DOE Office of Science and Nuclear Physics Overview

EIC Users Meeting

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Office of Nuclear Physics
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U.S. DEPARTMENT OF ENERGY | Office of Science

SC Mission:

Delivery of scientific discoveries and major scientific tools to transform our understanding of nature and advance the energy, economic, and national security of the United States.

Over 29,000 Researchers Supported; at >300 Institutions and 16 DOE Labs

Steward 10 of the 17 DOE National labs

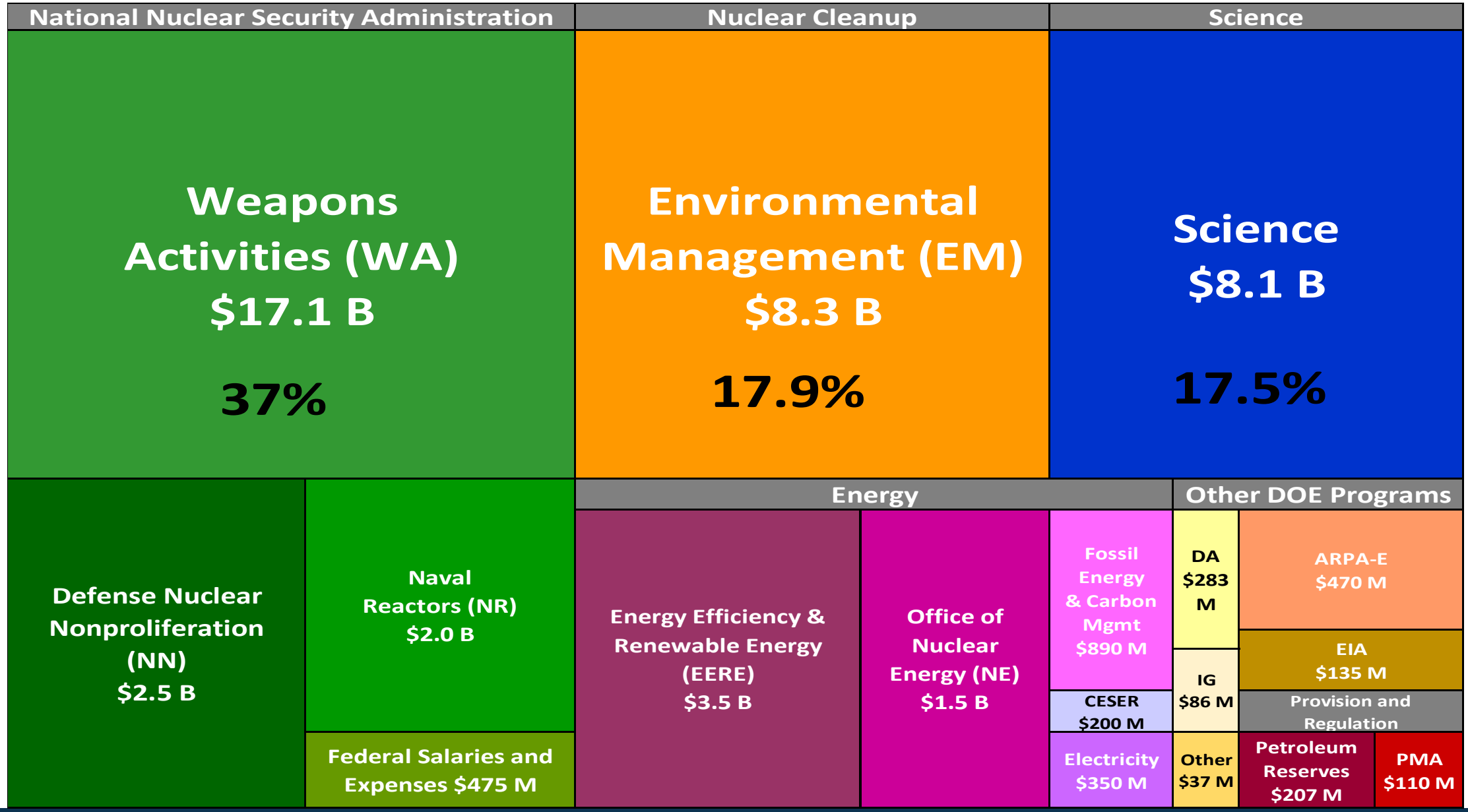
Nearly 40,000 Users of 28 SC Scientific Facilities

