

114TH CONGRESS
1ST SESSION

S. 1408

To provide for a program of research, development, demonstration, and commercial application in vehicle technologies at the Department of Energy.

IN THE SENATE OF THE UNITED STATES

MAY 20, 2015

Mr. PETERS (for himself, Mr. ALEXANDER, and Ms. STABENOW) introduced the following bill; which was read twice and referred to the Committee on Energy and Natural Resources

A BILL

To provide for a program of research, development, demonstration, and commercial application in vehicle technologies at the Department of Energy.

1 *Be it enacted by the Senate and House of Representa-*
2 *tives of the United States of America in Congress assembled,*

3 **SECTION 1. SHORT TITLE; TABLE OF CONTENTS.**

4 (a) SHORT TITLE.—This Act may be cited as the
5 “Vehicle Innovation Act of 2015”.

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

- Sec. 1. Short title; table of contents.
- Sec. 2. Findings.
- Sec. 3. Objectives.
- Sec. 4. Definitions.

Sec. 5. Authorization of appropriations.

TITLE I—VEHICLE RESEARCH AND DEVELOPMENT

Sec. 101. Program.

Sec. 102. Sensing and communications technologies.

Sec. 103. Manufacturing.

Sec. 104. User testing facilities.

Sec. 105. Reporting.

TITLE II—MEDIUM- AND HEAVY-DUTY COMMERCIAL AND TRANSIT VEHICLES

Sec. 201. Program.

Sec. 202. Class 8 truck and trailer systems demonstration.

Sec. 203. Technology testing and metrics.

Sec. 204. Nonroad systems pilot program.

1 **SEC. 2. FINDINGS.**

2 Congress finds the following:

3 (1) According to the Energy Information Ad-
4 ministration, the transportation sector accounts for
5 approximately 28 percent of the United States pri-
6 mary energy demand and greenhouse gas emissions,
7 and 21 percent of global oil demand.

8 (2) The United States transportation sector is
9 over 90-percent dependent on petroleum.

10 (3) United States heavy truck fuel consumption
11 will increase 27 percent by 2030.

12 (4) The domestic automotive and commercial
13 vehicle manufacturing sectors have increasingly lim-
14 ited resources for research, development, and engi-
15 neering of advanced technologies.

16 (5) Vehicle, engine, and component manufactur-
17 ers are playing a more important role in vehicle

1 technology development, and should be better inte-
 2 grated into Federal research efforts.

3 (6) Priorities for the vehicle technologies re-
 4 search of the Department of Energy have shifted
 5 drastically in recent years among diesel hybrids, hy-
 6 drogen fuel cell vehicles, and plug-in electric hybrids,
 7 with little continuity among them.

8 (7) The integration of vehicle, communication,
 9 and infrastructure technologies has great potential
 10 for efficiency gains through better management of
 11 the total transportation system.

12 (8) The Federal Government should balance its
 13 role in researching longer-term exploratory concepts
 14 and developing nearer-term transformational tech-
 15 nologies for vehicles.

16 **SEC. 3. OBJECTIVES.**

17 The objectives of this Act are—

18 (1) to develop United States technologies and
 19 practices that—

20 (A) improve the fuel efficiency and emis-
 21 sions of all vehicles produced in the United
 22 States; and

23 (B) reduce vehicle reliance on petroleum-
 24 based fuels;

1 (2) to support domestic research, development,
2 engineering, demonstration, and commercial applica-
3 tion and manufacturing of advanced vehicles, en-
4 gines, and components;

5 (3) to enable vehicles to move larger volumes of
6 goods and more passengers with less energy and
7 emissions;

8 (4) to develop cost-effective advanced tech-
9 nologies for wide-scale utilization throughout the
10 passenger, commercial, government, and transit ve-
11 hicle sectors;

12 (5) to allow for greater consumer choice of vehi-
13 cle technologies and fuels;

14 (6) shorten technology development and inte-
15 gration cycles in the vehicle industry;

16 (7) to ensure a proper balance and diversity of
17 Federal investment in vehicle technologies; and

18 (8) to strengthen partnerships between Federal
19 and State governmental agencies and the private
20 and academic sectors.

21 **SEC. 4. DEFINITIONS.**

22 In this Act:

23 (1) DEPARTMENT.—The term “Department”
24 means the Department of Energy.

1 (2) SECRETARY.—The term “Secretary” means
2 the Secretary of Energy.

