

SOLAR FUELS INNOVATION ACT

—————
JULY 11, 2016.—Committed to the Committee of the Whole House on the State of
the Union and ordered to be printed
—————

Mr. SMITH of Texas, from the Committee on Science, Space, and
Technology, submitted the following

R E P O R T

together with

ADDITIONAL VIEWS

[To accompany H.R. 5638]

[Including cost estimate of the Congressional Budget Office]

The Committee on Science, Space, and Technology, to whom was referred the bill (H.R. 5638) to provide for the establishment at the Department of Energy of a Solar Fuels Basic Research Initiative, having considered the same, report favorably thereon with an amendment and recommend that the bill as amended do pass.

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The amendment is as follows:

Strike all after the enacting clause and insert the following:

SECTION 1. SHORT TITLE.

This Act may be cited as the “Solar Fuels Innovation Act”.

SEC. 2. SOLAR FUELS BASIC RESEARCH INITIATIVE.

(a) AMENDMENT.—Section 973 of the Energy Policy Act of 2005 (42 U.S.C. 16313) is amended to read as follows:

“SEC. 973. SOLAR FUELS BASIC RESEARCH INITIATIVE.

“(a) INITIATIVE.—

“(1) IN GENERAL.—The Secretary shall carry out a research initiative, to be known as the Solar Fuels Basic Research Initiative, to expand theoretical and fundamental knowledge of photochemistry, electrochemistry, biochemistry, and materials science useful for the practical development of experimental systems to convert solar energy to chemical energy.

“(2) LEVERAGING.—The Secretary shall leverage expertise and resources from the Basic Energy Sciences Program and Biological and Environmental Research Program within the Office of Science, and the Office of Energy Efficiency and Renewable Energy, as provided under subsections (b) and (c).

“(3) TEAMS.—The Secretary shall organize activities under the Solar Fuels Basic Research Initiative to include multidisciplinary teams leveraging expertise from the National Laboratories, universities, and the private sector to the extent practicable. These multidisciplinary teams shall pursue aggressive, milestone-driven basic research goals. The Secretary shall provide sufficient resources for those teams to achieve those goals over a period of time to be determined by the Secretary.

“(4) ADDITIONAL ACTIVITIES.—The Secretary is authorized to organize additional activities under this subsection through Energy Frontier Research Centers, Energy Innovation Hubs, or other organizational structures.

“(b) ARTIFICIAL PHOTOSYNTHESIS.—

“(1) IN GENERAL.—The Secretary shall, as part of the Solar Fuels Basic Research Initiative, carry out a program to support research needed to bridge scientific barriers and discover knowledge relevant to artificial photosynthetic systems. In carrying out activities under this subsection, the Director of the Office of Basic Energy Sciences shall support basic research to pursue distinct lines of scientific inquiry, including photoinduced production of hydrogen and oxygen from water, and the sustainable photoinduced reduction of carbon dioxide to fuel products including hydrocarbons, alcohols, carbon monoxide, and natural gas. The Assistant Secretary for Energy Efficiency and Renewable Energy shall support translational research, development, and validation of physical concepts developed under this subsection.

“(2) STANDARD OF REVIEW.—The Secretary shall review the program activities under this subsection to determine the achievement of technical milestones.

“(3) AUTHORIZATION OF APPROPRIATIONS.—

“(A) AUTHORIZATION.—Subject to subsection (d), there are authorized for carrying out activities under this subsection for each of fiscal years 2017 through 2020—

“(i) \$50,000,000 from funds within the Basic Energy Sciences Program account; and

“(ii) \$25,000,000 from funds within the Energy Efficiency and Renewable Energy account.

“(B) PROHIBITION.—No funds authorized under this subsection may be obligated or expended for commercial application of energy technology.

“(c) BIOCHEMISTRY, REPLICATION OF NATURAL PHOTOSYNTHESIS, AND RELATED PROCESSES.—

“(1) IN GENERAL.—The Secretary shall, as part of the Solar Fuels Basic Research Initiative, carry out a program to support research needed to replicate natural photosynthetic processes by use of artificial photosynthetic components and materials. In carrying out activities under this subsection, the Director of the Office of Basic Energy Sciences shall support basic research to expand fundamental knowledge to replicate natural synthesis processes, including the photoinduced reduction of dinitrogen to ammonia, absorption of carbon dioxide from ambient air, molecular-based charge separation and storage, photoinitiated electron transfer, and catalysis in biological or biomimetic systems. The Associate Director of Biological and Environmental Research shall support systems biology and genomics approaches to understand genetic and physiological pathways connected to photosynthetic mechanisms. The Assistant Secretary for Energy Efficiency and Renewable Energy shall support translational research, development, and validation of physical concepts developed under this subsection.

