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Exhibit R-2, RDT&E Budget Item Justification: PB 2022 Office of the Secretary Of Defense **Date:** May 2021

Appropriation/Budget Activity 0400: <i>Research, Development, Test & Evaluation, Defense-Wide I BA 3: Advanced Technology Development (ATD)</i>	R-1 Program Element (Number/Name) PE 0604055D8Z / <i>Operational Energy Capability Improvement (OECI)</i>
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COST (\$ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
Total Program Element	0.000	62.686	16.000	74.300	-	74.300	-	-	-	-	-	-
455: <i>Operational Energy Capability Improvement</i>	0.000	62.686	16.000	74.300	-	74.300	-	-	-	-	-	-

Note

The FY 2021 NDAA included a rescission note on pages 166-169, "The agreement modifies a provision proposed by the House recommending rescissions and provides for the rescission of \$3,248,047,000." Per the FY21 NDAA rescission, the FY 2020 Operational Energy Capability Improvement Program Element was reduced by -\$10 million to \$54.900 million.

FY 2021 program funds were realigned in FY 2020 for higher departmental priorities under the Defense-Wide Review (DWR). However, in accordance with guidance in NDAA 2021 Section 322 "The Secretary of Defense shall include in the annual budget submission of the President under section 1105(a) of title 31, United States Code, a dedicated budget line item for fielding operational energy improvements, including such improvements for which funds from the Operational Energy Capability Improvement Fund have been expended to create the operational and business case for broader employment" funds are restored in the Presidential Defense Memorandum for FY 2022.

FY 2021 funds (\$16 million) are congressional directed adds for nuclear fuel core development to support the PELE reactor maturation and also funding to support power and thermal management maturation for directed energy weapons.

For FY 2020, in accordance with guidance in NDAA 2020 Section 239, and in concert with the Strategic Environmental Research and Development Program/ Environmental Security Technology Certification Program (SERDP/ESTCP), the Operational Energy Capability Improvement (OECI) funds were rebalanced to implement Energy Storage and Tactical Micro-grids. With the FY 2021 rescission, \$7.375 million in funding was rescinded. FY 2022 funding will be prioritized to complete these directed efforts in tactical micro-grid development and Energy storage to increase lethality and interoperability for Joint and Coalition warfighting.

A. Mission Description and Budget Item Justification

The Operational Energy Capability Improvement (OECI) project matures and demonstrates advanced technologies in operational energy across warfighting platforms and domains. Beginning in Fiscal Year 2020, the focus of this project was the culmination, demonstration and transition of all ongoing OECI efforts to service and agency partners.

Beginning in FY 2022, OECI will complete projects impacted by lack of funding due to the rescission and competitively award funding to support new projects in DoD Science and Technology Energy Strategy Focus areas of 1) Powering the Force, 2) Electrifying the Battlespace, and 3) Commanding Energy. Competitively awarded projects will continue to focus on multi-year technology maturation efforts. In FY 2022 1-year surge projects and 1-year studies that support OECI operational energy focus area and gap/seam requirements will also be awarded. These one-year efforts speed technologies to the warfighter and allow the OECI program to re-start rotational multi-year efforts. These investments address high priority joint operational energy requirements to ensure best-use of operational energy on the battlefield

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informed, when and where possible, by climate change mitigation. Projects will increase the joint force's lethality and agility and reduce logistical burdens. These new capabilities are required to address threats from near peer enemies.

B. Program Change Summary (\$ in Millions)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
Previous President's Budget	64.900	0.000	0.000	0.000	0.000
Current President's Budget	62.686	16.000	74.300	0.000	74.300
Total Adjustments	-2.214	16.000	74.300	0.000	74.300
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	16.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-	-			
• Program Adjustment	-2.214	-	74.300	-	74.300

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: 455: *Operational Energy Capability Improvement*

Congressional Add: *Operational Energy Capability Improvement Program Increase*

Congressional Add Subtotals for Project: 455

Congressional Add Totals for all Projects

	FY 2020	FY 2021
	0.000	16.000
Congressional Add Subtotals for Project: 455	0.000	16.000
Congressional Add Totals for all Projects	0.000	16.000

Change Summary Explanation

The \$74.300 million increase in FY 2022 is for Energy Science and Technology efforts that improve agility and resiliency in supplying operational energy with advanced power, storage, and distribution technologies.