3 **SEC. 5. AUTHORIZATION OF APPROPRIATIONS.**

4 There are authorized to be appropriated to the Sec-
5 retary for research, development, engineering, demonstra-
6 tion, and commercial application of vehicles and related
7 technologies in the United States, including activities au-
8 thorized under this Act—

9 (1) for fiscal year 2015, \$301,506,000;

10 (2) for fiscal year 2016, \$313,567,000;

11 (3) for fiscal year 2017, \$326,109,000;

12 (4) for fiscal year 2018, \$339,154,000;

13 (5) for fiscal year 2019, \$352,720,000; and

14 (6) for fiscal year 2020, \$366,829,000.

15 **TITLE I—VEHICLE RESEARCH**
16 **AND DEVELOPMENT**

17 **SEC. 101. PROGRAM.**

18 (a) ACTIVITIES.—The Secretary shall conduct a pro-
19 gram of basic and applied research, development, engi-
20 neering, demonstration, and commercial application activi-
21 ties on materials, technologies, and processes with the po-
22 tential to substantially reduce or eliminate petroleum use
23 and the emissions of the Nation’s passenger and commer-
24 cial vehicles, including activities in the areas of—

- 1 (1) hybridization or full electrification of vehicle
- 2 systems;
- 3 (2) batteries and other energy storage devices;
- 4 (3) power electronics;
- 5 (4) vehicle, component, and subsystem manu-
- 6 facturing technologies and processes;
- 7 (5) engine efficiency and combustion optimiza-
- 8 tion;
- 9 (6) waste heat recovery;
- 10 (7) transmission and drivetrains;
- 11 (8) hydrogen vehicle technologies, including fuel
- 12 cells and internal combustion engines, and hydrogen
- 13 infrastructure, including hydrogen energy storage to
- 14 enable renewables and provide hydrogen for fuel and
- 15 power;
- 16 (9) natural gas vehicle technologies;
- 17 (10) aerodynamics, rolling resistance (including
- 18 tires and wheel assemblies), and accessory power
- 19 loads of vehicles and associated equipment;
- 20 (11) vehicle weight reduction, including
- 21 lightweighting materials and the development of
- 22 manufacturing processes to fabricate, assemble, and
- 23 use dissimilar materials;
- 24 (12) friction and wear reduction;
- 25 (13) engine and component durability;

- 1 (14) innovative propulsion systems;
- 2 (15) advanced boosting systems;
- 3 (16) hydraulic hybrid technologies;
- 4 (17) engine compatibility with and optimization
- 5 for a variety of transportation fuels including nat-
- 6 ural gas and other liquid and gaseous fuels;
- 7 (18) predictive engineering, modeling, and sim-
- 8 ulation of vehicle and transportation systems;
- 9 (19) refueling and charging infrastructure for
- 10 alternative fueled and electric or plug-in electric hy-
- 11 brid vehicles, including the unique challenges facing
- 12 rural areas;
- 13 (20) gaseous fuels storage systems and system
- 14 integration and optimization;
- 15 (21) sensing, communications, and actuation
- 16 technologies for vehicle, electrical grid, and infra-
- 17 structure;
- 18 (22) efficient use, substitution, and recycling of
- 19 potentially critical materials in vehicles, including
- 20 rare earth elements and precious metals, at risk of
- 21 supply disruption;
- 22 (23) aftertreatment technologies;
- 23 (24) thermal management of battery systems;
- 24 (25) retrofitting advanced vehicle technologies
- 25 to existing vehicles;

1 (26) development of common standards, speci-
2 fications, and architectures for both transportation
3 and stationary battery applications;
4 (27) advanced internal combustion engines;
5 (28) mild hybrid;
6 (29) engine down speeding; and
7 (30) other research areas as determined by the
8 Secretary.

9 (b) TRANSFORMATIONAL TECHNOLOGY.—The Sec-
10 retary shall ensure that the Department continues to sup-
11 port research, development, engineering, demonstration,
12 and commercial application activities and maintains com-
13 petency in mid- to long-term transformational vehicle tech-
14 nologies with potential to achieve deep reductions in petro-
15 leum use and emissions, including activities in the areas
16 of—

17 (1) hydrogen vehicle technologies, including fuel
18 cells, hydrogen storage, infrastructure, and activities
19 in hydrogen technology validation and safety codes
20 and standards;

21 (2) multiple battery chemistries and novel en-
22 ergy storage devices, including nonchemical batteries
23 and electromechanical storage technologies such as
24 hydraulics, flywheels, and compressed air storage;

1 (3) communication and connectivity among ve-
2 hicles, infrastructure, and the electrical grid; and

3 (4) other innovative technologies research and
4 development, as determined by the Secretary.