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“(A) AUTHORIZATION.—Subject to subsection (d), there are authorized for carrying out activities under this subsection for each of fiscal years 2017 through 2020—

“(i) \$50,000,000 from funds within the Basic Energy Sciences Program and Biological and Environmental Research Program accounts; and

“(ii) \$25,000,000 from funds within the Energy Efficiency and Renewable Energy account.

“(B) PROHIBITION.—No funds authorized under this subsection may be obligated or expended for commercial application of energy technology.

“(d) FUNDING.—No additional funds are authorized to be appropriated under this section. This section shall be carried out using funds otherwise authorized by law.”.

(b) TABLE OF CONTENTS AMENDMENT.—The item relating to section 973 in the table of contents of such Act is amended to read as follows:

“Sec. 973. Solar Fuels Basic Research Initiative.”.

COMMITTEE STATEMENT AND VIEWS

PURPOSE AND SUMMARY

This legislation replaces Section 973 (Catalysis Research Program) of Title IX of the Energy Policy Act of 2005 (42 U.S.C. 16313) with new policy direction and program authority for the Department of Energy’s (DOE’s) Office of Science. Section 973 will now direct DOE to prioritize basic research in chemistry and materials science relevant to experimental solar fuels systems by establishing a solar fuels basic research initiative.

LEGISLATIVE HISTORY

On June 15, 2016, the Energy Subcommittee of the Committee on Science, Space, and Technology held a hearing entitled “Innovation in Solar Fuels, Electricity Storage, and Advanced Materials,” which explored opportunities in basic and early stage research for experimental solar fuels systems.

On June 17, 2015, the Energy Subcommittee of the Committee on Science, Space, and Technology held a hearing entitled, “Department of Energy Oversight: Energy Innovation Hubs,” which scrutinized the effectiveness of the DOE’s model for energy innovation through the leveraging of expertise from the DOE laboratories, universities, and the private sector.

COMMITTEE VIEWS

Under this Act, the DOE will organize its basic research efforts to advance artificial photosynthesis, photosynthesis replication, and related processes to produce chemical energy, otherwise known as solar fuels, under the new Solar Fuels Basic Research Initiative (the Initiative). The Initiative provides direction for the DOE Office of Science to concentrate its approach to solar fuels through basic research carried out by multidisciplinary teams. The Initiative may leverage established organizational structures, including energy frontier research centers and DOE’s Energy Innovation Hub on fuels from sunlight, known as the Joint Center for Artificial Photosynthesis. The Committee encourages DOE to consider new mechanisms to efficiently make accessible the milestone driven research that will result from this initiative in order to most effectively engage with the research community.

The Initiative also provides authority for a seamless transition from basic research to applied research and development. Once the Office of Science makes the determination that its work has met the objectives and bounds of its basic research mission, the Office of Energy Efficiency and Renewable Energy is authorized to carry out the necessary translational research to validate and demonstrate the concepts envisioned by the research teams supported by the Office of Science to the private sector and other interested stakeholders.

SECTION-BY-SECTION

Sec. 1. Short title

The short title of this legislation is “Solar Fuels Innovation Act.”

Sec. 2. Solar Fuels Basic Research Initiative

This section amends Section 973 of the Energy Policy Act of 2005 by striking outdated program direction and replacing it. This section establishes a Solar Fuels Basic Research Initiative that will support basic and early stage research to advance fundamental scientific knowledge of photochemistry, electrochemistry, biochemistry, and materials science relevant to experimental solar fuels systems. This section provides statutory direction and authorizes appropriations for the Secretary of Energy to leverage expertise from the Office of Science and Office of Energy Efficiency and Renewable Energy to carry out research activities. No additional funds are authorized as all activities under this section are to be carried out using existing funding. Also, no funds authorized under this section are to be used for commercialization activities.

