

118TH CONGRESS  
1ST SESSION

# H. R. 5090

To support research, development, demonstration, and other activities to develop innovative vehicle technologies, and for other purposes.

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## IN THE HOUSE OF REPRESENTATIVES

JULY 28, 2023

Ms. STEVENS (for herself and Mrs. DINGELL) introduced the following bill; which was referred to the Committee on Science, Space, and Technology

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## A BILL

To support research, development, demonstration, and other activities to develop innovative vehicle technologies, and for other purposes.

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.**

4 This Act may be cited as the “Shifting Forward Vehi-  
5 cle Technologies Research and Development Act”.

6 **SEC. 2. DEFINITIONS.**

7 In this Act:

8 (1) **ALTERNATIVE FUEL.**—The term “alter-  
9 native fuel” means a fuel that results in a signifi-  
10 cant reduction in lifecycle greenhouse gas (GHG)

1 and criteria air pollutant emissions compared to con-  
2 ventional fuel options.

3 (2) **EXTREME FAST CHARGING.**—The term “ex-  
4 treme fast charging” means recharging up to 80  
5 percent of battery capacity in approximately 10 min-  
6 utes or less.

7 (3) **SUSTAINABLE MATERIALS.**—The term “sus-  
8 tainable materials” means materials used through-  
9 out the consumer and industrial economy that can  
10 be produced in required volumes without depleting  
11 nonrenewable resources and without disrupting the  
12 established steady-state equilibrium of the environ-  
13 ment and key natural resource systems.

14 (4) **DEPARTMENT.**—The term “Department”  
15 means the Department of Energy.

16 (5) **SECRETARY.**—The term “Secretary” means  
17 the Secretary of Energy.

18 **SEC. 3. REPORTING ON THE DEVELOPMENT OF CERTAIN**  
19 **TECHNOLOGIES.**

20 Not later than two years after the date of the enact-  
21 ment of this Act and every two years thereafter through  
22 2028, the Secretary shall submit to the Committee on  
23 Science, Space, and Technology of the House of Rep-  
24 resentatives and the Committee on Energy and Natural  
25 Resources of the Senate a report describing—

1 (1) the activities undertaken pursuant to this  
2 Act, including—

3 (A) the status of public-private partner-  
4 ships;

5 (B) progress of the programs under sec-  
6 tions 4, 6, 8, and 12 in meeting goals and  
7 timelines; and

8 (C) a strategic plan for funding of activi-  
9 ties across agencies; and

10 (2) the technologies and knowledge developed  
11 and demonstrated as a result of such activities, with  
12 a particular emphasis on whether such technologies  
13 were successfully adopted for commercial applica-  
14 tions, and if so, whether products relying on such  
15 technologies are manufactured in the United States.

16 **SEC. 4. ADVANCED VEHICLE RESEARCH AND DEVELOP-**  
17 **MENT PROGRAM.**

18 (a) **IN GENERAL.**—The Secretary, in consultation  
19 with the heads of relevant Federal agencies, shall conduct  
20 a research, development, and demonstration program of  
21 advanced vehicle technologies on more efficient, sustain-  
22 able, and domestically available materials and manufac-  
23 turing processes with the potential to—

1           (1) substantially reduce or eliminate greenhouse  
2           gas emissions from the manufacture and use of pas-  
3           senger and commercial vehicles; and

4           (2) reduce the cost of vehicle manufacturing  
5           and ownership.

6           (b) PROGRAM COMPONENTS.—In carrying out the  
7           program under subsection (a), the Secretary shall coordi-  
8           nate with the activities authorized under section 137 of  
9           the Energy Independence and Security Act of 2007 (42  
10          U.S.C. 17014; relating to research and development into  
11          integrating electric vehicles onto the electric grid) and sub-  
12          section (q) of section 641 of the United States Energy  
13          Storage Competitiveness Act of 2007 (42 U.S.C. 17231;  
14          enacted as subtitle D of title VI of the Energy Independ-  
15          ence and Security Act of 2007; relating to the establish-  
16          ment of a critical material recycling and reuse research,  
17          development, and demonstration program), and with the  
18          heads of relevant Federal agencies to determine a com-  
19          prehensive set of technical milestones for such activities  
20          and focus on research and development challenges across  
21          the vehicle supply chain including, to the maximum extent  
22          practicable, activities in the areas of—

23                 (1) electrification of vehicle systems, including  
24                 compact and efficient electric drivetrain systems;

