FY 2022 Request Overview Briefing

U.S. DEPARTMENT OF ENERGY

Office of ENERGY EFFICIENCY & RENEWABLE ENERGY

June 2021

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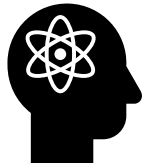
FY 2022 Request Strategy

Accelerate the research, development, demonstration, and deployment of technologies and solutions to equitably transition America to a carbon pollution-free electricity sector by 2035 and a economy by no later than 2050, creating good-paying jobs with the free and fair chance to join a union, and ensuring the clean energy economy benefits all Americans, especially workers and communities impacted by the energy transition and those historically underserved by the energy system and overburdened by pollution.

EERE Mission

Keys to Ensure the Greatest Impact

Environmental Justice and Equity



Diversity in STEM

Workforce Development

State and Local Partnerships

EERE Program Priorities

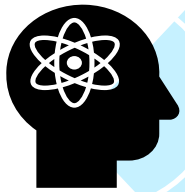
- Decarbonizing the electricity sector
- Decarbonizing transportation across all modes
- Decarbonizing energy-intensive industries
- Reduce the carbon footprint of buildings
- Decarbonizing the agriculture sector, specifically focused on the nexus between energy and water

EERE Emphasis Areas to Ensure the Greatest Impact

Including Examples from FY 2022 Request Investments

Energy and Environmental Justice

- *Hydrogen* - Analytical research that assesses regional impacts of hydrogen and fuel cell technologies (e.g., criteria pollutants, water), to inform environmental justice goals and support energy communities
- *Wind* - Research to understand socioeconomic impacts of wind energy development to develop solutions to promote equity and benefits, especially for energy communities
- *EERE-wide*: Multi-office energy transition initiative (ETI) that specifically looks to support clean energy transition in underserved and energy communities through long term, community driven approaches



Diversity in STEM

- *EERE-Wide* - Coordinated workforce training for clean energy technologies including solar and expansion of successful training models nationwide
- *EERE-Wide* - efforts to expand STEM pipeline development programs and new research partnerships among underutilized Minority Serving Institutions across the country.
- *Buildings* – Initiate a Minority-Serving STEM R&D Consortium focused on next generation lighting technologies

Workforce Development

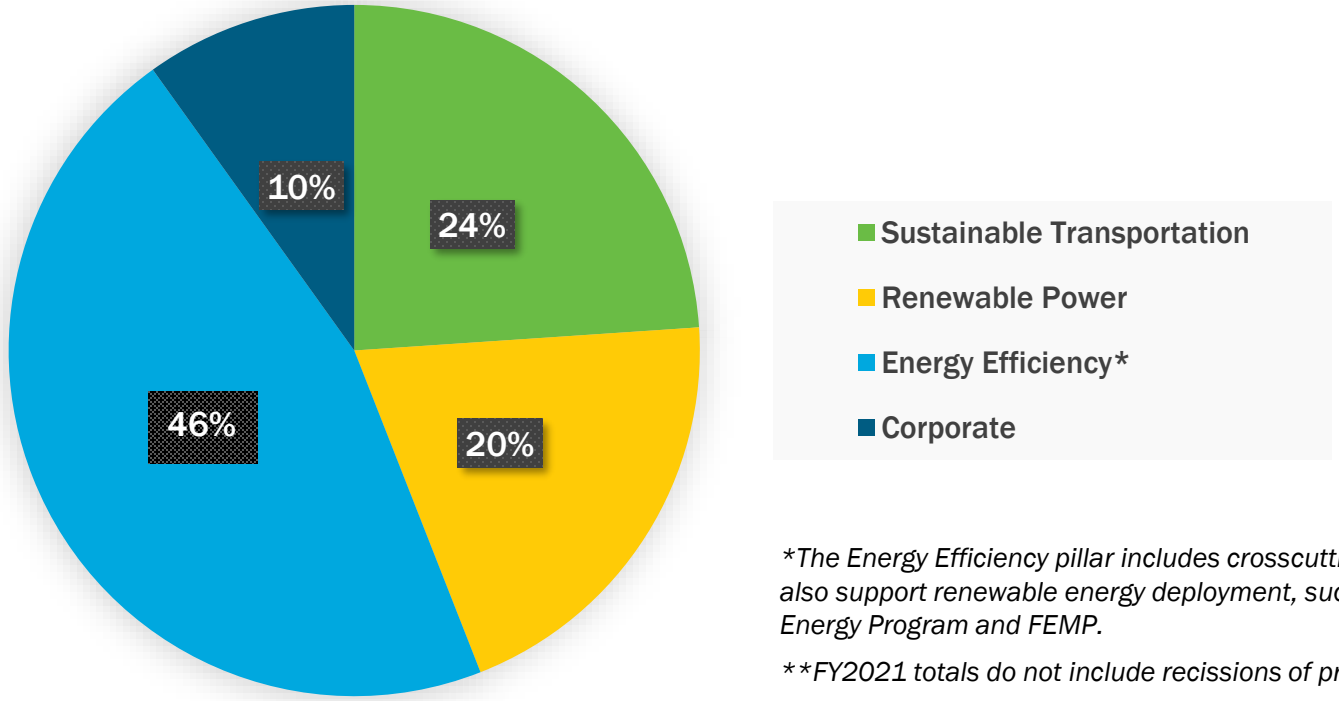
- *Advanced Manufacturing* - Workforce Development activity that supports participants at varying career levels, engages underserved and energy communities and integrates activities across AMO programs and partner offices
- *Vehicles* - The EcoCAR Mobility Challenge, a university student competition that provides science and technology training for the future advanced automotive workforce