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Appropriation/Budget Activity 0400 / 3					R-1 Program Element (Number/Name) PE 0604055D8Z / <i>Operational Energy Capability Improvement (OECI)</i>				Project (Number/Name) 455 / <i>Operational Energy Capability Improvement</i>			
COST (\$ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
455: <i>Operational Energy Capability Improvement</i>	0.000	62.686	16.000	74.300	-	74.300	-	-	-	-	-	-
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The basic mission of the OECI is to fund innovation that will improve DoD operational effectiveness via targeted S&T investments. As Defense-Wide funding, it incentivizes S&T to promote long term change in DoD capabilities so they are better aligned with the Operational Energy Strategy. OECI generally fosters innovation to improve operational energy performance and has two key mission aspects. First, to develop, demonstrate and transition into use operational energy technologies and practices that will improve DoD military capabilities and/or reduce costs. Second, to establish within the military Services sustainable, institutional capability to continue to research, develop and adopt operational energy innovations. OECI funds serve as “seed money” to start or consolidate promising operational energy programs to be sustained by the Services; accordingly, OECI generally emphasizes supporting or establishing programs, rather than one-off projects.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2020	FY 2021	FY 2022
Title: Operational Energy Capability Improvement (OECI)	62.686	-	74.300
<p>Description: In FY 2021, OECI is continuing or completing more than 30 classified and unclassified projects including:</p> <ul style="list-style-type: none"> • Undersea thermal energy generation • Long duration Unmanned Aerial Vehicles and Unmanned Ground Vehicles • Power and Thermal Management for High Power / Pulse Power systems and integration <p>FY 2020 Accomplishments: Successful demonstration of an autonomous robotic refueling system is now transitioning to the Navy. Demonstrated complete diurnal cycle flight of a zero logistics fuel unmanned aerial vehicle with expected flight endurance of at least 72 hours. Completed transition and obtained follow-up funding of the tactical vehicle electrification kit to PM Transportation Systems, PM Joint Light Tactical Vehicle, PM Terminal High Altitude Area Defense, and PM Command Post Integrated Infrastructure.</p> <p>FY 2022 Plans: Operational Energy Capability Improvement will develop and demonstrate the most promising, innovative, and cost-effective technologies and methods that address joint high priority operational energy requirements. OECI funding efforts will identify and mitigate energy-related risks and increase warfighting capabilities and resilience. OECI will invest in three focus areas:</p> <ul style="list-style-type: none"> • Powering the Force: Support the deployment of mobile and distributed operations with resilient and agile energy logistics in contested environments. Reduce the risks, vulnerability, and climate impacts of DoD’s dependence on fuel. 			