1           (2) power electronics, electric machines, and  
2           electric machine drive systems, which may include—

3                   (A) electronic motors, including advanced  
4                   inverters and motors that can be used for pas-  
5                   senger vehicles and commercial vehicles;

6                   (B) magnetic materials, including perma-  
7                   nent magnets with reduced or no critical mate-  
8                   rials;

9                   (C) improving partial load efficiency;

10                  (D) design of power electronics and electric  
11                  motor technologies that enable efficient recy-  
12                  cling of critical materials; and

13                  (E) assessing potential impacts of various  
14                  vehicle systems on electric propulsion perform-  
15                  ance, including potential impacts from AM/FM  
16                  radio frequencies;

17           (3) vehicle batteries and relevant systems,  
18           which may include—

19                   (A) advanced batteries systems,  
20                   ultracapacitors, and other competitive energy  
21                   storage devices;

22                   (B) common interconnection protocols,  
23                   specifications, and architecture for both trans-  
24                   portation and stationary battery applications;

1 (C) energy density and capacity, re-  
2 charging robustness, extreme fast charging and  
3 wireless charging capabilities, and efficiencies to  
4 lower cost;

5 (D) lifetime improvement and reduction of  
6 potential lifecycle impacts from advanced bat-  
7 teries;

8 (E) improving efficient use and reuse, sub-  
9 stitution, and recycling of critical materials in  
10 vehicles, including rare earth elements and pre-  
11 cious metals, at risk of supply disruption;

12 (F) advanced battery protection systems  
13 for safe handling of high voltage power and  
14 thermal management;

15 (G) technologies enabling flexible manufac-  
16 turing facilities that can accommodate different  
17 vehicle battery chemistries and configurations;  
18 and

19 (H) improving the efficiency and safety of  
20 the manufacturing of advanced batteries;

21 (4) vehicle components and systems, including  
22 manufacturing technologies and processes, which  
23 may include—

24 (A) reducing or repurposing waste  
25 streams, reducing emissions, and energy inten-

1           sity of vehicle, engine, and advanced battery  
2           manufacturing processes; and

3           (B) increasing the production rate and de-  
4           creasing the cost of advanced battery and hy-  
5           drogen fuel cell manufacturing, including pur-  
6           pose-built hydrogen fuel cell vehicles, hydrogen  
7           fueling infrastructure, and components;

8           (5) hybrid and alternative fuel vehicles and fuel  
9           pathways, which may include—

10           (A) vehicle fuel cells and relevant systems,  
11           including power electronics systems to regulate  
12           fuel cell voltages;

13           (B) synthetic fuels from recycled carbon  
14           dioxide and net-zero carbon liquid fuels; and

15           (C) advanced biofuel technologies;

16           (6) lubricants and accessory power loads for hy-  
17           brid and electric vehicles aftertreatment tech-  
18           nologies;

19           (7) vehicle weight reduction, which may include  
20           the development of—

21           (A) more sustainable and cost-effective  
22           lightweight materials; and

23           (B) higher efficiency manufacturing proc-  
24           esses, such as additive manufacturing, to  
25           produce sustainable lightweight materials and

1 fabricate, assemble, and use dissimilar mate-  
2 rials, including—

3 (i) lightweight systems which combine  
4 several existing vehicle components; and

5 (ii) voluntary, consensus-based stand-  
6 ards for strategic lightweight materials;

7 (8) improved vehicle recycling methods to in-  
8 crease the recycled material content of feedstocks  
9 used in raw material manufacturing;

10 (9) vehicle propulsion systems, which may in-  
11 clude—

12 (A) engine and component durability;

13 (B) engine down speeding;

14 (C) advanced internal combustion engines;

15 (D) transmission gear and engine oper-  
16 ation matching; and

17 (E) advanced transmission technologies;

18 (10) applying advanced computing resources to  
19 large, voluntarily provided industry datasets from  
20 providers and cities to support the development of  
21 predictive engineering, modeling, and simulation of  
22 components, vehicle, and transportation systems;

23 (11) leveraging the use of machine learning to-  
24 ward manufacturing and additive manufacturing op-  
25 timization, which may include—



1 (A) assessing the efficiency and safety of  
2 manufacturing processes;

3 (12) advanced computing systems, including en-  
4 ergy efficient systems, technology, and networking  
5 for vehicular on-board, off-board, and edge com-  
6 puting applications;

7 (13) assessing automation in both vehicle and  
8 infrastructure systems;