State & Local Partnerships

- *EERE-wide* - Clean Energy for Local Governments program to provide competitive awards to support the development and deployment of transformative clean energy programs of qualifying local governments, such as disadvantaged and energy communities
- *Solar* - The National Community Solar Partnership, which provides technical assistance to businesses, non-profit organizations, and state, local and tribal governments to expand access to affordable community solar, especially in energy communities

EERE FY 2022 Request Summary

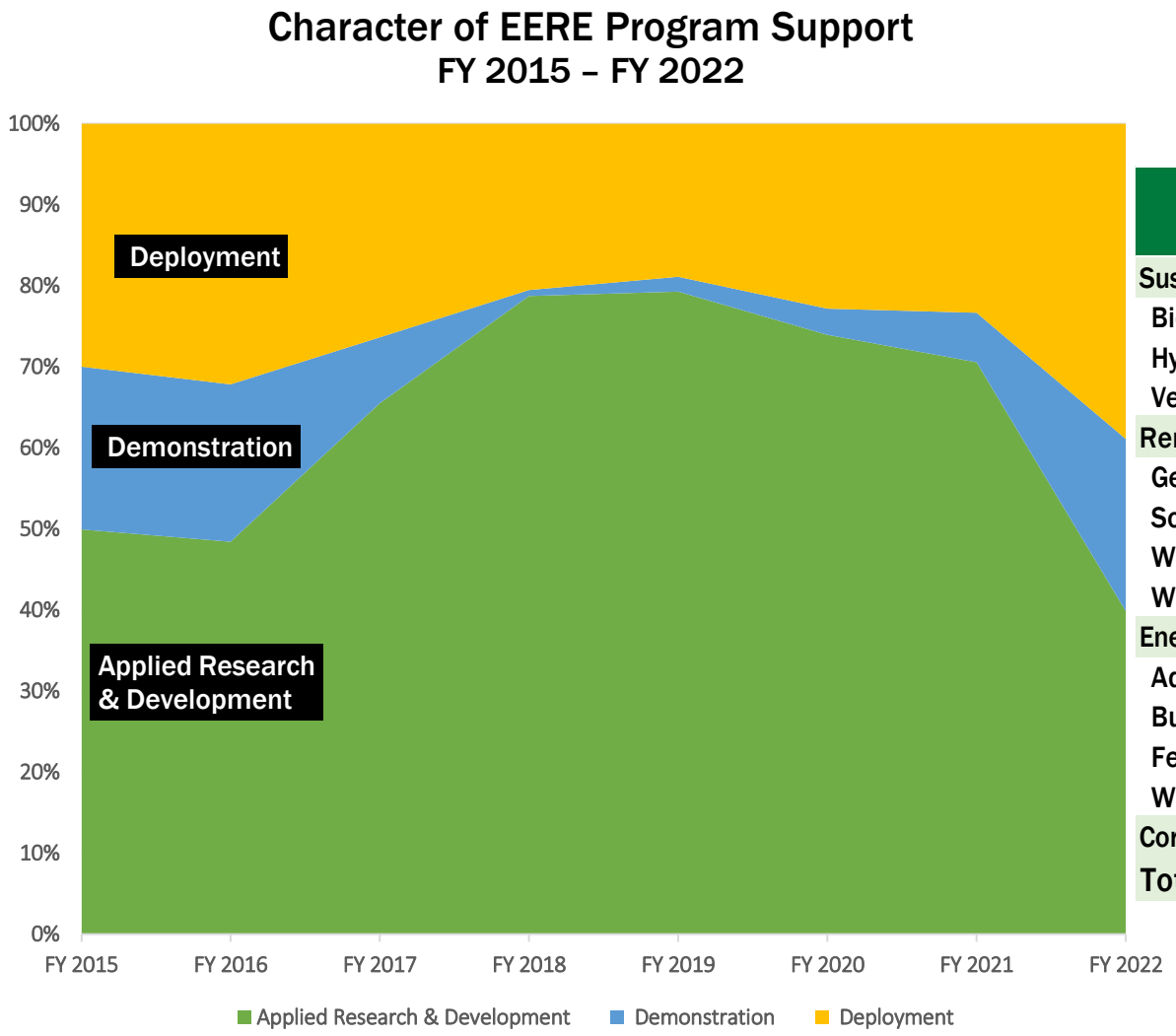
EERE Programmatic Pillar (dollars in thousands)	FY 2021 Enacted	FY 2022 Request	Increase/ Decrease	Percent Increase
Sustainable Transportation	805,000	1,132,500	327,500	41%
Renewable Power	646,000	951,765	305,765	47%
Energy Efficiency	1,103,500	2,179,150	1,075,650	97%
Corporate Support Programs	309,500	468,585	159,085	51%
Total, EERE	2,864,000	4,732,000	1,868,000	65%



*The Energy Efficiency pillar includes crosscutting programs that also support renewable energy deployment, such as the State Energy Program and FEMP.

