



## CONGRESSIONAL BUDGET OFFICE COST ESTIMATE

November 28, 2018

### **H.R. 6140** **Advanced Nuclear Fuel Availability Act**

*As ordered reported by the House Committee on Energy and Commerce on July 12, 2018*

#### **SUMMARY**

H.R. 6140 would direct the Department of Energy (DOE) to conduct various studies and activities related to the supply of new types of fuels for commercial nuclear reactors. In particular, the bill would authorize DOE to acquire certain materials on behalf of other entities and to develop a schedule for recovering those costs. Other provisions in the bill would authorize the appropriation of \$1.5 million for each of fiscal years 2019 through 2021 to assist in the development of new methods for transporting new nuclear materials. Finally, DOE's authority to implement the programs would expire at the end of 2033.

CBO estimates that implementing H.R. 6140 would increase net direct spending by \$120 million over the 2019-2028 period as a result of provisions authorizing DOE to purchase materials. CBO estimates, however, that this net cost would be offset in subsequent years by income from commercial sales of the material. In addition, CBO estimates that the programmatic costs associated with implementing the bill would total \$20 million over the 2019-2023 period, assuming appropriation of the authorized amounts.

Because enacting H.R. 6140 would affect direct spending, pay-as-you-go procedures apply. The bill would not affect revenues.

CBO estimates that enacting H.R. 6140 would not increase net direct spending or on-budget deficits by more than \$5 billion in any of the four consecutive 10-year periods beginning in 2029.

H.R. 6140 contains no intergovernmental or private-sector mandates as defined in the Unfunded Mandates Reform Act (UMRA).

## ESTIMATED COST TO THE FEDERAL GOVERNMENT

The estimated budgetary effect of H.R. 6140 is shown in the following table. The costs of the legislation fall within budget function 270 (energy).

|   | By Fiscal Year, in Millions of Dollars |      |      |      |      |      |      |      |      |      |      | 2019- | 2019- |  |
|---|--|------|------|------|------|------|------|------|------|------|------|-------|-------|--|
|   | 2019                                   | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2023 | 2028  |       |  |
| <b>INCREASES IN DIRECT SPENDING</b>                   |  |      |      |      |      |      |      |      |      |      |      |       |       |  |
| Acquisition Costs                                     |  |      |      |      |      |      |      |      |      |      |      |       |       |  |
| Estimated Budget Authority                            | 0                                      | 0    | 150  | 0    | 0    | 0    | 1    | 5    | 5    | 5    | 150  | 166   |       |  |
| Estimated Outlays                                     | 0                                      | 0    | 8    | 15   | 45   | 45   | 38   | 5    | 5    | 5    | 68   | 166   |       |  |
| Cost Recovery Fees                                    |  |      |      |      |      |      |      |      |      |      |      |       |       |  |
| Estimated Budget Authority                            | 0                                      | 0    | 0    | 0    | 0    | 0    | -1   | -9   | -18  | -18  | 0    | -46   |       |  |
| Estimated Outlays                                     | 0                                      | 0    | 0    | 0    | 0    | 0    | -1   | -9   | -18  | -18  | 0    | -46   |       |  |
| Total Direct Spending                                 |  |      |      |      |      |      |      |      |      |      |      |       |       |  |
| Estimated Budget Authority                            | 0                                      | 0    | 150  | 0    | 0    | 0    | 0    | -4   | -13  | -13  | 150  | 120   |       |  |
| Estimated Outlays                                     | 0                                      | 0    | 8    | 15   | 45   | 45   | 37   | -4   | -13  | -13  | 68   | 120   |       |  |
| <b>INCREASES IN SPENDING SUBJECT TO APPROPRIATION</b> |  |      |      |      |      |      |      |      |      |      |      |       |       |  |
| Estimated Authorization Level                         | 2                                      | 4    | 6    | 6    | 5    | 5    | 5    | 5    | 5    | 5    | 23   | 48    |       |  |
| Estimated Outlays                                     | *                                      | 3    | 5    | 7    | 5    | 5    | 5    | 5    | 5    | 5    | 20   | 45    |       |  |

\* = between zero and \$500,000.

## BASIS OF ESTIMATE

For this estimate, CBO assumes that the legislation will be enacted near the start of 2019.