9 (14) infrastructure, which may include—

10 (A) refueling and charging infrastructure  
11 for alternative fueled and electric drive or plug-  
12 in electric hybrid vehicles, with consideration  
13 for the unique challenges facing urban and  
14 rural areas;

15 (B) extreme fast charging, including  
16 through wired and wireless charging systems;

17 (C) integration, bidirectional capability,  
18 and operational optimization of vehicle elec-  
19 trification for light, medium, and heavy duty  
20 with the charging infrastructure and the elec-  
21 tric grid; and

22 (D) sensing, communications, and actu-  
23 ation technologies for vehicle, electric grid, and  
24 infrastructure, which may include—

- 1 (i) communication, onboard sensing,  
2 and connectivity among vehicles, infra-  
3 structure, pedestrians, and the electrical  
4 grid;
- 5 (ii) assessing the use of autonomous  
6 vehicles or connectivity to improve roadway  
7 throughput; and
- 8 (iii) research autonomous refueling  
9 and charging technologies and infrastruc-  
10 ture;
- 11 (15) retrofitting advanced vehicle technologies  
12 to existing vehicles;
- 13 (16) informing and educating the public on the  
14 energy benefits of automation and connected vehicle  
15 technologies, connected infrastructure assets, and  
16 mobility applied sensors to build trust and accept-  
17 ance;
- 18 (17) reusing valuable components and mate-  
19 rials, such as permanent magnets and other electric  
20 drive components for advanced vehicles; and
- 21 (18) transportation system analysis to further  
22 understand the energy implications and opportuni-  
23 ties of advanced mobility solutions, communication,  
24 and connectivity among vehicles, infrastructure, pe-  
25 destrians, and the electrical grid.

1 (c) NONROAD TRANSPORTATION ENVIRONMENTAL  
2 AND TECHNICAL ASSISTANCE RESEARCH.—

3 (1) IN GENERAL.—The Secretary, in carrying  
4 out the program established under subsection (a),  
5 and in consultation with the heads of relevant Fed-  
6 eral agencies, shall support research, development,  
7 and demonstration activities to address and reduce  
8 nonroad sector emissions from transportation fuels  
9 used in aviation, rail, and maritime technologies and  
10 other relevant technologies. Such activities may be  
11 carried out primarily by an Energy Innovation Hub  
12 established under section 206 of the Department of  
13 Energy Research Coordination Act (42 U.S.C.  
14 18632).

15 (2) PURPOSE.—The purpose of the research,  
16 development, and demonstration activities under  
17 paragraph (1) shall be to—

18 (A) identify, study, evaluate, test, and  
19 demonstrate emerging transformational  
20 nonroad vehicle energy technologies and prac-  
21 tices to improve environmental performance to  
22 meet Federal and international standards and  
23 guidelines, including reducing greenhouse gas  
24 emissions, water emissions, or other particulate  
25 or toxic emissions;

1 (B) advance research, development, and  
2 demonstration activities to—

3 (i) overcome barriers in trans-  
4 formational nonroad vehicle energy tech-  
5 nologies, including alternative fuels such as  
6 hydrogen, components, and other energy  
7 technologies to improve total machine or  
8 system efficiency for nonroad mobile equip-  
9 ment; and

10 (ii) increase the fuel economy and use  
11 of alternative fuels and alternative energy;

12 (C) support opportunities to transfer rel-  
13 evant research findings and technologies be-  
14 tween the nonroad and on-highway equipment  
15 and vehicle sectors; and

16 (D) test relevant precommercial tech-  
17 nologies.

18 (3) COORDINATION.—The Secretary may co-  
19 ordinate the research, development, and demonstra-  
20 tion activities under paragraph (1) with activities—

21 (A) that are associated with the develop-  
22 ment or approval of validation and testing re-  
23 gimes; and

24 (B) related to certification or validation of  
25 emerging energy technologies or practices that

1 demonstrate significant environmental or other  
2 benefits to domestic non-road transportation in-  
3 dustries.

4 (4) ASSISTANCE.—The Secretary may enter  
5 into cooperative agreements, contracts, or other  
6 agreements with academic, public, private, and non-  
7 governmental entities and facilities to carry out the  
8 activities under paragraph (1).