5 (c) INDUSTRY PARTICIPATION.—To the maximum
6 extent practicable, activities under this Act shall be carried
7 out in partnership or collaboration with automotive manu-
8 facturers, heavy commercial, vocational, and transit vehi-
9 cle manufacturers, qualified plug-in electric vehicle manu-
10 facturers, compressed natural gas vehicle manufacturers,
11 vehicle and engine equipment and component manufactur-
12 ers, manufacturing equipment manufacturers, advanced
13 vehicle service providers, fuel producers and energy sup-
14 pliers, electric utilities, universities, national laboratories,
15 and independent research laboratories. In carrying out
16 this Act the Secretary shall—

17 (1) determine whether a wide range of compa-
18 nies that manufacture or assemble vehicles or com-
19 ponents in the United States are represented in on-
20 going public private partnership activities, including
21 firms that have not traditionally participated in fed-
22 erally sponsored research and development activities,
23 and where possible, partner with such firms that
24 conduct significant and relevant research and devel-
25 opment activities in the United States;

1 (2) leverage the capabilities and resources of,
2 and formalize partnerships with, industry-led stake-
3 holder organizations, nonprofit organizations, indus-
4 try consortia, and trade associations with expertise
5 in the research and development of, and education
6 and outreach activities in, advanced automotive and
7 commercial vehicle technologies;

8 (3) develop more effective processes for trans-
9 ferring research findings and technologies to indus-
10 try;

11 (4) give consideration to conversion of existing
12 or former vehicle technology development or manu-
13 facturing facilities for the purposes of this Act;

14 (5) support public-private partnerships, dedi-
15 cated to overcoming barriers in commercial applica-
16 tion of transformational vehicle technologies, that
17 utilize such industry-led technology development fa-
18 cilities of entities with demonstrated expertise in
19 successfully designing and engineering pre-commer-
20 cial generations of such transformational technology;
21 and

22 (6) promote efforts to ensure that technology
23 research, development, engineering, and commercial
24 application activities funded under this Act are car-
25 ried out in the United States.

1 (d) INTERAGENCY AND INTRAAGENCY COORDINA-
2 TION.—To the maximum extent practicable, the Secretary
3 shall coordinate research, development, demonstration,
4 and commercial application activities among—

5 (1) relevant programs within the Department,
6 including—

7 (A) the Office of Energy Efficiency and
8 Renewable Energy;

9 (B) the Office of Science;

10 (C) the Office of Electricity Delivery and
11 Energy Reliability;

12 (D) the Office of Fossil Energy;

13 (E) the Advanced Research Projects Agen-
14 cy—Energy; and

15 (F) other offices as determined by the Sec-
16 retary; and

17 (2) relevant technology research and develop-
18 ment programs within other Federal agencies, as de-
19 termined by the Secretary.

20 (e) COORDINATION AND NONDUPLICATION.—In co-
21 ordinating activities the Secretary shall ensure, to the
22 maximum extent practicable, that activities do not dupli-
23 cate those of other programs within the Department or
24 other relevant research agencies.

1 (f) FEDERAL DEMONSTRATION OF TECH-
 2 NOLOGIES.—The Secretary shall make information avail-
 3 able to procurement programs of Federal agencies regard-
 4 ing the potential to demonstrate technologies resulting
 5 from activities funded through programs under this Act.

6 (g) INTERGOVERNMENTAL COORDINATION.—The
 7 Secretary shall seek opportunities to leverage resources
 8 and support initiatives of State and local governments in
 9 developing and promoting advanced vehicle technologies,
 10 manufacturing, and infrastructure.

11 (h) CRITERIA.—When awarding grants under this
 12 program, the Secretary shall give priority to those tech-
 13 nologies (either individually or as part of a system) that—

14 (1) provide the greatest aggregate fuel savings
 15 based on the reasonable projected sales volumes of
 16 the technology; and

17 (2) provide the greatest increase in United
 18 States employment.