FY 2023 Enacted : $8.1B

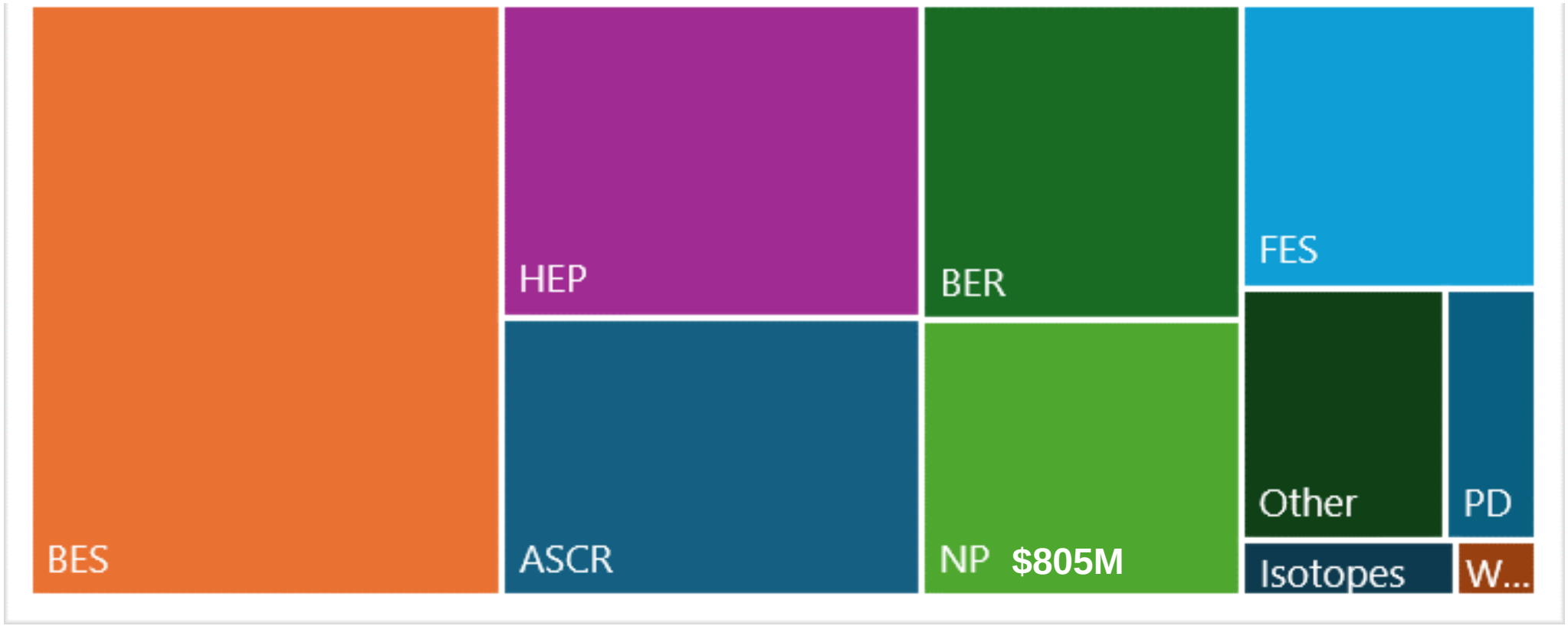
FY 2024 Enacted : $8.24B

FY 2025 Request : $8.583B

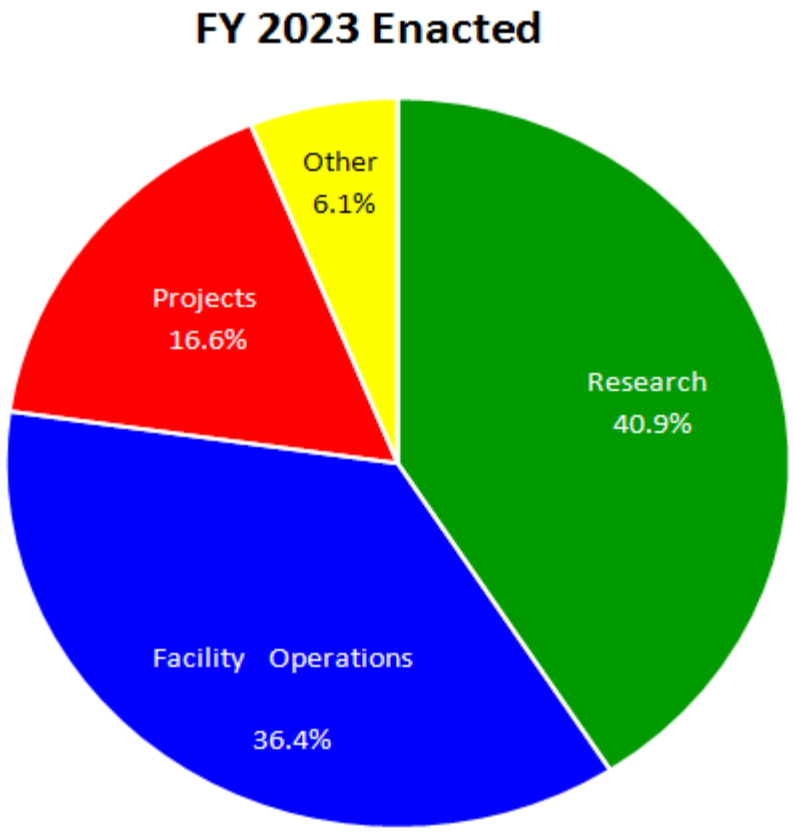
The DOE FY 2023 Enacted Appropriation was ~$46B