9 (5) TRANSFORMATIONAL NONROAD VEHICLE  
10 TECHNOLOGY DEFINED.—In this section, the term  
11 “transformational nonroad vehicle technology”  
12 means an innovative technology that—

13 (A) enables advanced nonroad transpor-  
14 tation, nonroad transportation components, and  
15 related energy technologies that have the poten-  
16 tial to produce significantly lower emissions and  
17 greater energy savings than current commercial  
18 technologies;

19 (B) enables improved or expanded supply  
20 and production of domestic emission reducing  
21 fuels and components; or

22 (C) ensures the long term, secure, and sus-  
23 tainable supply of critical materials.

24 (d) STANDARD OF REVIEW.—The Secretary shall pe-  
25 riodically review activities carried out under this section

1 to determine the achievement of technical milestones as  
2 determined by the Secretary.

3 (e) TECHNOLOGY TESTING AND METRICS.—In car-  
4 rying out the program under subsection (a), the Secretary,  
5 in coordination with the National Institute of Standards  
6 and Technology, shall—

7 (1) develop voluntary, consensus-based standard  
8 testing procedures, methodologies, and best practices  
9 for evaluating the performance of advanced vehicle  
10 technologies, including heavy vehicle technologies  
11 under a range of representative duty cycles and op-  
12 erating conditions, including for electrified and hy-  
13 drogen fuel cell systems; and

14 (2) evaluate advanced vehicle performance, in-  
15 cluding heavy vehicle and nonroad vehicle perform-  
16 ance using work performance-based metrics.

17 **SEC. 5. ADVANCED ON-ROAD VEHICLE SECURITY PRO-**  
18 **GRAM.**

19 (a) IN GENERAL.—The Secretary, in coordination  
20 with the program under section 4, the program authorized  
21 under section 137 of the Energy Independence and Secu-  
22 rity Act of 2007 (42 U.S.C. 17014), and the heads of rel-  
23 evant Federal agencies, shall establish a research and de-  
24 velopment program focused on the cybersecurity and phys-  
25 ical security of interconnections between vehicles, vehicle

1 energy storage systems, charging equipment, buildings,  
2 and the electric grid for plug-in electric vehicles, connected  
3 vehicles, autonomous, and other relevant vehicles, includ-  
4 ing the security impacts, efficiency, and safety of plug-  
5 in electric vehicles using alternating current charging,  
6 high-power direct current fast charging, and extreme fast  
7 charging.

8 (b) ASSESSMENT.—The Secretary shall develop a 5-  
9 to 10-year impact assessment of emergent cybersecurity  
10 threats and vulnerabilities to the United States on-road  
11 transportation system and connected infrastructure by  
12 identifying—

13 (1) areas of research with respect to which Fed-  
14 eral cross-agency research coordination and coopera-  
15 tion may help address such threats and  
16 vulnerabilities; and

17 (2) current research and challenges associated  
18 with cyber-physical protection and resiliency of elec-  
19 tric and connected and automated vehicle tech-  
20 nologies.

21 **SEC. 6. VEHICLE ENERGY STORAGE SYSTEM SAFETY PRO-**  
22 **GRAM.**

23 (a) IN GENERAL.—In coordination with the program  
24 under section 4, the Secretary shall support a program

1 of research, development, and demonstration of vehicle en-  
2 ergy storage safety and reliability.

3 (b) ACTIVITIES.—In carrying out this section, the  
4 Secretary shall support activities to—

5 (1) examine the mechanisms that lead to vehicle  
6 energy storage system safety and reliability inci-  
7 dents;

8 (2) develop new materials to improve overall ve-  
9 hicle energy storage system safety and abuse toler-  
10 ance;

11 (3) perform abuse testing;

12 (4) advance and perform testing techniques;

13 (5) demonstrate detailed failure analyses;

14 (6) mitigate vehicle energy storage cell and sys-  
15 tem failures, including hydrogen fuel storage tanks;  
16 and

17 (7) develop crush-induced battery safety proto-  
18 cols and technical standards to improve robustness.

19 **SEC. 7. ADVANCED VEHICLE TECHNOLOGIES ADVISORY**  
20 **COMMITTEE.**

21 (a) IN GENERAL.—Not later than 180 days after the  
22 date of the enactment of this Act, the Secretary shall es-  
23 tablish the Advanced Vehicle Technologies Advisory Com-  
24 mittee (in this section referred to as the “advisory com-  
25 mittee”) to advise the Secretary on vehicle technology and



1 mobility system research advancements. The advisory  
2 committee shall be composed of not fewer than 15 mem-  
3 bers, including representatives of research and academic  
4 institutions, environmental organizations, industry, and  
5 nongovernmental entities, including relevant labor organi-  
6 zations and associations representing automobile manu-  
7 facturers, who are qualified to provide advice on the re-  
8 search, development, and demonstration activities under  
9 this Act (in this section referred to as the “DOE Vehicle  
10 Program”).