19 **SEC. 102. SENSING AND COMMUNICATIONS TECH-**
 20 **NOLOGIES.**

21 The Secretary, in coordination with the relevant re-
 22 search programs of other Federal agencies, shall conduct
 23 research, development, engineering, demonstration, and
 24 deployment activities on connectivity of vehicle roadway,
 25 vulnerable road users, traffic control systems, and trans-

1 portation data systems, including on sensing, data, com-
 2 putation, communication, cybersecurity, and actuation
 3 technologies that allow for improved safety, reduced en-
 4 ergy and fuel use, optimized traffic flow, and vehicle elec-
 5 trification, including technologies for—

6 (1) onboard vehicle, engine, transmission and
 7 component sensing, actuation, and calibration;

8 (2) vehicle-to-vehicle sensing and communica-
 9 tion;

10 (3) vehicle-to-infrastructure sensing and com-
 11 munication;

12 (4) vehicle-to-pedestrian and vehicle-to-bicyclist
 13 sensing and communication; and

14 (5) vehicle integration with the electrical grid.

15 **SEC. 103. MANUFACTURING.**

16 The Secretary shall carry out a research, develop-
 17 ment, engineering, demonstration, and commercial appli-
 18 cation program of advanced vehicle manufacturing tech-
 19 nologies and practices, including innovative processes—

20 (1) to increase the production rate and decrease
 21 the cost of advanced battery and fuel cell manufac-
 22 turing;

23 (2) to vary the capability of individual manufac-
 24 turing facilities to accommodate different battery
 25 chemistries and configurations;

1 (3) to reduce waste streams, emissions, and en-
2 ergy intensity of vehicle, engine, advanced battery
3 and component manufacturing processes;

4 (4) to recycle and remanufacture used batteries
5 and other vehicle components for reuse in vehicles or
6 stationary applications;

7 (5) to develop manufacturing processes to effec-
8 tively fabricate, assemble, and produce cost-effective
9 lightweight materials such as advanced aluminum
10 and other metal alloys, polymeric composites, and
11 carbon fiber for use in vehicles;

12 (6) to produce lightweight high pressure storage
13 systems for gaseous fuels;

14 (7) to design and manufacture purpose-built hy-
15 drogen fuel cell vehicles and components;

16 (8) to improve the calendar life and cycle life of
17 advanced batteries; and

18 (9) to produce permanent magnets for advanced
19 vehicles.

20 **SEC. 104. USER TESTING FACILITIES.**

21 Activities under this Act may include construction,
22 expansion, or modification of new and existing vehicle, en-
23 gine, and component research and testing facilities for—

1 (1) testing or simulating interoperability of a
2 variety of vehicle components and systems, including
3 the technologies described in section 102;

4 (2) subjecting whole or partial vehicle platforms
5 to fully representative duty cycles and operating con-
6 ditions;

7 (3) developing and demonstrating a range of
8 chemistries and configurations for advanced vehicle
9 battery manufacturing;

10 (4) developing and demonstrating test cycles for
11 new and alternative fuels, and other advanced vehi-
12 cle technologies;

13 (5) developing and demonstrating methods to
14 charge electric vehicles and connect them to the elec-
15 tric grid; and

16 (6) developing, testing, and demonstrating hy-
17 drogen and natural gas refueling station tech-
18 nologies.

19 **SEC. 105. REPORTING.**

20 (a) **TECHNOLOGIES DEVELOPED.**—Not later than 18
21 months after the date of enactment of this Act and annu-
22 ally thereafter through 2020, the Secretary shall submit
23 to Congress a report regarding the technologies developed
24 as a result of the activities authorized by this title, with
25 a particular emphasis on whether the technologies were

1 successfully adopted for commercial applications, and if
 2 so, whether products relying on those technologies are
 3 manufactured in the United States.

4 (b) ADDITIONAL MATTERS.—At the end of each fis-
 5 cal year through 2020 the Secretary shall submit to the
 6 relevant Congressional committees of jurisdiction an an-
 7 nual report describing activities undertaken in the pre-
 8 vious year under this title, active industry participants, ef-
 9 forts to recruit new participants committed to design, en-
 10 gineering, and manufacturing of advanced vehicle tech-
 11 nologies in the United States, progress of the program in
 12 meeting goals and timelines, and a strategic plan for fund-
 13 ing of activities across agencies.