EXPLANATION OF AMENDMENTS

The Committee agreed by voice vote to an amendment that explicitly makes clear that the DOE may organize activities under the Initiative through energy innovation hubs.

COMMITTEE CONSIDERATION

On July 7, 2016, the Committee met in open session and ordered reported favorably the bill, H.R. 5638, as amended, by voice vote, a quorum being present.

APPLICATION OF LAW TO THE LEGISLATIVE BRANCH

Section 102(b)(3) of Public Law 104–1 requires a description of the application of this bill to the legislative branch where the bill relates to the terms and conditions of employment or access to public services and accommodations. This bill directs DOE to prioritize basic research in chemistry and materials science relevant to experimental solar fuels systems by establishing a solar fuels basic research initiative. As such this bill does not relate to employment or access to public services and accommodations.

STATEMENT OF OVERSIGHT FINDINGS AND RECOMMENDATIONS OF THE COMMITTEE

In compliance with clause 3(c)(1) of rule XIII and clause (2)(b)(1) of rule X of the Rules of the House of Representatives, the Commit-

tee's oversight findings and recommendations are reflected in the descriptive portions of this report.

STATEMENT OF GENERAL PERFORMANCE GOALS AND OBJECTIVES

H.R. 5638, the Solar Fuels Innovation Act, directs DOE to prioritize basic research in chemistry and materials science relevant to experimental solar fuels systems by establishing a solar fuels basic research initiative.

DUPLICATION OF FEDERAL PROGRAMS

No provision of H.R. 5638 establishes or reauthorizes a program of the Federal Government known to be duplicative of another Federal program, a program that was included in any report from the Government Accountability Office to Congress pursuant to section 21 of Public Law 111-139, or a program related to a program identified in the most recent Catalog of Federal Domestic Assistance.

DISCLOSURE OF DIRECTED RULE MAKINGS

The Committee estimates that enacting H.R. 5638 does not direct the completion of any specific rule makings within the meaning of 5 U.S.C. 551.

FEDERAL ADVISORY COMMITTEE ACT

The Committee finds that the legislation does not establish or authorize the establishment of an advisory committee within the definition of 5 U.S.C. App., Section 5(b).

UNFUNDED MANDATE STATEMENT

Section 423 of the Congressional Budget and Impoundment Control Act (as amended by Section 101(a)(2) of the Unfunded Mandate Reform Act, P.L. 104-4) requires a statement as to whether the provisions of the reported include unfunded mandates. In compliance with this requirement the Committee has received a letter from the Congressional Budget Office included herein.

EARMARK IDENTIFICATION

H.R. 5638 does not include any congressional earmarks, limited tax benefits, or limited tariff benefits as defined in clause 9 of rule XXI.

NEW BUDGET AUTHORITY AND TAX EXPENDITURES

Clause 3(c)(2) of rule XIII of the Rules of the House of Representatives is inapplicable because this legislation does not provide new budgetary authority or increased tax expenditures.

CONGRESSIONAL BUDGET OFFICE COST ESTIMATE

With respect to the requirements of clause 3(c)(3) of rule XIII of the Rules of the House of Representatives, an estimate and comparison prepared by the Director of Congressional Budget Office under section 402 of the Congressional Budget Act of 1974 was not submitted to the Committee before the filing of the report.

CHANGES IN EXISTING LAW MADE BY THE BILL, AS REPORTED

In compliance with clause 3(e) of rule XIII of the Rules of the House of Representatives, changes in existing law made by the bill, as reported, are shown as follows (existing law proposed to be omitted is enclosed in black brackets, new matter is printed in italic, and existing law in which no change is proposed is shown in roman):

ENERGY POLICY ACT OF 2005

* * * * *

SECTION 1. SHORT TITLE; TABLE OF CONTENTS.

(a) **SHORT TITLE.**—This Act may be cited as the “Energy Policy Act of 2005”.

(b) **TABLE OF CONTENTS.**—The table of contents for this Act is as follows:

* * * * *

TITLE IX—RESEARCH AND DEVELOPMENT

* * * * *

Subtitle G—Science

* * * * *

[Sec. 973. Catalysis research program.]

Sec. 973. Solar Fuels Basic Research Initiative.