CBO estimates that implementing purchase agreements authorized by H.R. 6140 would increase net direct spending by \$120 million over the 2019-2028 period, reflecting gross capital and operating costs of \$166 million and offsetting receipts from recoveries of \$46 million. CBO estimates that the net costs incurred through 2028 would be offset in subsequent years by income from sales of the materials. In addition, CBO estimates that implementing the bill would cost \$20 million over the 2019-2023 period, assuming appropriation of the authorized and necessary amounts.

### Direct Spending

H.R. 6140 would authorize DOE to acquire high-assay, low-enriched uranium (HALEU) for new commercial uses. DOE would be directed to establish a consortium of entities

involved in the nuclear fuel cycle to assess the potential supply and demand for such materials and to develop a schedule for recovering any acquisition costs that the department incurs. Under the bill, DOE would be expressly prohibited from including materials allocated for defense purposes in its assessment of available supplies. Because the legislation does not expressly make those transactions subject to further appropriation, CBO views the acquisition authority as a form of direct spending.

**Background on HALEU.** Producing fuels for nuclear reactors involves a multistep process to turn uranium ore into a form that can be used to generate electricity. Historically, electric utilities have purchased the raw materials and then entered into contracts with domestic or foreign companies to increase—or enrich—the concentration of uranium isotope from less than 1 percent to up to 3 percent to 5 percent. Such materials are known as low-enriched uranium (LEU). Most enrichment services are purchased under long-term contracts.

According to academic and industry experts, most new technologies for advanced nuclear reactors will require uranium with higher concentrations of uranium isotopes, ranging from over 6 percent to nearly 20 percent. In addition, some have proposed using such materials—known as high-assay LEU, or HALEU—for new types of fuel for conventional nuclear power plants. At this time, however, there are no large commercial sources of HALEU anywhere in the world.<sup>1</sup>

Private companies have been reluctant to invest in new enrichment facilities for HALEU because of uncertainty surrounding the technical and economic viability of new nuclear technologies. A recent industry assessment suggests that the annual demand for HALEU in the 2020s could range from less than 5 metric tons to more than 100 metric tons a year—the equivalent of less than 1 percent to 5 percent, respectively, of the current demand for conventional LEU.<sup>2</sup> In addition, the timing of any sales will depend on the availability of new shipping containers and fuel fabrication facilities, which may take several years to design and build.

**Estimated Budgetary Effects of the Bill.** H.R. 6140 would direct DOE to make HALEU available, to the extent practical, for commercial uses by the end of 2025. CBO anticipates that DOE would acquire the materials by making commitments to purchase HALEU that would be produced in the future. Assuming those agreements follow

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1. DOE produces small quantities of HALEU for research and medical purposes by modifying materials in defense stockpiles, but most of the stockpiled materials available for civilian uses are projected to be used by 2030. Although some foreign entities also produce materials that could be imported for use by commercial users, such imports would require specialized licenses, transportation systems, and marketing arrangements. For more information, see Massachusetts Institute of Technology, *The Future of Nuclear Energy in a Carbon-Constrained World: An Interdisciplinary MIT Study* (2018), p. 88, <http://tinyurl.com/ycdxnugt>.
  2. See Nuclear Energy Institute, letter to Secretary Rick Perry on the Need for High-Assay Low-Enriched Uranium (July 5, 2018), <http://tinyurl.com/yaqvwoc>.

standard industry practice, CBO expects that the value of DOE's purchases would cover the capital cost of the new production facilities as well as the operating costs incurred during the first 8 to 10 years of production. For this estimate, CBO assumes DOE would minimize the net cost of the HALEU by reimbursing the enrichers' construction and operating costs as they are incurred.

The cost of implementing H.R. 6140 would depend on the type and scale of enrichment services purchased by DOE. Based on information from industry experts and historical trends in enrichment prices and costs, CBO estimates that DOE would spend between \$100 million and \$200 million for new enrichment capacity for HALEU, with a midpoint of \$150 million. That estimated cost reflects CBO's expectation that DOE would require buyers to provide raw materials in the form of LEU and that DOE would purchase the minimum quantities necessary for testing and demonstrating new nuclear reactor and fuel technologies, which could range from a few metric tons to over 10 metric tons per year.