**FY2021 totals do not include recissions of prior year balances

EERE's FY 2022 Request prioritizes demonstration & deployment



EERE Budget Program	FY 2022 Request (dollars in thousands) Deployment	Demonstration	Applied Research & Development
Sustainable Transportation	51,760	354,660	726,080
Bioenergy Technologies	1,200	110,350	228,450
Hydrogen and Fuel Cells	1,000	88,600	107,900
Vehicle Technologies	49,560	155,710	389,730
Renewable Power	155,197	250,589	545,979
Geothermal Technologies	11,875	48,625	103,260
Solar Energy Technologies	57,850	66,250	262,475
Wind Power Technologies	70,472	36,303	98,095
Water Power Technologies	15,000	99,411	82,149
Energy Efficiency	1,450,977	301,131	427,042
Advanced Manufacturing	62,298	241,000	247,202
Building Technologies	142,029	60,131	179,840
Federal Energy Management Program	438,150	-	-
Weatherization and Intergovernmental Programs	808,500	-	-
Corporate Support Programs	NA	NA	NA
Total, EERE	1,657,934	906,380	1,699,101

Sustainable Transportation

RDD&D efforts to decarbonize transportation across all modes—Enable **vehicle electrification**, commercially viable **hydrogen fuel cell trucks**, sustainable **aviation fuel** from biomass, and waste carbon resources. Low-GHG options for **off-road vehicles, rail, and maritime.**

(dollars in thousands)	FY 2021 Enacted	FY 2022 Request	$ Change	% Change
Vehicle Technologies	400,000	595,000	195,000	49%
Bioenergy Technologies	255,000	340,000	85,000	33%
Hydrogen and Fuel Cell Technologies	150,000	197,500	47,500	32%

Key EERE Priorities Enabled:

Transportation

Industry

Agriculture

Decarbonize Electricity

Deployments or demonstration to show viable commercial paths in time to allow for major 2030 commercial activity and 2035 large scale transition to the new technology to enable (considering fleet turnover) full decarbonization by 2050.

- Initiate EV community partner demonstration programs that provide templates for larger scale EV and charger deployments
- Demonstrate smart vehicle charging to enable vehicle-to-grid integration
- Demonstrate sustainable bio-energy pathways including biosolids to energy in rural communities
- Increased heavy duty fuel cell truck demonstration through SuperTruck III funding
- Increased support for pilot and demo-scale biofuel projects from multiple feedstocks

Achieve cost targets on batteries, hydrogen, fuel cells and biofuels to support market pull without major long-term subsidies.

- New battery technology and recycling RD&D; domestic supply chain development
- RD&D to reduce greenhouse gases from existing biofuels

Hydrogen use for industrial decarbonization and energy storage as well as sustainable biomass to achieve reduced GHG from the Agricultural sector.

- Funding to demonstrate lower cost hydrogen production through electrolyzers and integration of hydrogen with energy storage to support renewable power
- RD&D to decarbonize steel and ammonia production through hydrogen

Sustainable Transportation (ST)

Vehicle Technologies – FY 2022 Request

Vehicle Technologies accelerates the implementation of affordable and clean vehicle technology through a portfolio of research, development, demonstration, and deployment while also improving mobility options for all Americans.

Subprogram (dollars in thousands)	FY 2021 Enacted	FY 2022 Request	FY 2022 vs. FY 2021	% Change
Battery and Electrification Technologies	178,700	248,700	+70,000	+39%
Advanced Engines and Fuel Technologies	70,000	30,000	-40,000	-57%
Materials Technology	40,000	60,000	+20,000	+50%
Energy Efficient Mobility Systems	45,000	70,000	+25,000	+56%
Technology Integration	60,300	180,300	+120,000	+199%
Data, Modeling, and Analysis	6,000	6,000	0	-
Total	**400,000**	**595,000**	**+195,000**	**+49%**

FY 2022 Emphasis Areas:

- Demonstrate and deploy technologies that enable transportation opportunities for all communities, with an emphasis on those that are currently underserved, and accelerate electric vehicle adoption at the community level.
- Target-driven approach to achieve the performance and cost needed to advance technology in which industry can deploy in a broad range of affordable, efficient, and clean transportation choices to move people and goods across America.
  - Leverage industry partnerships (U.S. DRIVE/21st Century Truck) for relevant technical and market expertise.
  - Leverage interagency collaborations (DOD, DOC, DOT, EPA) for strategic stewardship of Federal investments.
- Advanced Battery R&D for EVs and batteries across clean energy applications including the Energy Storage Grand Challenge, aiming to reduce the cost of electric vehicle battery cells by more than half to $60/kWh.
- In accordance with Executive Order 14008: Tackling the Climate Crisis at Home and Abroad, deemphasize support for RDD&D designed to expand the use of fossil-fueled internal combustion engines.