11 (b) ASSESSMENT.—The advisory committee shall as-  
12 sess—

13 (1) the current state of United States competi-  
14 tiveness in advancing vehicle technologies and mobil-  
15 ity systems, including—

16 (A) the scope and scale of United States  
17 investments in sustainable and advanced trans-  
18 portation research, development, and dem-  
19 onstration; and

20 (B) the scope and scale of research, devel-  
21 opment, and demonstration activities to lower  
22 vehicle and fuel lifecycle greenhouse gas emis-  
23 sions;

24 (2) progress made in implementing the DOE  
25 Vehicle Program, including progress toward meeting

1 the technical milestones as determined by the Sec-  
2 retary pursuant to section 4;

3 (3) the balance of research and development ac-  
4 tivities and funding across the DOE Vehicle Pro-  
5 gram;

6 (4) the management, coordination, implementa-  
7 tion, and activities of the DOE Vehicle Program;

8 (5) whether environmental, safety, security, and  
9 other appropriate issues are adequately addressed by  
10 the DOE Vehicle Program; and

11 (6) other relevant topics as determined by the  
12 Secretary.

13 (c) REPORTS.—Not later than two years after the  
14 date of the enactment of this Act and not less frequently  
15 than once every three years thereafter, the advisory com-  
16 mittee shall submit to the Secretary, the Committee on  
17 Science, Space, and Technology of the House of Rep-  
18 resentatives and the Committee on Energy and Natural  
19 Resources of the Senate a report on—

20 (1) the findings of the advisory committee’s as-  
21 sessments under subsection (b); and

22 (2) the advisory committee’s recommendations  
23 for ways to improve or revise the DOE Vehicle Pro-  
24 gram.

1 (d) APPLICATION OF FEDERAL ADVISORY COM-  
2 MITTEE ACT.—Section 14 of the Federal Advisory Com-  
3 mittee Act (5 U.S.C. App.) shall not apply to the advisory  
4 committee.

5 **SEC. 8. MEDIUM- AND HEAVY-DUTY COMMERCIAL AND**  
6 **TRANSIT VEHICLES PROGRAM.**

7 (a) IN GENERAL.—The Secretary, in coordination  
8 with relevant research and development programs carried  
9 out by other relevant Federal agencies and appropriate in-  
10 dustry stakeholders, including relevant labor organiza-  
11 tions, shall carry out a program of research, development,  
12 and demonstration activities on advanced energy tech-  
13 nologies for medium- to heavy-duty commercial, voca-  
14 tional, recreational, and transit vehicles, including, to the  
15 maximum extent practicable, activities in the areas of—

16 (1) vehicle engines, which may include—

17 (A) engine efficiency, emission controls,  
18 and combustion research;

19 (B) energy and space-efficient emissions  
20 control systems;

21 (C) engine idle and parasitic energy loss  
22 reduction;

23 (D) advanced internal combustion engines;

24 and

25 (E) engine down speeding;

- 1 (2) electric drive trains, including—
- 2 (A) durable highly efficient power elec-
- 3 tronics and electric machinery research;
- 4 (B) partial load efficiency improvements;
- 5 (C) control and coordination research for
- 6 electric drive systems using multiple electric
- 7 motors;
- 8 (D) regenerative braking to recoup braking
- 9 energy; and
- 10 (E) high fidelity modeling to accelerate de-
- 11 sign and adoption of electrified commercial ve-
- 12 hicles;
- 13 (3) friction and wear reduction;
- 14 (4) improved aerodynamics and tire rolling re-
- 15 sistance;
- 16 (5) advanced lightweighting materials and vehi-
- 17 cle designs;
- 18 (6) synthetic fuels from recycled CO<sub>2</sub> and other
- 19 net-zero carbon liquid fuels;
- 20 (7) vehicle batteries, including—
- 21 (A) complete vehicle and battery pack
- 22 modeling, simulation, and testing; and
- 23 (B) thermal management of battery sys-
- 24 tems;

1 (8) mild hybrid, heavy hybrid, plug-in hybrid,  
2 and electric platforms, and energy storage tech-  
3 nologies, including—

4 (A) identifying and developing solutions for  
5 technical barriers to advance batteries;