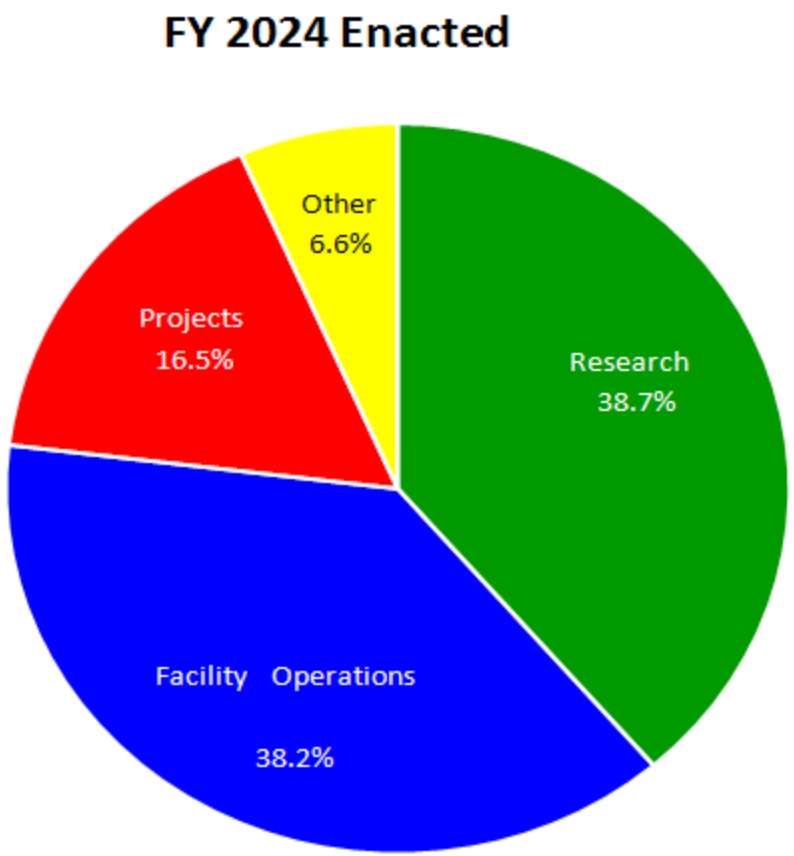


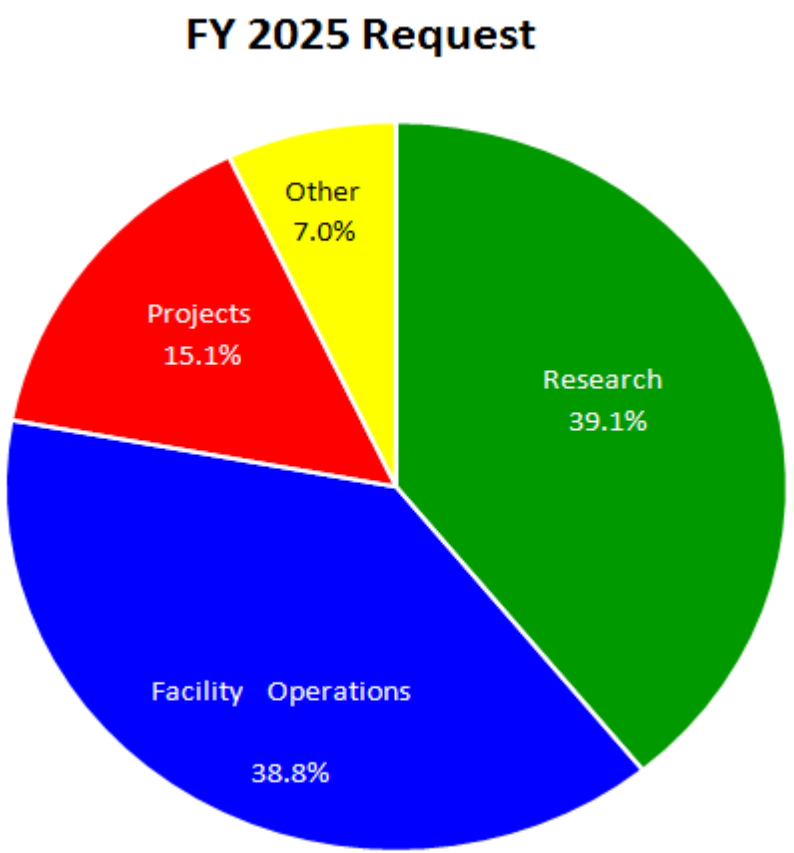
FY 2023 SC Enacted is $8.1B supporting research and facilities across the SC mission areas



SC Enacted FY 2023 and 2024, and FY 2025 Request:
~40% Research, 40% Facility Operations; Balance Projects