14 **TITLE II—MEDIUM- AND HEAVY-** 15 **DUTY COMMERCIAL AND** 16 **TRANSIT VEHICLES**

17 **SEC. 201. PROGRAM.**

18 (a) IN GENERAL.—The Secretary, in partnership
 19 with relevant research and development programs in other
 20 Federal agencies, and a range of appropriate industry
 21 stakeholders, shall carry out a program of cooperative re-
 22 search, development, demonstration, and commercial ap-
 23 plication activities on advanced technologies for medium-
 24 to heavy-duty commercial, vocational, recreational, and
 25 transit vehicles, including activities in the areas of—

- 1 (1) engine efficiency and combustion research;
- 2 (2) onboard storage technologies for compressed
- 3 and liquefied natural gas;
- 4 (3) development and integration of engine tech-
- 5 nologies designed for natural gas operation of a vari-
- 6 ety of vehicle platforms;
- 7 (4) waste heat recovery and conversion;
- 8 (5) improved aerodynamics and tire rolling re-
- 9 sistance;
- 10 (6) energy and space-efficient emissions control
- 11 systems;
- 12 (7) mild hybrid, heavy hybrid, hybrid hydraulic,
- 13 plug-in hybrid, and electric platforms, and energy
- 14 storage technologies;
- 15 (8) drivetrain optimization;
- 16 (9) friction and wear reduction;
- 17 (10) engine idle and parasitic energy loss reduc-
- 18 tion;
- 19 (11) electrification of accessory loads;
- 20 (12) onboard sensing and communications tech-
- 21 nologies;
- 22 (13) advanced lightweighting materials and ve-
- 23 hicle designs;
- 24 (14) increasing load capacity per vehicle;
- 25 (15) thermal management of battery systems;

1 (16) recharging infrastructure;

2 (17) compressed natural gas infrastructure;

3 (18) advanced internal combustion engines;

4 (19) complete vehicle and power pack modeling,
5 simulation, and testing;

6 (20) hydrogen vehicle technologies, including
7 fuel cells and internal combustion engines, and hy-
8 drogen infrastructure, including hydrogen energy
9 storage to enable renewables and provide hydrogen
10 for fuel and power;

11 (21) retrofitting advanced technologies onto ex-
12 isting truck fleets;

13 (22) advanced boosting systems;

14 (23) engine down speeding; and

15 (24) integration of these and other advanced
16 systems onto a single truck and trailer platform.

17 (b) REPORTING.—At the end of each fiscal year
18 through fiscal year 2020, the Secretary shall submit to
19 Congress an annual report describing activities under-
20 taken in the previous year, active industry participants,
21 efforts to recruit new participants, progress of the pro-
22 gram in meeting goals and timelines, and a strategic plan
23 for funding of activities across agencies.

1 **SEC. 202. CLASS 8 TRUCK AND TRAILER SYSTEMS DEM-**
2 **ONSTRATION.**

3 (a) IN GENERAL.—The Secretary shall conduct a
4 competitive grant program to demonstrate the integration
5 of multiple advanced technologies on Class 8 truck and
6 trailer platforms, including a combination of technologies
7 listed in section 201(a).

8 (b) APPLICANT TEAMS.—Applicant teams may be
9 comprised of truck and trailer manufacturers, engine and
10 component manufacturers, fleet customers, university re-
11 searchers, and other applicants as appropriate for the de-
12 velopment and demonstration of integrated Class 8 truck
13 and trailer systems.

14 **SEC. 203. TECHNOLOGY TESTING AND METRICS.**

15 The Secretary, in coordination with the partners of
16 the interagency research program described in section
17 201(a)—

18 (1) shall develop standard testing procedures
19 and technologies for evaluating the performance of
20 advanced heavy vehicle technologies under a range of
21 representative duty cycles and operating conditions,
22 including for heavy hybrid propulsion systems;

23 (2) shall evaluate heavy vehicle performance
24 using work performance-based metrics other than
25 those based on miles per gallon, including those
26 based on units of volume and weight transported for

1 freight applications, and appropriate metrics based
2 on the work performed by nonroad systems; and
3 (3) may construct heavy duty truck and bus
4 testing facilities.

5 **SEC. 204. NONROAD SYSTEMS PILOT PROGRAM.**

6 The Secretary shall undertake a pilot program of re-
7 search, development, demonstration, and commercial ap-
8 plications of technologies to improve total machine or sys-
9 tem efficiency for nonroad mobile equipment including ag-
10 ricultural, construction, air, and sea port equipment, and
11 shall seek opportunities to transfer relevant research find-
12 ings and technologies between the nonroad and on-high-
13 way equipment and vehicle sectors.

○