6 (B) electric drive systems; and

7 (C) charging and refueling systems for me-  
8 dium-duty goods and heavy-duty freight deliv-  
9 ery vehicles;

10 (9) vehicle components, including—

11 (A) transmission and drivetrain optimiza-  
12 tion, including compact and efficient electric  
13 drivetrain systems;

14 (B) waste heat recovery and conversion;

15 (C) electrification of steering systems,  
16 braking systems, and accessory loads;

17 (D) onboard sensing, computing, and com-  
18 munications technologies; and

19 (E) advanced battery protection systems  
20 for safe handling of high voltage power;

21 (10) relevant infrastructure, including  
22 bidirectional capability, beyond megawatt charging,  
23 and increasing load capacity per vehicle;

24 (11) recharging infrastructure and compressed  
25 natural gas infrastructure;

1 (12) hydrogen vehicle technologies, including—

2 (A) fuel cells;

3 (B) hydrogen fueling infrastructure;

4 (C) the development of medium and heavy-  
5 duty refueling equipment design and concepts;

6 (D) synthetic fuels;

7 (E) onboard technologies for compressed  
8 and other advanced hydrogen storage systems;  
9 and

10 (F) advanced cooling technologies for fuel  
11 cell thermal management;

12 (13) retrofitting advanced energy technologies  
13 onto existing truck and bus fleets;

14 (14) assessment of automated and connected  
15 vehicle technologies;

16 (15) energy use strategies, including charging  
17 patterns that minimize impacts on the distribution  
18 grid and optimize the use of clean, low-cost genera-  
19 tion resources; and

20 (16) integration of advanced systems onto a  
21 single truck and trailer platform or bus.

22 (b) MEDIUM- AND HEAVY-DUTY SYSTEMS RE-  
23 SEARCH, DEVELOPMENT, AND DEMONSTRATION.—

24 (1) IN GENERAL.—The Secretary shall award  
25 financial assistance for the research, development,

1 and demonstration of the integration of multiple ad-  
2 vanced energy technologies and advanced operational  
3 efficiency for medium- and heavy-duty platforms and  
4 trailers, including the integration of technologies  
5 specified in subsection (a).

6 (2) APPLICANT.—Applicants applying for as-  
7 sistance under paragraph (1) may be comprised of  
8 truck and trailer manufacturers, engine and compo-  
9 nent manufacturers, hydrogen fuel cell and compo-  
10 nent manufacturers, public and private fleet owners  
11 and customers, university researchers, and other ap-  
12 plicants determined by the Secretary.

13 **SEC. 9. TECHNICAL ASSISTANCE TO STATE, LOCAL, AND**  
14 **TRIBAL GOVERNMENTS.**

15 (a) IN GENERAL.—In carrying out this Act, the Sec-  
16 retary may provide technical assistance to State, local, and  
17 Tribal governments or to a public-private partnership de-  
18 scribed in subsection (b) to assist with the commercial ap-  
19 plication of alternative fuels and alternative fuels vehicle  
20 technologies and infrastructure.

21 (b) PUBLIC-PRIVATE PARTNERSHIP DESCRIBED.—A  
22 public-private partnership described in this subsection is  
23 a public-private partnership comprised of State, local, or  
24 Tribal governments and nongovernmental entities, includ-  
25 ing industry partners.

1 (c) ASSISTANCE.—Technical assistance under this  
2 section may include—

3 (1) coordination in the selection, location, and  
4 timing of alternative fuel recharging and refueling  
5 equipment and distribution infrastructure, including  
6 the identification of transportation corridors and  
7 specific alternative fuels that may be made available;

8 (2) development of communication and other  
9 relevant protocols that integrate vehicle refueling  
10 and recharging into electric, hydrogen, biofuels, or  
11 other alternative fuel distribution systems;

12 (3) development of procedures for the installa-  
13 tion of alternative fuel distribution and recharging  
14 and refueling equipment;

15 (4) education and outreach for the commercial  
16 application of alternative fuels; and

17 (5) analysis of nontechnical barriers to integra-  
18 tion of alternative fuel vehicles into electric and nat-  
19 ural gas utility distribution systems.

20 (d) AUTHORIZATION OF APPROPRIATIONS.—There is  
21 authorized to be appropriated to carry out this section  
22 \$50,000,000 for each of fiscal years 2024 through 2028.