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TITLE IX—RESEARCH AND DEVELOPMENT

* * * * *

Subtitle G—Science

* * * * *

[SEC. 973. CATALYSIS RESEARCH PROGRAM.]

[(a) ESTABLISHMENT.—The Secretary, acting through the Office of Science, shall support a program of research and development in catalysis science consistent with the statutory authorities of the Department related to research and development.

[(b) COMPONENTS.—The program shall include efforts to—

[(1) enable catalyst design using combinations of experimental and mechanistic methodologies coupled with computational modeling of catalytic reactions at the molecular level;

[(2) develop techniques for high throughput synthesis, assay, and characterization at nanometer and subnanometer scales in-situ under actual operating conditions;

[(3) synthesize catalysts with specific site architectures;

[(4) conduct research on the use of precious metals for catalysis; and

[(5) translate molecular understanding to the design of catalytic compounds.

[(c) DUTIES OF THE OFFICE OF SCIENCE.—In carrying out the program, the Director of the Office of Science shall—

[(1) support both individual investigators and multidisciplinary teams of investigators to pioneer new approaches in catalytic design;

[(2) develop, plan, construct, acquire, share, or operate special equipment or facilities for the use of investigators in collaboration with national user facilities, such as nanoscience and engineering centers;

[(3) support technology transfer activities to benefit industry and other users of catalysis science and engineering; and

[(4) coordinate research and development activities with industry and other Federal agencies.

[(d) ASSESSMENT.—Not later than 3 years after the date of enactment of this Act, the Secretary shall enter into an arrangement with the National Academy of Sciences to—

[(1) review the catalysis program to measure—

[(A) gains made in the fundamental science of catalysis; and

[(B) progress towards developing new fuels for energy production and material fabrication processes; and

[(2) submit to Congress a report describing the results of the review.]

SEC. 973. SOLAR FUELS BASIC RESEARCH INITIATIVE.

(a) *INITIATIVE.*—

(1) *IN GENERAL.*—*The Secretary shall carry out a research initiative, to be known as the Solar Fuels Basic Research Initiative, to expand theoretical and fundamental knowledge of photochemistry, electrochemistry, biochemistry, and materials science useful for the practical development of experimental systems to convert solar energy to chemical energy.*

(2) *LEVERAGING.*—*The Secretary shall leverage expertise and resources from the Basic Energy Sciences Program and Biological and Environmental Research Program within the Office of Science, and the Office of Energy Efficiency and Renewable Energy, as provided under subsections (b) and (c).*

(3) *TEAMS.*—*The Secretary shall organize activities under the Solar Fuels Basic Research Initiative to include multidisciplinary teams leveraging expertise from the National Laboratories, universities, and the private sector to the extent practicable. These multidisciplinary teams shall pursue aggressive, milestone-driven basic research goals. The Secretary shall provide sufficient resources for those teams to achieve those goals over a period of time to be determined by the Secretary.*

(4) *ADDITIONAL ACTIVITIES.*—*The Secretary is authorized to organize additional activities under this subsection through Energy Frontier Research Centers, Energy Innovation Hubs, or other organizational structures.*

(b) *ARTIFICIAL PHOTOSYNTHESIS.*—

(1) *IN GENERAL.*—*The Secretary shall, as part of the Solar Fuels Basic Research Initiative, carry out a program to support research needed to bridge scientific barriers and discover knowledge relevant to artificial photosynthetic systems. In carrying out activities under this subsection, the Director of the Office of Basic Energy Sciences shall support basic research to*

pursue distinct lines of scientific inquiry, including photoinduced production of hydrogen and oxygen from water, and the sustainable photoinduced reduction of carbon dioxide to fuel products including hydrocarbons, alcohols, carbon monoxide, and natural gas. The Assistant Secretary for Energy Efficiency and Renewable Energy shall support translational research, development, and validation of physical concepts developed under this subsection.