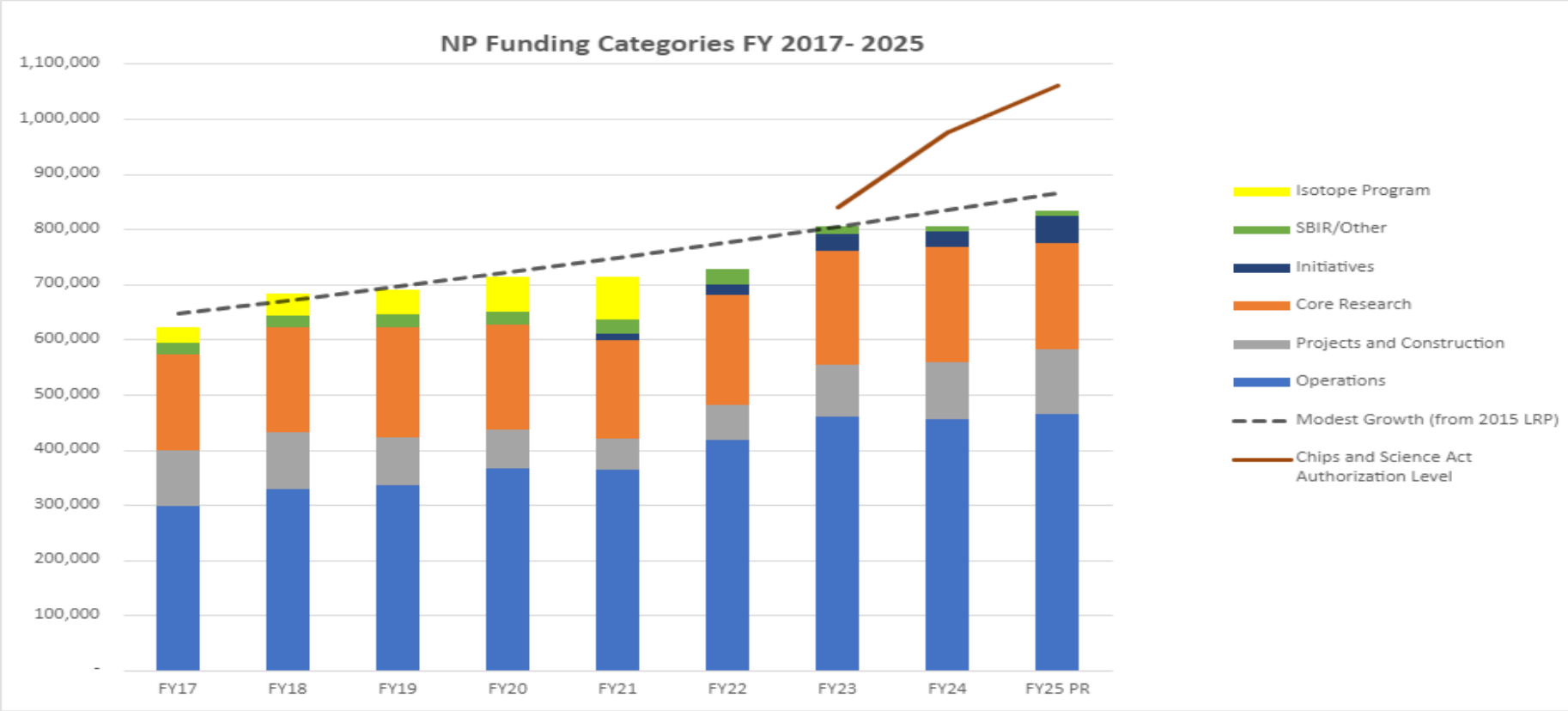






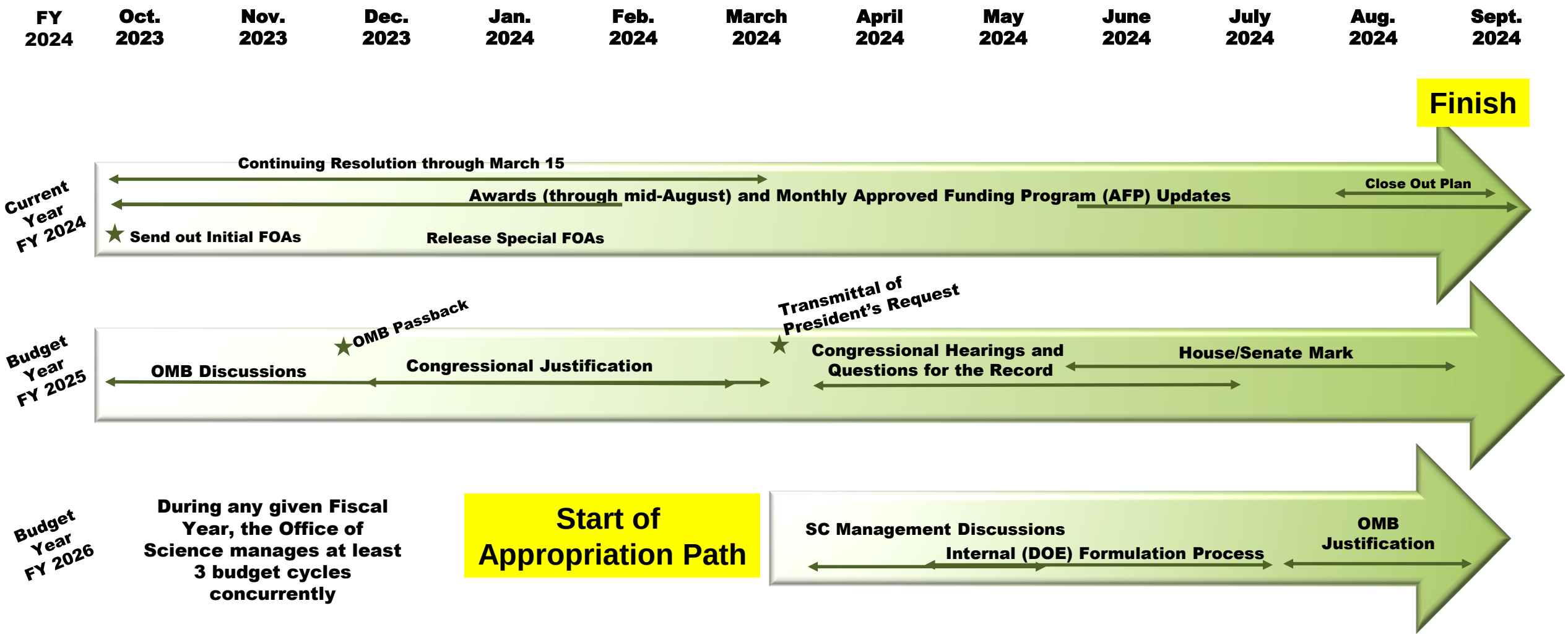
Trend in DOE-NP Appropriations

FY 2024 appropriation ($804M) is approximately flat with FY 2023
FY 2025 President's Budget Request is ~$833.1M, ~3.6% above FY 2024



FY 2024 supports user facility operations at ~90% of the funding level required for full operations; FY 2025 President's Budget Request at >90%. Increase support for construction is focused on EIC. In FY 2024, Core research is up slightly. In the FY 2025 request, increased initiative support (+$23M) focuses on AI/ML, RENEW, and FAIR; Core research is down by ~$17M.

FY 2024 – FY 2026 Budget Timeline



Office of Science: Highlights from the FY 2024 Enacted Budget

- FY 2024 Enacted: $8.24B, an increase of $140M over FY 2023 Enacted
- Initiate Microelectronics Science Research Centers at $30M
- Initiate Fusion Innovation Research Engine (FIRE) Collaboratives at $45M
- User facilities at 89% of funding required for full operations
- "The Department is directed to provide not later than 90 days, and quarterly thereafter, a briefing on its actions to progressively move to fully funding research awards of $2,500,000 or less."