1 **SEC. 10. GRADUATE AUTOMOTIVE TECHNOLOGY EDU-**  
2 **CATION CENTERS OF RESEARCH EXCEL-**  
3 **LENCE (GATE).**

4 (a) **IN GENERAL.**—The Secretary shall award grants  
5 to establish up to seven Graduate Automotive Technology  
6 Education Centers of Research Excellence (referred to in  
7 this section as “Centers”) at an institution of higher edu-  
8 cation or a consortium thereof, to provide future genera-  
9 tions of engineers and scientists with knowledge and skills  
10 in advanced automotive energy technologies.

11 (b) **PURPOSE.**—Each Center shall—

12 (1) promote the development of skilled engi-  
13 neering professionals who will overcome technical  
14 barriers and help commercialize the next generation  
15 of advanced automotive energy technologies;

16 (2) support graduate research and establish or  
17 expand course study and laboratory work; and

18 (3) test energy technologies that represent the  
19 scale of technology development beyond laboratory  
20 testing, but not yet advanced to testing under oper-  
21 ational conditions at commercial scale.

22 (c) **CONSIDERATIONS.**—In awarding grants for the  
23 operation of the Centers under this section, the Secretary  
24 shall ensure that—

25 (1) the portfolio of Centers includes a diverse  
26 representation of geographical regions and resources;

1           (2) each new Center demonstrates unique re-  
2           search capabilities, unique regional benefits, or new  
3           energy technology development opportunities; and

4           (3) applicants are institutions of higher edu-  
5           cation with established expertise in engineering and  
6           design for advanced automotive energy technologies  
7           or are involved in partnerships with such institu-  
8           tions.

9           (d) REQUIREMENT.—In carrying out subsection (c),  
10          the Secretary shall ensure that grants for the operation  
11          of the Centers under this section are awarded to two or  
12          more entities that represent a Historically Black College  
13          or University, minority-serving institution, or Tribal Col-  
14          lege or University as the primary awardees or as members  
15          of a consortium.

16          (e) SCHEDULE.—Each grant to operate a Center  
17          under this section shall be awarded for a term of not more  
18          than five years, subject to the availability of appropria-  
19          tions. The Secretary may renew such five-year terms only  
20          once without competition limits, subject to a merit review  
21          process.

22          (f) LIMITATION.—Funds provided through a grant  
23          under this section may not be used for the construction  
24          of a physical building or facility to hold a Center unless  
25          the Secretary determines that such construction is nec-

1 essary for reasons of safety or the use of relevant equip-  
2 ment.

3 (g) TECHNICAL ASSISTANCE.—The Director may  
4 provide technical assistance to institutions of higher edu-  
5 cation receiving a grant under this section or entities seek-  
6 ing such a grant.

7 (h) AUTHORIZATION OF APPROPRIATIONS.—There  
8 are authorized to be appropriated to carry out this section  
9 \$8,300,000 for each of fiscal years 2024 through 2028.

10 **SEC. 11. REQUEST FOR INFORMATION TO ASSESS RE-**  
11 **SEARCH GAPS IN ALTERNATIVE FUEL DELIV-**  
12 **ERY, DISTRIBUTION, AND TRANSMISSION.**

13 (a) IN GENERAL.—Not later than one year after the  
14 date of the enactment of this section, the Secretary shall  
15 publish a request for information that shall be used by  
16 the Secretary to evaluate research, development, and dem-  
17 onstration activities to assess alternative fuel transmission  
18 and delivery technical barriers. The request shall identify  
19 research barriers associated to existing electric trans-  
20 mission and distribution systems to the distribution of al-  
21 ternative fuels and the deployment of alternative fuel re-  
22 charging and refueling capability, at economically competi-  
23 tive costs of alternative fuel for consumers, including re-  
24 search to address—

1           (1) electric grid load management and applica-  
2           tions that will allow bidirectional batteries in plug-  
3           in electric drive vehicles to be used for grid storage,  
4           ancillary services provision, and backup power;

5           (2) integration of plug-in bidirectional electric  
6           drive vehicles with smart grid technology, including  
7           necessary equipment, and information technology  
8           systems;

9           (3) technical and economic barriers to delivery  
10          technologies for hydrogen and biofuels sufficient to  
11          support widespread consumer use; and

12          (4) any other technical barriers to installing  
13          sufficient and regionally appropriate alternative fuel  
14          recharging and refueling infrastructure, including  
15          sufficiency and efficient use of zero-emissions gen-  
16          eration and transmission capabilities.