Vehicle Technologies – FY 2022 Highlights and Major Changes

- **Advanced Nationwide Adoption and Deployment of Electric Vehicles (EV) and EV Infrastructure ($100M):** Improve equitable access to the benefits of electrified transportation, considering plug-in electric vehicles (PEVs) and charging infrastructure availability for mobility choices such as personal vehicle ownership, car sharing, ride sharing, school transport, and public transit. Work to increase charging infrastructure, PEV cost parity with conventional vehicles, education, and workforce training to facilitate widespread PEV adoption. Such activities also support the Administration's goal to deploy 500,000 PEV charging stations throughout the Nation.
- **New Advance Battery R&D ($75M):** Support many significant objectives associated with decarbonization, both in transportation directly, and in energy storage more broadly to support decarbonization of the electricity sector. Initiate laboratory and cooperative agreements for projects aimed at achieving the following new objectives: reducing electric vehicle (EV) battery cell cost by 50 percent to $60/kWh by 2030 to achieve EV cost parity with internal combustion engine vehicles; eliminating dependence on critical materials such as cobalt, nickel, and graphite, reducing battery supply chain vulnerabilities by 2030; and establishing a lithium battery recycling ecosystem to recover 90 percent of spent lithium batteries and re-introducing 90 percent of key materials into the battery supply chain by 2030.
- **Expand SuperTruck 3 ($30M):** Fund projects to electrify medium- and heavy-duty freight trucks. Additional investment will boost vehicle efficiency and expand EV infrastructure. Work will advance the Administration's goal of achieving carbon pollution-free electricity by 2035 and to deliver an equitable, clean energy future, and put the United States on a path to achieve net-zero emissions, economy-wide, by no later than 2050 (in accordance with Executive Order 14008: Tackling the Climate Crisis at Home and Abroad).
- **Clean Energy Mobility Solutions for Underserved Communities ($20M):** Support for robust local and regional partnerships including the Clean Cities activity to ease barriers and promote the use of new transportation technologies with a focus on addressing the barriers to light-, medium-, and heavy-duty plug-in electric vehicle (PEV) deployment, especially in underserved communities (e.g., low-income, rural, and other demographics that currently have minimal access to PEVs).
- **Reduction to Internal Combustion Engine RDD&D (-$40M):** Deemphasize support for RDD&D designed to expand the use of fossil-fueled internal combustion engines (in accordance with Executive Order 14008: Tackling the Climate Crisis at Home and Abroad).

Bioenergy Technologies – FY 2022 Request

Bioenergy Technologies supports Research and innovation to convert domestic biomass and waste resources to cost-effective, low-carbon biofuels and bioproducts.

Subprogram (in thousands)	FY 2021 Enacted	FY 2022 Request	FY 2022 vs. FY 2021	% Change
Feedstock Technologies	40,000	50,000	+10,000	+25%
Advanced Algal Systems	40,000	35,000	-5,000	-13%
Conversion Technologies	110,000	110,000	-	0%
System Development and Integration	60,000	135,500	+75,500	+126%
Data, Modeling and Analysis	9,500	9,500	-	0%
Total	**259,500**	**340,000**	**+80,500**	**+31%**

FY 2022 Emphasis Areas

- Decarbonizing transportation, industry and agriculture – Creating high-quality jobs, particularly in rural America
- Decarbonizing difficult to electrify modes of transportation – Sustainable Aviation Fuels (SAF); Rail, Maritime and heavy-duty trucks
- Spurring innovation in high-value bioproducts and renewable chemicals - Expanding the bioeconomy and support the transition to net-zero emissions
- Community-based solutions – Addressing environmental, economic, and social challenges at the regional, state and local levels to ensure equity, inclusion and environmental justice

Bioenergy Technologies – FY 2022 Highlights & Major Changes

- **Scale-up of Integrated Biorefineries ($75M):** Increasing focus on enabling scale-up of low-carbon fuels through demonstration of cost-effective production pathways with an emphasis on Sustainable Aviation Fuels (SAF). Demonstrating new SAF pathways is urgently needed in order to enable wide-spread production needed for a 2050 net-zero economy.
- **Improving Lifecycle GHG emissions from Existing Biofuel Production ($15M):** New initiative to demonstrate solutions that can reduce CO_2 emissions from "traditional" biofuels facilities from 40 percent, to over 70 percent, compared with petroleum through sustainable agriculture, fuel switching, productivity enhancements, and/or conversion-efficiency measures.
- **Community Organic Waste Management Solutions ($10M):** New community-scale, public-private partnerships to reduce harmful emissions and other environmental issues from operations that produce manure and other wet wastes that disproportionally affect disadvantaged communities in rural areas. Funding will support engineering, construction, and operation of up to 2 pilot-scale projects that employ advanced technologies suitable for various community circumstances to demonstrate overall potential.
- **Healthy Forest Management, Sustainable Agriculture, Biogenic Carbon Drawdown ($13M):** New RD&D program on sustainable agriculture practices and help farmers maximize profits on marginal lands while providing valuable feedstocks for bioenergy production. Funding will develop sensors and tools for soil carbon monitoring and soil carbon enhancement via biochar while enabling carbon credit banking markets and other activities requiring verifiable carbon emission data.

Hydrogen and Fuel Cell Technologies – FY 2022 Request

The Hydrogen and Fuel Cell Technologies Office (HFTO) focuses on research, development, and demonstration of hydrogen and fuel cell technologies across multiple sectors enabling innovation, a strong domestic economy, and a clean, equitable energy future.