Using information from industry studies, CBO estimates that most of the construction-related outlays would occur by 2026, assuming that developers receive the necessary regulatory and marketing approvals in the next few years.<sup>3</sup> Once the facilities are operational, CBO estimates, DOE would spend another \$5 million a year for operating expenses, or a total of \$16 million over the 2019-2028 period. CBO estimates that DOE would recover about one-quarter of the capital costs and two-thirds of the operating costs by 2028, resulting in receipts totaling \$46 million over the 10-year period.

### **Spending Subject to Appropriation**

CBO estimates that implementing H.R. 6140 would cost \$20 million over the 2019-2023 period, assuming appropriation of the authorized amounts. That total includes the \$4.5 million specifically authorized for DOE to assist in the design and licensing of transportation systems needed to transport HALEU and related materials.

CBO also estimates that DOE would spend about \$16 million over the 2019-2023 period to operate the consortium and implement agreements to acquire HALEU and to sell it to commercial users. For this estimate, CBO assumes that DOE would review and execute about 10 contracts under the acquisition program and that the administrative costs of processing and servicing those agreements would be similar to the costs incurred by DOE in processing applications for loans and loan guarantees.

In addition, CBO expects that implementing H.R. 6140 could affect the workload of the Nuclear Regulatory Commission (NRC), which licenses and regulates civilian facilities that use radioactive materials. In particular, that agency would be heavily involved in the

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3. For more information, see Nuclear Energy Institute, *Addressing the Challenges with Establishing the Infrastructure for the front-end of the Fuel Cycle for Advanced Reactors*, NEI White Paper (January 2018), <http://tinyurl.com/ydampztz6> (PDF, 504 KB).

design and licensing of facilities and transportation containers required to develop a commercial supply of HALEU. To the extent that the legislation results in an overall increase or acceleration of such activities, the bill could increase the NRC's costs, which are subject to appropriation. However, because the NRC is required under current law to offset most of its funding through fees charged to entities it regulates, CBO estimates that any net changes in the agency's spending under the bill would not exceed \$500,000 in any year.

## **UNCERTAINTY**

CBO aims to produce cost estimates that generally reflect the middle of a range of the most likely budgetary outcomes that would result if the legislation was enacted. In estimating the effects of H.R. 6140, CBO had to account for several sources of uncertainty:

- CBO does not know the quantity or price of the HALEU that DOE would acquire to implement the bill. Spending could be higher or lower than the estimated amounts depending on the size of the commercial market for HALEU, DOE's role in meeting the needs of that market, and the cost of supplying those materials.
- CBO cannot determine the form or terms of the contractual arrangements that DOE would use to acquire materials under the bill. Costs also could differ if DOE chose to purchase materials from Russia or another foreign entity.
- CBO cannot predict the amount or timing of collections from fees paid by private entities for the use of the fuel. Advanced nuclear reactor projects face technological and market risks, which could affect the timing and amount of their purchases or payments.

## **PAY-AS-YOU-GO CONSIDERATIONS**

The Statutory Pay-As-You-Go Act of 2010 establishes budget-reporting and enforcement procedures for legislation affecting direct spending or revenues. The net changes in outlays that are subject to those pay-as-you-go procedures are shown in the following table.

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**CBO Estimate of Pay-As-You-Go Effects for H.R. 6140, the Advanced Nuclear Fuel Availability Act, as Ordered Reported by the House Committee on Energy and Commerce on July 12, 2018**

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|                                    | By Fiscal Year, in Millions of Dollars |      |      |      |      |      |      |      |      |      | 2019-<br>2023 | 2019-<br>2028 |
|------------------------------------|--|------|------|------|------|------|------|------|------|------|---------------|---------------|
|                                    | 2019                                   | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 |               |               |
| <b>NET INCREASE IN THE DEFICIT</b> |  |      |      |      |      |      |      |      |      |      |               |               |
| Statutory Pay-As-You-Go Effect     | 0                                      | 0    | 8    | 15   | 45   | 45   | 37   | -4   | -13  | -13  | 68            | 120           |

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**INCREASE IN LONG-TERM DIRECT SPENDING AND DEFICITS**

CBO estimates that enacting H.R. 6140 would not increase net direct spending or on-budget deficits by more than \$5 billion in any of the four consecutive 10-year periods beginning in 2029.

**MANDATES**

H.R. 6140 contains no intergovernmental or private-sector mandates as defined in UMRA.

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