FY 2024 Funding Opportunities/National Lab Calls

Funding Opportunity Announcement/Lab Call	Title	Release Date	Closing Date	Estimated FY 2024 Funding
FOA-SC-3176	Early Career Research Program	12/15/2023	4/25/2024	~$8M (NP)
FOA-SC-3201	EPSCoR State-Lab Grants	12/08/2023	2/28/2024	~$2M+
FOA-3238	Nuclear Data Interagency Working Group Research Program	1/04/2024	4/04/2024	~$12M (NP+NNSA)
FOA-3261	Research and Development for Next Generation Nuclear Physics Accelerator Facilities	1/22/2024	3/04/2024	~$4M+ ~$4M (FY 2025)
FOA-SC 3207	Funding for Accelerated, Inclusive Research (FAIR)	3/12/2024	7/23/2024	~$2M
FOA-SC 3280	Reaching a New Energy Sciences Workforce (RENEW)	3/12/2024	7/23/2024	~$6M

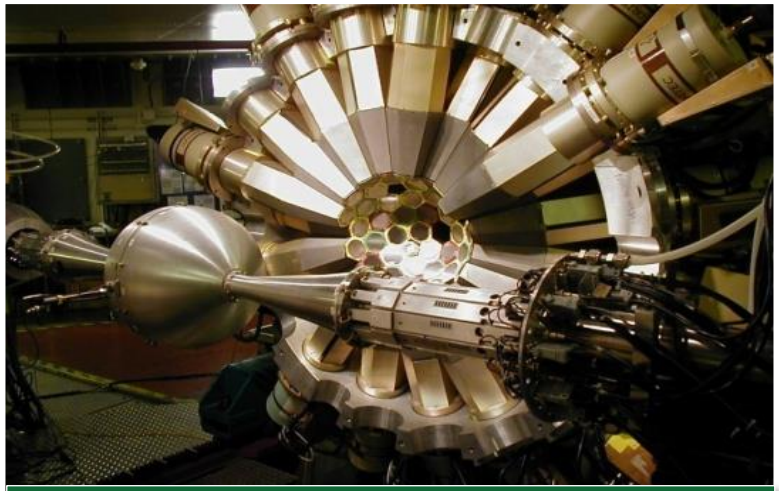
FY 2025 Request – Research Highlights

- Artificial Intelligence research (+$93.127M; $259M)
- Microelectronics (+$22M, $94.7M), including $45M for Microelectronics Science Research Centers
- U.S. Fusion Acceleration (+$18.8M), including the Fusion Innovation Research Engine (FIRE) collaboratives
- Climate Initiative ($20M)
- SC Energy Earthshots (+$95M; $115M)
- Broadening Participation & Workforce Development
  - Reaching a New Energy Sciences Workforce (RENEW) to increase participation to include non-R1 MSIs (+$68.6M; $120M)
  - Funding for Accelerated, Inclusive Research (FAIR) (+$31.6M; $64M)

Four World-Leading, Complementary User Facilities Driving Science

Relativistic Heavy Ion Collider

Continuous Electron Beam Accelerator Facility



Argonne Tandem Linac Accelerator

Facility for Rare Isotope Beams

NP User Facility Operations Status

FY 2023 Enacted	FY 2024 Enacted	FY 2025 PR
All NP user facilities operate at >90% of optimal funding in FY 2023. ◆ **RHIC** operates 25 weeks (96% optimal) ◆ **CEBAF** operates 33 weeks (96% optimal) ◆ **ATLAS** operates 40 weeks (96% optimal) ◆ **FRIB** operates 26 weeks (99% of optimal)	**All NP user facilities operate at roughly 90% of optimal funding in FY 2024.** ◆ **RHIC** supported for 19 weeks (94% optimal) ◆ **CEBAF** operates 27 weeks (88% optimal) ◆ **ATLAS** operates 39 weeks (91% optimal) ◆ **FRIB** operates 24 weeks (94% optimal)	**All NP user facilities operate at roughly 90% of optimal funding in FY 2025.** ◆ **RHIC** operates 22 weeks (95% optimal) ◆ **CEBAF** operates 25 weeks (89% optimal) ◆ **ATLAS** operates 40 weeks (90% optimal) ◆ **FRIB** operates 26 weeks (90% of optimal)

- RHIC to run 25 weeks (including 6 additional weeks due to early end of Run 23) in FY 2024 focused on p+p data for sPHENIX and STAR
- CEBAF to run 30 weeks in FY 2024 with the aim to complete experiments scheduled in Hall A; 3 additional weeks were added by replanning several activities in accelerator operations and experimental support
- ATLAS to run 39 weeks in FY 2024; GRETINA on site and commissioning of the nuCARIBU driver cyclotron
- FRIB to run 24 weeks in FY 2024, operating at 10 kW

NP Projects Status

Project	Location	Status	Cost	CD-4
Construction Projects				
Electron-Ion Collider (EIC)	BNL	CD-3A	$1.7B to $2.8B (Est)	Q4 FY33 (Est)
Major Items of Equipment				
Gamma Ray Energy Tracking Array (GRETA) Fully Funded!	LBNL	CD-2/3	$58.3M (TPC)	3/2028
Measurement of Lepton-Lepton Electroweak Reactions (MOLLER) Fully Funded!	TJNAF	CD-2/3	$48.66M (TPC)	Q4 FY28
High Rigidity Spectrometer (HRS)	MSU	CD-1	$85.0M to $111.4M (Est)	Q2 FY29 (Est)
Ton Scale Neutrinoless Double Beta Decay (TS-NLDBD) Program	TBD	CD-0	$215M to $250M (Est)	TBD

FY 2023 Enacted	FY 2024 Enacted	FY 2025 PR
EIC at TEC of $50M and OPC of $20M	**EIC** at TEC of $95M and OPC of $2.9M	**EIC** at TEC of $110M and OPC of $2.9M
GRETA at optimal level, providing the project with the final year of funding ($15.5M) **MOLLER** receives the final $4M of planned TEC funding **TS-NLDBD** at $1.44M TEC **HRS** at $3M TEC	**GRETA** and **MOLLER** received full TPC amount in FY2023 Request. Progress continues; no new funding requested. **TS-NLDBD** at $3M TEC **HRS** at $3M TEC	**GRETA** and **MOLLER** received full TPC amount in FY23 Request. Progress continues; but no new funding requested. **TS-NLDBD** at $2M TEC **HRS** at $3.3M TEC