Subprogram (in thousands)	FY 2021 Enacted	FY 2022 Request	FY 2022 vs. FY 2021	% Change
Fuel Cell Technologies	25,000	35,000	+10,000	+40%
Hydrogen Technologies	71,000	78,500	+7,500	+11%
Systems Development and Integration	51,000	81,000	+30,000	+59%
Data, Modeling and Analysis	3,000	3,000	-	-
Total	**150,000**	**197,500**	**+47,500**	**+32%**

FY 2022 Emphasis Areas

- Expand beyond early-stage R&D, include later-stage and demonstration efforts for H2 and fuel cells with a focus on hard-to-decarbonize sectors (e.g., steel manufacturing, heavy duty transport), energy storage, and achieving H2@Scale
- Supports Administration goals including: a carbon-free grid by 2035 and net-zero carbon economy by 2050,
- Accelerate electrolyzer RDD&D, demonstrate H2 energy storage and end use (including offshore wind, steel and ammonia production), and H2 fuel cells for heavy duty trucks as part of the SuperTruck program,
- Priorities include addressing environmental justice and disadvantaged/underserved communities, workforce development, DEI and STEM, and collaboration across offices (e.g., Fossil, Nuclear, Science, Wind, Solar, Advanced Manufacturing, Vehicles, etc.)

Key Metrics include:

- $2/kg clean hydrogen production by 2025 (vs. ~$5-6/kg baseline)
- $80/kW and 25,000-hour durability fuel cells and $9/kWh hydrogen storage by 2030 (vs. baseline of ~$200/kW, ~5,000-hour durability, and ~$15/kWh storage)

Note: Targets are modeled cost at high volume

Hydrogen and Fuel Cell Technologies – FY 2022 Highlights and Major Changes

Enable Affordable, Clean Hydrogen Technologies ($78.5M):

- Emphasizes H2NEW consortium for electrolyzers, HydroGEN for advanced water-splitting to enable $2/kg clean hydrogen by 2025 and a longer-term target of $1/kg
- Includes materials/carriers for hydrogen storage/ delivery, and materials compatibility (e.g., H-Mat consortium) and infrastructure technologies

Develop Affordable, Reliable Fuel Cell Technologies ($35M)

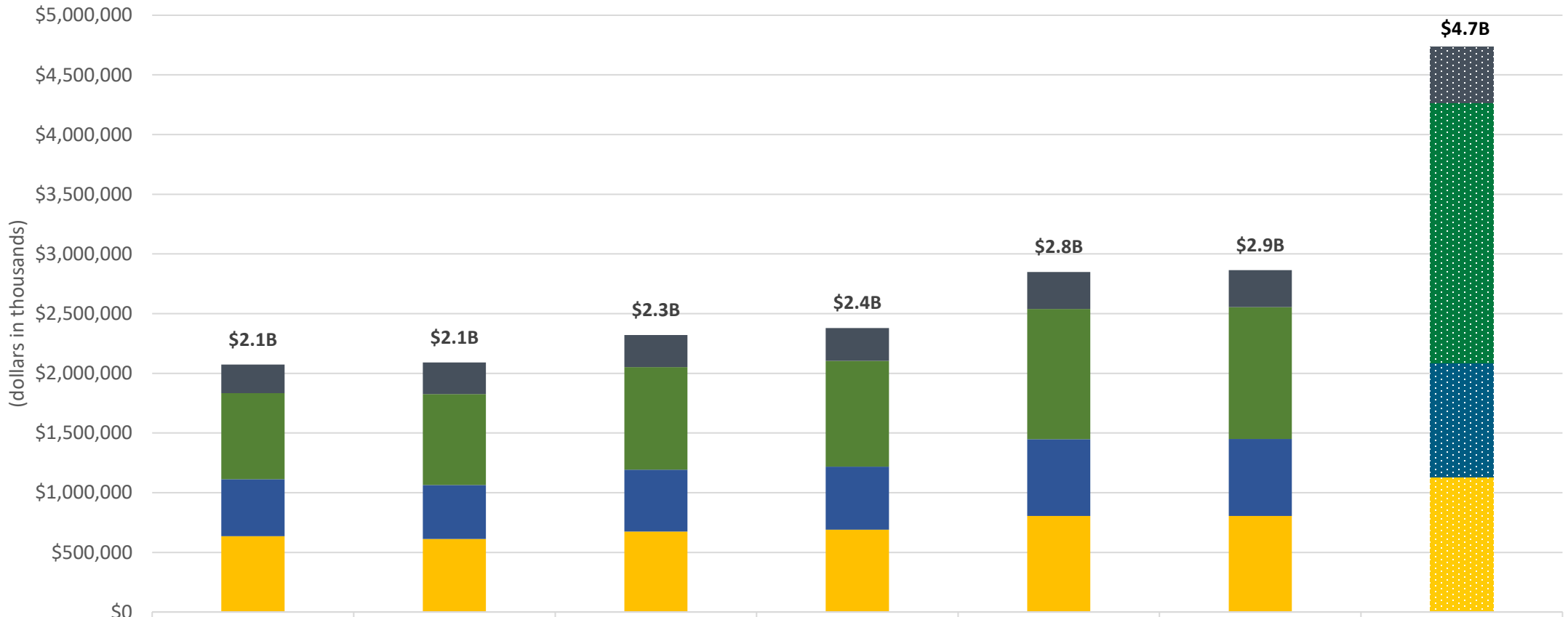
- Focuses on Million Mile Fuel Cell Truck Consortium (M2FCT) and fuel cells for SuperTruck III
- Includes materials (catalysts, membranes, electrodes, etc.) and components and systems development to meet cost, efficiency, and durability metrics with crosscutting impact potential (transportation and stationary applications)