17          (b) CONSULTATION.—The Secretary shall carry out  
18          this section in coordination with relevant industry, State,  
19          local, and Tribal governments, and academic stockholders.

20          (c) REPORT.—Not later than two years after the date  
21          of the enactment of this Act, the Secretary shall submit  
22          to the Committee on Science, Space, and Technology of  
23          the House of Representatives and the Committee on En-  
24          ergy and Natural Resources of the Senate a report sum-  
25          marizing the findings under subsection (a).

1 **SEC. 12. ENERGY EFFICIENT MOBILITY SYSTEMS PRO-**  
2 **GRAM.**

3 (a) IN GENERAL.—The Secretary, in consultation  
4 with the heads of relevant Federal agencies, shall support  
5 a program of research, development, and demonstration  
6 of advanced energy efficient mobility solutions that will  
7 address the potential energy impacts of advanced vehicle  
8 technologies throughout the transportation sector. Such  
9 program shall include the development of tools, tech-  
10 niques, processes, and capabilities to understand and iden-  
11 tify essential components to improve the energy produc-  
12 tivity of integrated mobility systems.

13 (b) ACTIVITIES.—In carrying out this section, the  
14 Secretary shall support activities to—

15 (1) improve the energy and mobility impacts of  
16 emerging and potentially disruptive technologies and  
17 services;

18 (2) assess automated vehicle computing loads  
19 and capabilities;

20 (3) improve onboard sensing and external  
21 connectivity, including Vehicle-to-Vehicle, Vehicle-to-  
22 Infrastructure, and Vehicle-to-Everything;

23 (4) maximize vehicle energy efficiency for con-  
24 nected vehicles under real-world driving conditions;

25 (5) assess methods to use autonomous vehicles  
26 or connectivity to improve roadway throughput;

1           (6) research advance autonomous refueling and  
2 charging technologies and infrastructure;

3           (7) apply machine learning with high perform-  
4 ance computing resources to large industry datasets  
5 from providers and cities to develop predictive capa-  
6 bilities for the transportation system;

7           (8) optimize systems for mobility, grid and  
8 buildings to support vehicle electrification and vehi-  
9 cle automation from light duty to heavy duty with  
10 grid stability, demand response, and reliability; and

11           (9) carry out other innovative energy focused  
12 research and development areas as determined by  
13 the Secretary.

14 **SEC. 13. COORDINATION.**

15       (a) IN GENERAL.—In carrying out the activities  
16 under this Act, the Secretary shall, to the maximum extent  
17 practicable, coordinate research, development, and dem-  
18 onstration activities among—

19           (1) relevant programs of the Department, in-  
20 cluding programs carried out by—

21                   (A) the Office of Energy Efficiency and  
22 Renewable Energy;

23                   (B) the Office of Science;

24                   (C) the Office of Electricity;

25                   (D) the Office of Fossil Energy;

1 (E) the Office of Cybersecurity, Energy  
2 Security, and Emergency Response;

3 (F) the Advanced Research Projects Agen-  
4 cy—Energy;

5 (G) the Office of Clean Energy Dem-  
6 onstrations; and

7 (H) other offices as determined by the Sec-  
8 retary; and

9 (2) relevant technology research and develop-  
10 ment programs of other Federal agencies, includ-  
11 ing—

12 (A) the Department of Transportation;

13 (B) the National Institute of Standards &  
14 Technology;

15 (C) the National Science Foundation;

16 (D) the Department of Defense; and

17 (E) other Federal agencies as determined  
18 by the Secretary.

19 (b) INTERGOVERNMENTAL COORDINATION.—In car-  
20 rying out this Act, the Secretary shall seek opportunities  
21 to leverage resources and support initiatives of Federal,  
22 State, and local governments in developing advanced vehi-  
23 cle technologies, manufacturing, and infrastructure.

1 **SEC. 14. AUTHORIZATION OF APPROPRIATIONS.**

2       There are authorized to be appropriated to the Sec-  
3 retary for research, development, and demonstration of al-  
4 ternative fuels, vehicle propulsion systems, vehicle compo-  
5 nents, and other related technologies in the United States,  
6 including activities authorized under this Act—

7           (1) for fiscal year 2024, \$530,000,000;

8           (2) for fiscal year 2025, \$556,500,000;

9           (3) for fiscal year 2026, \$584,325,000;

10          (4) for fiscal year 2027, \$613,541,250; and

11          (5) for fiscal year 2028, \$644,218,312.

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