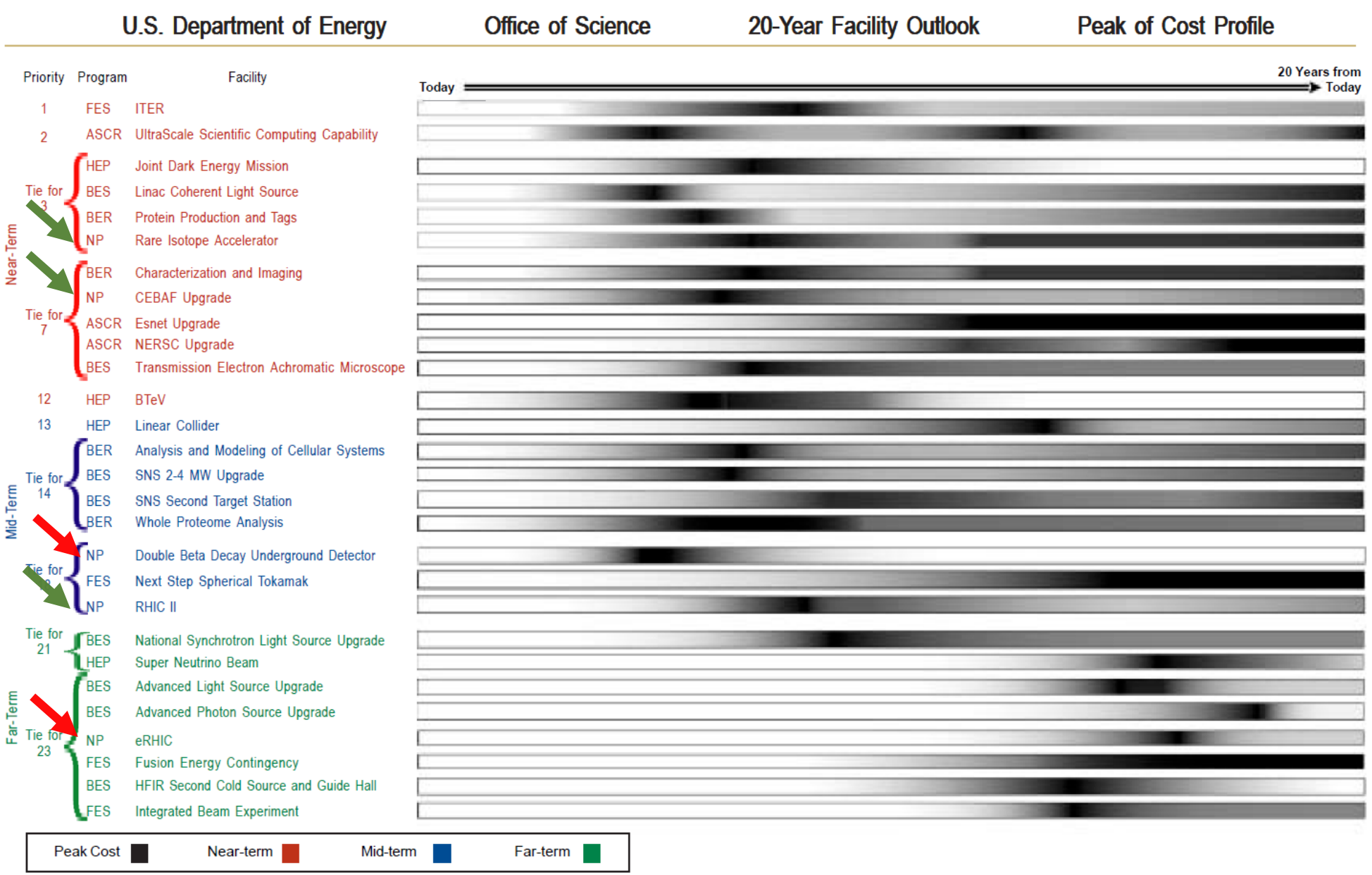
Current Advisory Charge: *2003 Facilities for the Future of Science* established best practice of long-term planning and prioritization

- Published in 2003, report provided a prioritized list of major scientific facilities for the next 20 years
  - Interim report highlighting progress released in 2007