Accelerate Demonstrations for Hard-to-Decarbonize Sectors through Systems Development and Integration ($81M)

- Includes demos for medium/heavy duty trucks, energy storage (e.g., offshore wind), grid integration, and end uses
- Includes clean hydrogen demos for decarbonizing industry/chemicals (e.g., steel and ammonia)
- Continues safety, codes, standards, workforce development and training to ensure safety and harmonized codes and standards

Questions

EERE Appropriations by Sector, FY 2016 – FY 2022



	FY 2016 Enacted	FY 2017 Enacted	FY 2018 Enacted	FY 2019 Enacted	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request
Corporate Support	$238,000	$264,500	$268,000	$273,500	$309,500	$309,500	$468,585
Energy Efficiency	$721,000	$761,641	$858,727	$888,000	$1,091,000	$1,103,500	$2,179,150
Renewable Power	$478,050	$451,040	$519,306	$527,500	$642,000	$646,000	$951,765
Sustainable Transportation	$635,450	$612,959	$674,045	$690,000	$805,500	$805,000	$1,132,500
Total, EERE	$2,072,500	$2,090,140	$2,320,078	$2,379,000	$2,848,000	$2,864,000	$4,732,000

EERE totals do not include recissions of prior year balances.

Budget Summary

EERE Programs	FY 2020 Enacted ($K)	FY 2021 Enacted ($K)	FY 2022 Request ($K)
Sustainable Transportation	**805,500**	**805,000**	**1,132,500**
Vehicle Technologies	396,000	400,000	595,000
Bioenergy Technologies	259,500	255,000	340,000
Hydrogen and Fuel Cell Technologies	150,000	150,000	197,500
Renewable Power	**642,000**	**646,000**	**951,765**
Solar Energy Technologies	280,000	280,000	386,575
Wind Energy Technologies	104,000	110,000	204,870
Water Power Technologies	148,000	150,000	196,560
Geothermal Technologies	110,000	106,000	163,760
Energy Efficiency	**1,091,000**	**1,103,500**	**2,179,150**
Advanced Manufacturing	395,000	396,000	550,500
Federal Energy Management Program	40,000	40,000	438,150
Building Technologies	285,000	290,000	382,000
Weatherization and Intergovernmental Programs	371,000	377,500	808,500
Corporate Support	**309,500**	**309,500**	**468,585**
Program Direction	165,000	165,000	250,000
Strategic Programs	14,500	14,500	43,585
Facilities and Infrastructure (NREL)	130,000	130,000	175,000
Subtotal, EERE	**2,848,000**	**2,864,000**	**4,732,000**
Rescission of Prior Year Balances*	(58,000)	(2,240)	
Energy Program Rescission*	(12,723)		
Total, EERE	**2,777,277**	**2,861,760**	**4,732,000**

**Note: Rescissions affect Prior Year Balances rather than FY 2020 Enacted Budgetary Authority*

EERE Support for DOE-Wide Crosscutting Initiatives

New & Expanded Are Highlighted

Crosscut	FY 2021 Enacted	FY 2022 Request	Summary of Investment
Advanced Manufacturing	534,102	782,912	Actions to foster the innovations required to sustainably manufacture the clean energy technologies needed for the industrial, transportation, and buildings sectors, as well as the energy production and delivery systems needed to power these sectors.
Advanced Transportation	789,250	1,078,580	RDD&D efforts to strategically decarbonize transportation across all modes, working to enable vehicle electrification, commercially viable hydrogen fuel cell trucks, sustainable aviation fuel from biomass and waste carbon resources and GHG options for off-road vehicles, rail, and maritime.
Alternative Fuels	335,000	450,770	Initiatives in low-carbon and carbon-neutral fuels such as biofuels, hydrogen, and e-fuels to ensure economy-wide decarbonization is achievable for hard-to-electrify sectors, including heavy transport, air travel, and shipping.
AI & Machine Learning	46,805	62,746	Activities to ensure American scientific leadership in AI for decades to come and long-term economic success and national security including exploration of machine learning (ML), natural language processing, knowledge representation and reasoning, and computer vision, and the research into the safety, security, and robustness of AI systems.
Biotechnology	59,375	57,250	RDD&D in fundamental science, tool development and targeted capabilities to support technologies such as bioengineering techniques to optimize production of targets (fuels, chemicals, and materials) in microbes.
Carbon Dioxide Removal	20,300	20,800	Investments to enhance natural and biological systems as well as engineered technologies that remove CO2 from the atmosphere or oceans and durably store it in geological, terrestrial, or ocean reservoirs, or in products.
Carbon Management	278,050	365,700	A broad portfolio of approaches including carbon capture, utilization, and storage of emissions at point sources, the increased use and recycling of renewable carbon and waste carbon feedstocks, as well as carbon dioxide removal technologies and methodologies.
Clean Buildings & Cities	655,850	1,183,720	RDD&D to foster innovations and develop widely available, net-zero emission, cost-competitive technologies for buildings, cities, and associated infrastructure.
Critical Minerals	104,300	160,150	Activities aimed at diversifying the supply of, developing substitutes for, and driving recycling, reuse, and more efficient use of critical minerals at levels of the supply chain, including exploration, mining, concentration, separation, alloying, recycling, and reprocessing.