(2) *STANDARD OF REVIEW.—The Secretary shall review the program activities under this subsection to determine the achievement of technical milestones.*

(3) *AUTHORIZATION OF APPROPRIATIONS.—*

(A) *AUTHORIZATION.—Subject to subsection (d), there are authorized for carrying out activities under this subsection for each of fiscal years 2017 through 2020—*

(i) *\$50,000,000 from funds within the Basic Energy Sciences Program account; and*

(ii) *\$25,000,000 from funds within the Energy Efficiency and Renewable Energy account.*

(B) *PROHIBITION.—No funds authorized under this subsection may be obligated or expended for commercial application of energy technology.*

(c) *BIOCHEMISTRY, REPLICATION OF NATURAL PHOTOSYNTHESIS, AND RELATED PROCESSES.—*

(1) *IN GENERAL.—The Secretary shall, as part of the Solar Fuels Basic Research Initiative, carry out a program to support research needed to replicate natural photosynthetic processes by use of artificial photosynthetic components and materials. In carrying out activities under this subsection, the Director of the Office of Basic Energy Sciences shall support basic research to expand fundamental knowledge to replicate natural synthesis processes, including the photoinduced reduction of dinitrogen to ammonia, absorption of carbon dioxide from ambient air, molecular-based charge separation and storage, photoinitiated electron transfer, and catalysis in biological or biomimetic systems. The Associate Director of Biological and Environmental Research shall support systems biology and genomics approaches to understand genetic and physiological pathways connected to photosynthetic mechanisms. The Assistant Secretary for Energy Efficiency and Renewable Energy shall support translational research, development, and validation of physical concepts developed under this subsection.*

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(B) PROHIBITION.—No funds authorized under this subsection may be obligated or expended for commercial application of energy technology.

(d) FUNDING.—No additional funds are authorized to be appropriated under this section. This section shall be carried out using funds otherwise authorized by law.

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ADDITIONAL VIEWS

Last month this Committee held what I thought was a worthwhile hearing that helped illuminate the importance of strengthening our support for research in solar fuels. This is clearly the aim of the Solar Fuels Innovation Act, and I appreciate that the Majority is attempting to advance technologies that could go a long way to improving our energy security and to addressing the serious threat of climate change.

However, I am concerned about what may be some of the unintended consequences of the language in this bill, and the Department of Energy echoed these concerns to Majority and Minority Committee staff this week. DOE noted that labeling research as either “basic” or “applied” in legislation could be problematic given that the distinction can be unclear and subjective, and the activities described in this bill can easily be considered “applied” research given current guidance by the Office of Management and Budget. So language attempting to restrict the initiatives authorized in this bill to “basic” research activities could create an inherent conflict in their implementation.

I would note that at that hearing last month, I actually asked the witnesses about whether it is realistic to assert—and attempt to build policy around—a separation between basic and applied research. All of the witnesses agreed that such a division is non-existent, and policymakers should not try to divide these two categories of research or pit them against one another.

- Dr. Nathan Lewis said, “To the extent that the use-inspired fundamental research has an outlet into practical implementation, there should be no boundary.”

- Dr. Daniel Hallinan agreed and said, “The questions that we need to answer are well-defined by the applied side and then we can approach them from a fundamental perspective . . . There is not really a clear line between basic and applied.”

- Dr. Daniel Scherson said, “10% of the cost of an actual battery goes into materials and 90% into manufacturing, so you know we have to be able to bridge the gap between what we regard as fundamental research and applied research. I’m afraid companies may not want to take the risk.”

- And Dr. Collin Broholm noted the example of the legendary Bell Labs, a model for research that the private sector no longer supports, saying, “Those who are working in the discovery realm need to have the ability to view some of the challenges that exist in the real world as well so this artificial barrier is in fact very unfortunate.”

Lastly, I would note that one of the letters of support that the Chairman submitted for the record, from a company called Opus 12 based in Berkeley, California, highlighted significant concern with this bill’s limitation to basic research activities. The letter con-

cludes by stating that “[t]he Solar Fuels Innovation Act can be more than just a way to sponsor basic research. It can be a way for America to take the first steps toward a new frontier of commercially available solar fuels.” I think that’s the whole point of this bill.

So given the expert testimony from Majority and Minority witnesses that we received on this issue just a few weeks ago as well as the constructive guidance that the Department and leading innovators provided to us this week on this bill, I hope we can all agree that such labels aren’t helpful—and can be harmful. Rather, our goal is to guide and support energy research that the private sector is unlikely or unwilling to pursue at a sufficient pace to meet national economic, environmental, and energy security needs. Any arbitrary barrier to that goal, even if it’s well-intentioned, is a step in the wrong direction.

MARK TAKANO.