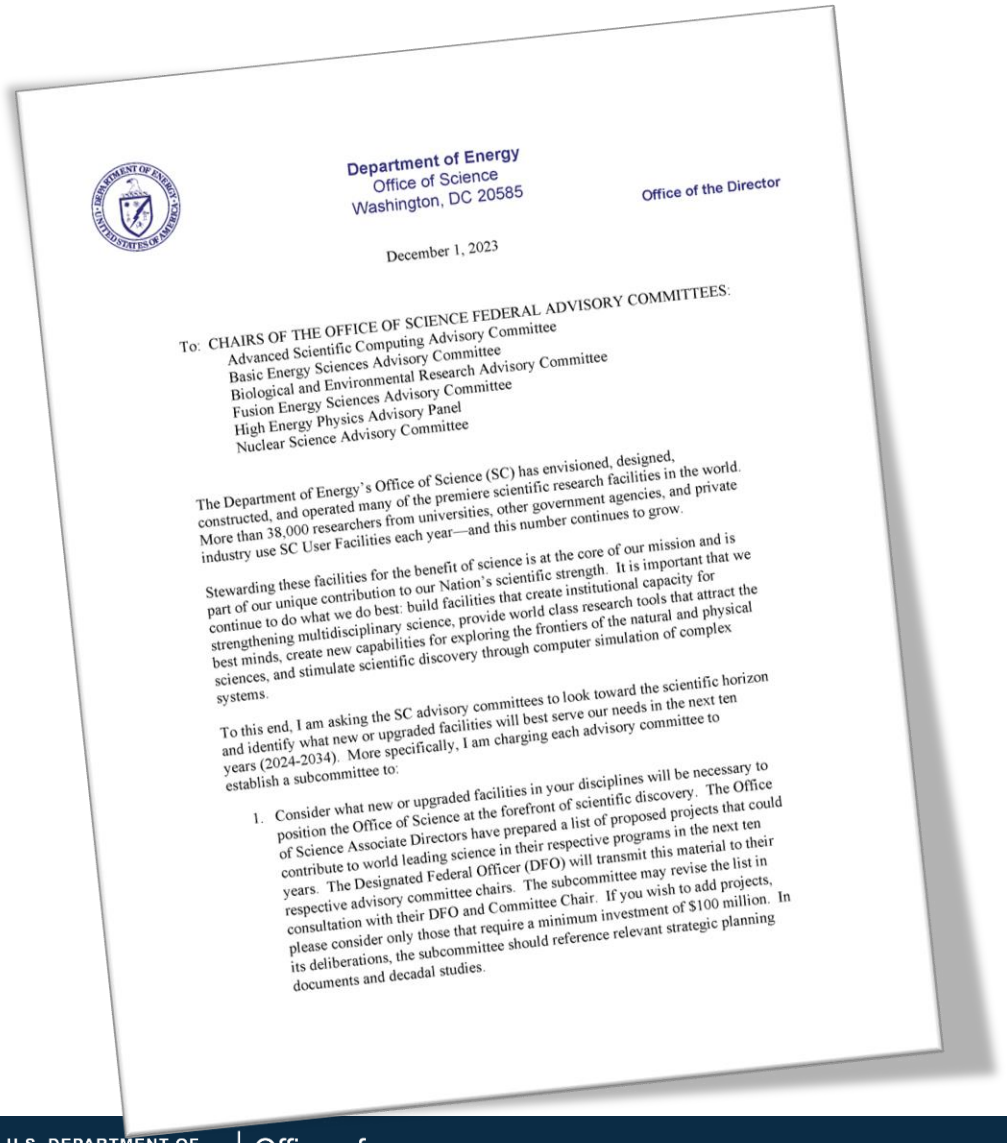
"We believe that the 20-year vision of future scientific facilities currently being developed in the Office of Science is outstanding and could have a far-reaching, positive effect on the Nation's leadership in science."

–Dr. Charles M. Vest, Chair of SEAB Task Force on the Future of Science Programs

2003 Report prioritized projects across scientific disciplines by focusing on world leadership, timeliness



Now is the time for an updated plan to advance U.S. science & innovation leadership for the next decade+



Department of Energy
Office of Science
Washington, DC 20585

Office of the Director

December 1, 2023

To: CHAIRS OF THE OFFICE OF SCIENCE FEDERAL ADVISORY COMMITTEES:
Advanced Scientific Computing Advisory Committee
Basic Energy Sciences Advisory Committee
Biological and Environmental Research Advisory Committee
Fusion Energy Sciences Advisory Committee
High Energy Physics Advisory Panel
Nuclear Science Advisory Committee

The Department of Energy's Office of Science (SC) has envisioned, designed, constructed, and operated many of the premiere scientific research facilities in the world. More than 38,000 researchers from universities, other government agencies, and private industry use SC User Facilities each year—and this number continues to grow.

Stewarding these facilities for the benefit of science is at the core of our mission and is part of our unique contribution to our Nation's scientific strength. It is important that we continue to do what we do best: build facilities that create institutional capacity for strengthening multidisciplinary science, provide world class research tools that attract the best minds, create new capabilities for exploring the frontiers of the natural and physical sciences, and stimulate scientific discovery through computer simulation of complex systems.

To this end, I am asking the SC advisory committees to look toward the scientific horizon and identify what new or upgraded facilities will best serve our needs in the next ten years (2024-2034). More specifically, I am charging each advisory committee to establish a subcommittee to:

1. Consider what new or upgraded facilities in your disciplines will be necessary to position the Office of Science at the forefront of scientific discovery. The Office of Science Associate Directors have prepared a list of proposed projects that could contribute to world leading science in their respective programs in the next ten years. The Designated Federal Officer (DFO) will transmit this material to their respective advisory committee chairs. The subcommittee may revise the list in consultation with their DFO and Committee Chair. If you wish to add projects, please consider only those that require a minimum investment of $100 million. In its deliberations, the subcommittee should reference relevant strategic planning documents and decadal studies.

- SC Director Berhe charged each advisory committee to form subcommittee to assess list of future facilities from Associate Directors
- Assessment on:
  - The potential to contribute to world-leading science in the next decade.
  - The readiness for construction.
- Assessments due in May 2024
- SC leadership will gather input and develop a prioritized strategy for facility investments for next decade

NSAC Facilities Charge: Assessment of Science and Readiness for Construction for NP Projects (pre-CD-2, >$100M)

List of projects provided by NP for consideration by the subcommittee:

- Electron-Ion Collider (EIC)
- High Rigidity Spectrometer (HRS)
- Ton Scale Neutrinoless Double Beta Decay (TS-NLDBD)
  - Large Enriched Germanium Experiment for NLDBD (LEGEND-1000)
  - Next Enriched Xenon Observatory (nEXO)
  - Cryogenic Underground Observatory for Rare Events with Particle Identification (CUPID)
- Project 8
- FRIB Energy Upgrade (FRIB400)
- Solenoid Large Intensity Device (SoLID)
- EIC Detector II