EERE Support for DOE-Wide Crosscutting Initiatives

New & Expanded Are Highlighted

Crosscut	FY 2021 Enacted	FY 2022 Request	Summary of Investment
Decarbonizing Agriculture	50,700	134,300	RDD&D including work related to reducing GHG emissions in the agricultural sector through the development of biofuels, the greater efficiency of off-road agricultural vehicles, on-site production of animal waste to clean energy, and better understanding and predicting water flow to design more water and energy efficient irrigation systems.
Decarbonizing Industry	242,710	798,800	Actions to enable scale up of cost-competitive, low-emissions technologies across the pillars of industrial decarbonization: energy efficiency; electrification; low carbon fuels, feedstocks and energy sources; and carbon capture utilization and storage (CCUS).
Energy Sector Cybersecurity	32,351	17,070	Activities in concert with other federal partners and stakeholders across industry, and state and local governments to strengthen the Nation's cybersecurity capabilities and addressing the most pressing cyber threats.
Energy Storage Grand Challenge	327,292	457,900	A comprehensive program to accelerate the development, commercialization, and utilization of energy storage technologies at the scale necessary for the U.S. to reach its decarbonization goals.
Energy-Water Nexus	66,350	78,500	RDD&D, modeling and assessment tools, technical support, informed policy, planning tools to inform financing, and workforce development to replace America's outdated and deteriorating water infrastructure across multiple economic sectors.
Grid Modernization Initiative	188,950	299,110	Efforts to support new architectural concepts, tools, and technologies to measure, analyze, predict, protect, and control the grid of the future, and on enabling the institutional conditions that allow for more rapid development and widespread adoption of these tools and technologies to improve the reliability, resiliency, security, affordability, sustainability, and flexibility of the grid.
Hydrogen	155,900	226,500	RDD&D to foster innovations and develop widely available, net-zero emission, cost-competitive technologies for the production, storage, and delivery of hydrogen, and for its end use as a chemical feedstock or fuel.
Integrated Energy Systems	416,000	572,920	Approaches to integrate more renewable energy generation onto the grid by combining multiple energy sources (renewables, nuclear plants, fossil plants) to respond more readily to changing market demands and supply by help meet our nation's clean energy goals and enhancing the U.S. energy grid's flexibility.
Plastics Innovation Challenge	20,500	16,000	Initiatives to reduce energy consumption and greenhouse GHG associated with the production and use of plastics and polymers.
Space-Related R&D Activities	22,000	93,125	Support the development of hydrogen, fuel cell, and photovoltaic technologies to address issues of life support, power generation, transmission, storage, surface transportation, and resource extraction and utilization

Selected EERE-Wide Investments

EERE-Wide Investments: Energy Storage Grand Challenge

What

- A comprehensive program to accelerate the development, commercialization, and utilization of energy storage technologies at the scale necessary for the U.S. to reach its decarbonization goals.
- Demonstrate and validate existing technologies for new uses, and develop, prove safe and effective, and commercialize and scale up manufacturing for new technologies within the next 5-10 years.

Why

- Energy storage technologies are critical to decarbonizing the energy sector, whether for the power sector, transportation, buildings, or industrial end use; they are also critical to strengthen the reliability and resilience of the grid.
- Attain and sustain global leadership in energy storage manufacturing, utilization, and exports, with a secure, resilient domestic supply chain

How

- Promote coordination across DOE to address challenges from a system-level, rather than a technology-specific perspective; leverage DOE and National Lab capabilities
- Leverage a variety of funding strategies to accelerate innovation across a range of storage technologies based on three concepts: Innovate Here, Make Here, Deploy Everywhere. Address associated scale up challenges.

(dollars in thousands)	FY 2021 Enacted	FY 2022 Request	FY 2022 vs. FY 2021
Energy Storage Grand Challenge	**327,292**	**457,900**	**+130,608**

Participating EERE Offices: *Advanced Manufacturing, Building Technologies, Geothermal Technologies, Hydrogen and Fuel Cell Technologies, Solar Energy Technologies, Strategic Programs, Vehicle Technologies, Water Power Technologies, Wind Energy Technologies*

EERE-Wide Investments: Grid Modernization Initiative

What

- Work across the U.S. Department of Energy to help create the modern grid of the future.
- Focus on efforts to support new architectural concepts, tools, and technologies to measure, analyze, predict, protect, and control the grid of the future, and on enabling the institutional conditions that allow for more rapid development and widespread adoption of these tools and technologies.
- Efforts to integrate the nation's electricity to improve reliability, resiliency, security, affordability, sustainability, and flexibility.

