate the introduction of marine energy production into the United States energy supply, giving priority to technologies most likely to lead to commercial utilization, while fostering accelerated research, development, demonstration, and commercial application of technology, including programs—

(1) to assist technology development on a variety of scales, including full-scale prototypes, to improve the components, processes, and systems used for power generation from marine energy resources;

(2) to establish and expand critical testing infrastructure and facilities necessary—
   (A) to cost-effectively and efficiently test and prove marine energy devices; and
   (B) to accelerate the technological readiness and commercialization of those devices;

(3) to support efforts to increase the efficiency of energy conversion, lower the cost, increase the use, improve the reliability, and demonstrate the applicability of marine energy technologies by participating in demonstration projects;

(4) to investigate variability issues and the efficient and reliable integration of marine energy with the utility grid;

(5) to identify and study critical short- and long-term needs to create a sustainable marine energy supply chain based in the United States;

(6) to increase the reliability and survivability of marine energy technologies;

(7) to verify the performance, reliability, maintainability, and cost of new marine energy device designs and system components in an operating environment;

(8) to consider the protection of critical infrastructure, such as adequate separation between marine energy devices and projects and submarine telecommunications cables, including consideration of established industry standards;

(9)(A) to coordinate the programs carried out under this section with, and avoid duplication of activities across, programs of the Department and other applicable Federal agencies, including National Laboratories; and

   (B) to coordinate public-private collaboration in carrying out the programs under this section;

(10) to identify opportunities for joint research and development programs and the development of economies of scale between—
   (A) marine energy technologies; and
   (B) other renewable energy and fossil energy programs, offshore oil and gas production activities, and activities of the Department of Defense;

(11) to identify, in conjunction with the Secretary of Commerce, acting through the Under Secretary of Commerce for Oceans and Atmosphere, and other relevant Federal agencies as appropriate, the potential environmental impacts, including potential impacts on fisheries and other marine resources, of marine energy technologies, measures to prevent adverse impacts, and technologies and other means available for monitoring and determining environmental impacts;
(12) to identify, in conjunction with the Secretary of the Department in which the United States Coast Guard is operating, acting through the Commandant of the United States Coast Guard, the potential navigational impacts of marine energy technologies and measures to prevent adverse impacts on navigation;

(13) to support in-water technology development with international partners using existing cooperative procedures (including memoranda of understanding)—

(A) to allow cooperative funding and other support of value to be exchanged and leveraged; and

(B) to encourage international research centers and international companies to participate in the development of marine energy technology in the United States and to encourage United States research centers and companies to participate in marine energy projects abroad; and

(14) to assist in the development of technology necessary to support the use of marine energy—

(A) for the generation and storage of power at sea, including in applications relating to—

(i) ocean observation and navigation;
(ii) underwater vehicle charging;
(iii) marine aquaculture;
(iv) production of marine algae; and
(v) extraction of critical minerals and gasses from seawater;

(B) for the generation and storage of power to promote the resilience of coastal communities, including in applications relating to—

(i) desalination;
(ii) disaster recovery and resilience;
(iii) community microgrids in isolated power systems; and

(C) in any other applications, as determined by the Secretary.

(b) Cost Sharing and Merit Review.—The Secretary shall carry out the program under this section in accordance with sections 988 and 989 of the Energy Policy Act of 2005 (42 U.S.C. 16352, 16353).

SEC. 634. NATIONAL MARINE RENEWABLE ENERGY RESEARCH, DEVELOPMENT, AND DEMONSTRATION ENERGY CENTERS.

(a) Centers.—The Secretary shall award grants to institutions of higher education (or consortia thereof) for the establishment of 1 or more National Marine Renewable Energy Research, Development, and Demonstration Centers. In selecting locations for Centers, the Secretary shall consider sites that meet one of the following criteria:

(1) Hosts an existing marine renewable energy research and development program in coordination with an engineering program at an institution of higher education.

(2) Has proven expertise to support environmental and policy-related issues associated with harnessing of energy in the marine environment.

(3) Has access to and utilizes the marine resources in the Gulf of Mexico, the Atlantic Ocean, or the Pacific Ocean. The Secretary may give special consideration to historically black
colleges and universities and land grant universities that also meet one of these criteria. In establishing criteria for the selection of the Centers, the Secretary shall consult with the Secretary of Commerce, acting through the Under Secretary of Commerce for Oceans and Atmosphere, on the criteria related to ocean waves, tides, and currents including those for advancing wave forecasting technologies, ocean temperature differences, and studying the compatibility of marine renewable energy technologies and systems with the environment, fisheries, and other marine resources.

(b) PURPOSES.—The Centers shall advance research, development, demonstration, and commercial application of marine renewable energy, and shall serve as an information clearinghouse for the marine renewable energy industry, collecting and disseminating information on best practices in all areas related to developing and managing enhanced marine renewable energy systems resources.

(a) CENTERS.—

(1) IN GENERAL.—The Secretary shall award grants to institutions of higher education for

(A) the continuation and expansion of research, development, and testing activities at National Marine Energy Centers established as of January 1, 2019; and

(B) the establishment of new National Marine Energy Centers.

(2) CRITERIA.—In selecting locations for new National Marine Energy Centers to be established under paragraph (1)(B), the Secretary shall consider sites that meet one of the following criteria:

(A) The new Center hosts an existing marine energy research and development program in coordination with an engineering program at an institution of higher education.

(B) The new Center has proven expertise to support environmental and policy-related issues associated with the harnessing of energy in the marine environment.

(C) The new Center has access to and uses marine resources.

(b) PURPOSES.—The National Marine Energy Centers shall coordinate with other National Marine Energy Centers, the Department, and the National Laboratories—

(1) to advance research, development, and demonstration of marine energy technologies;

(2) to support in-water testing and demonstration of marine energy technologies, including facilities capable of testing—

(A) marine energy systems of various technology readiness levels and scales;

(B) a variety of technologies in multiple test berths at a single location; and

(C) arrays of technology devices; and

(3) to serve as information clearinghouses for the marine energy industry by collecting and disseminating information on best practices in all areas relating to developing and managing marine energy resources and energy systems.
(c) **COST SHARING.**—The Secretary shall carry out the program under this section in accordance with section 988(b)(4) of the Energy Policy Act of 2005 (42 U.S.C. 16352(b)(4)).

(d) **DEMONSTRATION OF NEED.**—When applying for a grant under this section, an applicant shall include a description of why Federal support is necessary for the Center, including evidence that the research of the Center will not be conducted in the absence of Federal support.

* * * * *

**SEC. 636. AUTHORIZATION OF APPROPRIATIONS.**

There are authorized to be appropriated to the Secretary to carry out this subtitle [[$50,000,000 for each of the fiscal years 2008 through 2012] $160,000,000 for each of fiscal years 2020 and 2021, except that no funds shall be appropriated under this section for activities that are receiving funds under section 931(a)(2)(E)(i) of the Energy Policy Act of 2005 (42 U.S.C. 16231(a)(2)(E)(i)).

* * * * *