NSAC Facilities Charge Outcome

Major Nuclear Physics Facility	Scientific importance	Readiness for construction
Electron-Ion Collider (EIC)	(a) Absolutely central	(a) Ready to initiate
High Rigidity Spectrometer (HRS)	(b) Important	(a) Ready to initiate
Ton-scale Neutrinoless Double Beta Decay (TS-NLDBD)	(a) Absolutely central	(a) Ready to initiate
Project 8	(b) Important	(c) Mission and technical requirements not yet fully defined
FRIB Energy Upgrade (FRIB400)	(b) Important	(a) Ready to initiate
Solenoid Large Intensity Device (SoLID)	(b) Important	(a) Ready to initiate
EIC Detector II	(b) Important	(c) Mission and technical requirements not yet fully defined

- The importance of the science for each project as assessed by the Subcommittee was tied closely to the 2023 LRP
- In considering the readiness for construction the Subcommittee was guided by the current status of the project and remaining challenges, including the DOE critical decision level, if any.

The New NP Long Range Plan: A New Era of Discovery

Capitalize on the extraordinary opportunities for scientific discovery made possible by the substantial and sustained investments of the United States. We must draw on the talents of all in the nation to achieve this goal. …. **Capitalize on the unique ways nuclear physics can advance discovery science and applications for society.**

We reaffirm the exceptionally high priority of the following two investments in new capabilities for nuclear physics. The **Electron–Ion Collider (EIC)**, …will elucidate the origin of visible matter in the universe and significantly advance accelerator technology… **We recommend the expeditious completion of the EIC as the highest priority for *facility* construction.**

Neutrinoless double beta decay experiments have the potential to dramatically change our understanding of the physical laws governing the universe. **As the highest priority for new *experiment* construction**…, lead an international consortium that will undertake a neutrinoless double beta decay campaign.

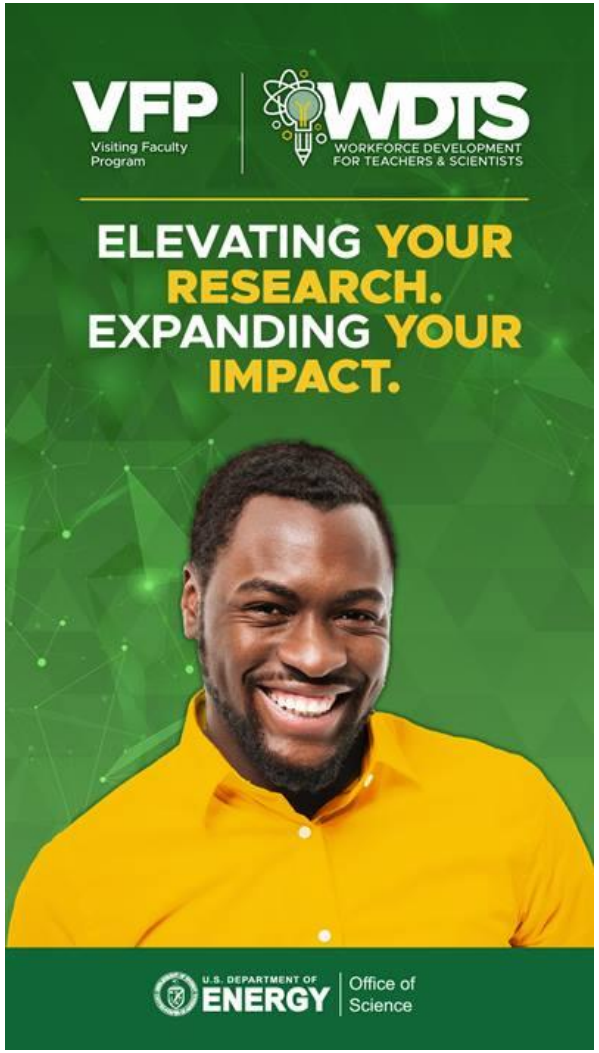
WDTS: Visiting Faculty Program

- Summer 10-week program. Option of inviting up to two students (one may be a graduate student).
- Returning VFP participants can apply for 10-week experiences in spring, fall terms; receive funding for teaching buyout.
- Two tracks:
  1. VFP Research Collaboration
  2. VFP Teaching Initiative Track (available for returning VFP participants)

- 113 VFPs awarded summer 2024, 6 NP scope

- 1 NP VFP in summer 2023, none in 2022

https://science.osti.gov/wdts/vfp



WDTS: Student Engagement Opportunities

Office of Science Graduate Student Research (SCGSR) Program

Supplemental awards to U.S. graduate students (US citizens or lawful permanent residents) to pursue part of their doctoral research at a DOE laboratory/ user facility in areas that address scientific challenges central to the Office of Science mission.

Science Undergraduate Laboratory Internships: Paid 10-week summer internship (May–Au gust) or in 10-week internship during the semester (August–December or January–May)

Community College Internships: Paid 10-week summer internship (May–August) or in 10-week internship during the semester (August–December or January–May)

International Engagement Activities

- Recent Events
  - DOE-IN2P3 (France) Statement of Interest on EIC collaboration signed (February 1, 2024)
  - UKRI announces £58.8M award to support EIC construction (March 27, 2024)
  - Meeting with Minister of University and Research of the Italian Republic (April 9, 2024)
  - French Ambassador visit to FRIB (July 22, 2024)
  - NP-INFN (Italy) bilateral meeting (August 1, 2024)
  - EIC Advisory Board (August 2, 2024)
  - EIC RRB (November 12-13, 2024)

CNRS-MSU kickoff meeting attendees

Summary

- Within the constraints of the annual appropriations, NP is working to implement the aspirations of the community outlined in the 2023 NSAC Long Range Plan
- SC leadership assessment of the NSAC and other SC Advisory Committee reports for the Facilities Charge is underway --

Thank you
Questions?