Why

- Our extensive, reliable power grid has fueled the nation's growth since the early 1900s; however, the grid we have today does not have the attributes necessary to meet the demands of the 21st century and beyond.

How

- Since 2013 over $330M of research funding has been highly coordinated and implemented across multiple offices, using a multi-year strategy as a guiding roadmap to grid modernization efforts.
- Under GMI, the Grid Modernization Laboratory Consortium (GMLC) was established as a strategic partnership between DOE and the national labs to bring together leading experts, technologies, and resources to collaborate on the goal of modernizing the nation's grid.

(dollars in thousands)	FY 2021 Enacted	FY 2022 Request	FY 2022 vs. FY 2021
Grid Modernization Initiative	**188,950**	**299,110**	**+110,160**

***Participating EERE Offices**: Advanced Manufacturing, Building Technologies, Hydrogen and Fuel Cell Technologies, Solar Energy Technologies, Vehicle Technologies, Water Power Technologies, Wind Energy Technologies*

EERE-Wide Investments: Critical Minerals Initiative

What

- A federal strategy for advancing transformational RD&D across the entire critical materials supply chain; strengthening America's critical mineral supply chains and defense industrial base; and growing the American critical minerals workforce.
- Partnership with government agencies, National Labs, industry stakeholders, and academia (EERE serves as the DOE co-chair of the National Science & Technology Council (NSTC) Critical Minerals Subcommittee (CMS))

Why

- Critical materials are used in many products important to the American energy economy, including clean energy technologies, but the U.S. imports most of our critical mineral commodities.
- The United States lacks downstream domestic processing and manufacturing capabilities for critical materials.
- To develop a sustainable and robust supply chain in the United States, we must innovate to reduce the costs of the materials and reduce the environmental impacts of production.

How

- DOE's R&D strategy for addressing critical materials has three pillars: diversify supply, develop substitutes, and drive recycling, reuse, and more efficient use of critical minerals.
- Leverage the expertise related to this area across the DOE National Laboratory complex as well as encompass all efforts across the Applied Energy Offices and the Office of Science.
- EERE is leading interagency efforts to develop an R&D roadmap to enhance scientific and technical capabilities across the entire critical materials supply chain.

(dollars in thousands)	FY 2021 Enacted	FY 2022 Request	FY 2022 vs. FY 2021
Critical Minerals Initiative	104,300	160,150	+55,850

Participating EERE Offices: *Advanced Manufacturing Office, Geothermal Technologies, Hydrogen and Fuel Cell Technologies, Vehicle Technologies*

EERE-Wide Investments: Energy-Water Nexus

What

- An initiative encompassing technology RDD&D, modeling and assessment tools, technical support, informed policy, planning tools, and workforce development to replace America's outdated and deteriorating water infrastructure across municipalities, industry, utilities, agriculture, and resource extraction with one that is more sustainable, climate adaptive, and equitable for the 21st century and beyond.

Why

- Our Nation's large scale, centralized water infrastructure based on a linear model of fresh water served us well in the 20th century, but it is breaking down under new pressures, due to climate change, increased competition for water resources, an aging water infrastructure, and regulatory hurdles.

How

- Launch desalination technologies that deliver cost-competitive clean water.
- Transform the energy sector's produced water from a waste to a resource.
- Achieve near-zero water impact for new thermoelectric power plants, and significantly lower freshwater use intensity within the existing fleet.
- Double resource recovery from municipal wastewater.
- Develop small, modular energy-water systems for urban, rural, tribal, national security, and disaster response settings.

(dollars in thousands)	FY 2021 Enacted	FY 2022 Request	FY 2022 vs. FY 2021
Energy-Water Nexus	66,350	78,500	+12,150

EERE Participating Offices: *Advanced Manufacturing Office, Bioenergy Technologies, Solar Energy Technologies, Water Power Technologies, Weatherization and Intergovernmental Programs*

EERE-Wide Investments: Carbon Management

What

- A broad portfolio of RDD&D, coordination, and collaboration approaches including carbon capture, utilization, and storage of emissions at point sources; the increased use and recycling of renewable carbon and waste carbon feedstocks; carbon dioxide removal technologies and approaches; and cross-DOE and regional collaboration.

Why

- Actions are an essential component of tackling the climate crisis and achieving a net-zero-carbon economy by 2050.
- Actions will support a just energy transition for the underserved.
- Need for improved management of renewable carbon, carbon oxides, and carbon waste supplies to enable a circular economy and repurpose carbon to generate new employment and economic opportunities.

How

- Research, develop, demonstrate, and deploy carbon capture and storage.
- Develop and enable low-carbon supply chains, end uses, and infrastructure.
- Accelerate carbon-neutral hydrogen (H2).
- Develop and enable renewable carbon supply chains, circular carbon lifecycles, and infrastructure.
- Invest in thoughtful transition strategies.
- Strengthen ross-DOE Coordination and Collaboration and coordinate on regional transition action plans.

Total EERE Contribution to Crosscut Initiative (dollars in thousands)	FY 2021 Enacted	FY 2022 Request	FY 2022 vs. FY 2021
Carbon Management	278,050	365,700	+87,650

EERE Participating Offices: *Advanced Manufacturing Office, Bioenergy Technologies, Hydrogen and Fuel Cell Technologies, Water Power Technologies*