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2020	FY 2021	FY 2022
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<p>• Electrifying the Battlespace: Enable the electrification of weapons, platforms, unmanned systems, and soldiers to field new weapon, sensing, active defense, and other technologies. Meet the growing demands of power across the battlespace.</p> <p>• Commanding Energy: Capture and understand energy profiles to transform the Joint Force from a reactive to a predictive energy management and control. Achieve real-time energy awareness and command and control at all levels.</p> <p>Additional projects in the three priority areas include: Powering the Force Investment focus:</p> <ul style="list-style-type: none"> • Integrate hybrid-electric platform power into standardized tactical micro-grids; ruggedize portable renewables and energy harvesting technology alongside distributed battery energy storage; decrease the detectable signature and value of fuel movers and storage <p>Benefits to the Department of these investments include more mobile and distributed operations with decreased logistics requirements and reduced the risk to personnel and equipment of carrying fuel into the fight, especially through contested environments.</p> <p>Electrifying the Battlespace Investment focus:</p> <ul style="list-style-type: none"> • Improve ruggedized battery performance, to include standardization and safety; develop hybrid systems that include electrical propulsion; reduce the weight of personally carried batteries; improve the efficiency, reliability, and performance of wireless power beaming receivers and integrated systems • Develop advance power and thermal management technologies to meet the growing demands of high-power systems <p>Benefits to the Department of these investments include further enabling the electrification of weapons, platforms, unmanned systems, soldiers, sensors, and other systems used by maneuver forces. This drastically reduces energy resupply risks, costs, and signatures to enable persistent unmanned systems and unattended sensors used for ISR.</p> <p>Commanding Energy Investment focus:</p> <ul style="list-style-type: none"> • Integrate operational energy into mission modeling tools, war-gaming, and personnel development <p>Benefits to the Department of these investments include analytic products used by operational planners to develop better mission and campaign pre-position, force flow and battlespace distribution plans; and by field commanders to better understand the energy profile of enemy forces and conduct real-time contingency planning to enable the joint force to manage and control battlespace energy in a more predictive and less reactive mode. The tools can provide field commanders options in response to enemy action not otherwise available, enabling actions that might be less predictable by enemy forces.</p> <p>Beginning in FY 2022, OECI will complete projects impacted by lack of funding due to the rescission including:</p>			
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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2020	FY 2021	FY 2022
<ul style="list-style-type: none"> • Testing/evaluation of critical energy storage and micro grid control hardware that includes interoperability assessment/validation, understanding the efficiency and effectiveness of vendor agnostic inverters and energy storage devices, developing state-of-the-art advanced controllers and maturing the intelligent power distribution devices • Testing of the integrated hybrid micro grid system to validate/optimize electrical and dynamic operation and the functioning of equipment in extreme environments • Further developing metrology to enable large, lightweight, flexible electronically-steerable power arrays in space thereby impacting the ability to scale and provide power to expeditionary and other remote users to extend the reach and lethality of multi-domain platforms while reducing costly and vulnerable supply lines. <p>FY 2021 to FY 2022 Increase/Decrease Statement: NDAA 2021 SEC. 322. instructed the Secretary of Defense to include in the annual budget submission of the President under section 1105(a) of title 31, United States Code, a dedicated budget line item for fielding operational energy improvements, including such improvements for which funds from the Operational Energy Capability Improvement Fund.</p>				
Accomplishments/Planned Programs Subtotals		62.686	-	74.300
		FY 2020	FY 2021	
Congressional Add: Operational Energy Capability Improvement Program Increase		0.000	16.000	
<p>FY 2020 Accomplishments: Development of a DOD-wide high voltage energy storage module specification to enable a standardized battery architecture based on commercial technologies that will be applicable to multiple DOD platforms.</p> <p>Validation, qualification, and operational demonstration of Energy Efficient Multi-Mission Fuel/ISR/Strike Pods for unmanned aerial vehicles, per Combatant Command requirements.</p> <p>Accomplishments include: (1) Standardization to lower costs due to competition, ensures higher volume, and reduces sustainment burden (logistics, maintainability); (2) Electrification to increase maneuver (via improved fuel efficiency from electrical drive), higher survivability (silent mobility / watch, active protection systems), and increase in lethality (via directed energy maturation); and (3) Prototypes are scalable and interchangeable. The results of these projects were adopted by and transitioned to the Services.</p> <p>Energy Efficient Multi-Mission Fuel/ISR/Strike Pods show energy storage systems greatly increase flight endurance for unmanned aircraft systems. Redesigned UAS provides increased endurance/range/efficiency.</p>				

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		FY 2020	FY 2021
<p>Updates to: Prop, Drive Train, Fuel Pods, Aerodynamics and Fuel Injection to deliver >30% performance increase. These impacts were demonstrated and transitioned to the warfighter.</p> <p>FY 2021 Plans: Congressional Adds directed for nuclear fuel core development to support the PELE reactor maturation and also funding to support power and thermal management maturation for directed energy weapons.</p> <p>The Tri-structural Isotropic (TRISO) fuel line is a collaboration between DoD, NASA, and DOE. The first phase in the process is to establish the viability of a commercial TRISO fuel line that could be used by these agencies for any program, and to produce enough TRISO fuel to demonstrate throughput and quality control. The second phase is to purchase a nuclear reactor core for the PELE program. The Congressional Add for TRISO fuel production builds a nuclear fuel fabrication line, in support of DoD's Project Pele for modular nuclear reactors as well as supporting activities for NASA. This funding includes the purchasing of equipment, installation, and additional testing, which will lead to production of demonstration nuclear fuel beginning in FY22. Payoff will ensure a commercial TRISO fuel line is available for the PELE Nuclear Micro-Reactor to procure the nuclear reactor core when the Record of Decision for the program is complete.</p> <p>The Congressional Add for thermal and power technology develops thermal energy storage technologies that are more efficient, effective, and size weight and power superior. Demonstrations are planned for relevant (hundreds of kW magnitude) power levels, indicative of directed energy weapon engagement and load profiles. This work will demonstrate core technologies associated with the materials, interfaces, controls, and overall system integration, and then apply those lessons to larger scale prototypes that support laser scaling initiatives with higher lethality.</p>			
Congressional Adds Subtotals		0.000	16.000
C. Other Program Funding Summary (\$ in Millions)			
N/A			
Remarks			
D. Acquisition Strategy			
N/A			