

# BER Advisory Committee (BERAC) Spring 2024 Meeting

Dorothy Koch

Associate Director, US DOE Office of Science  
For Biological and Environmental Research

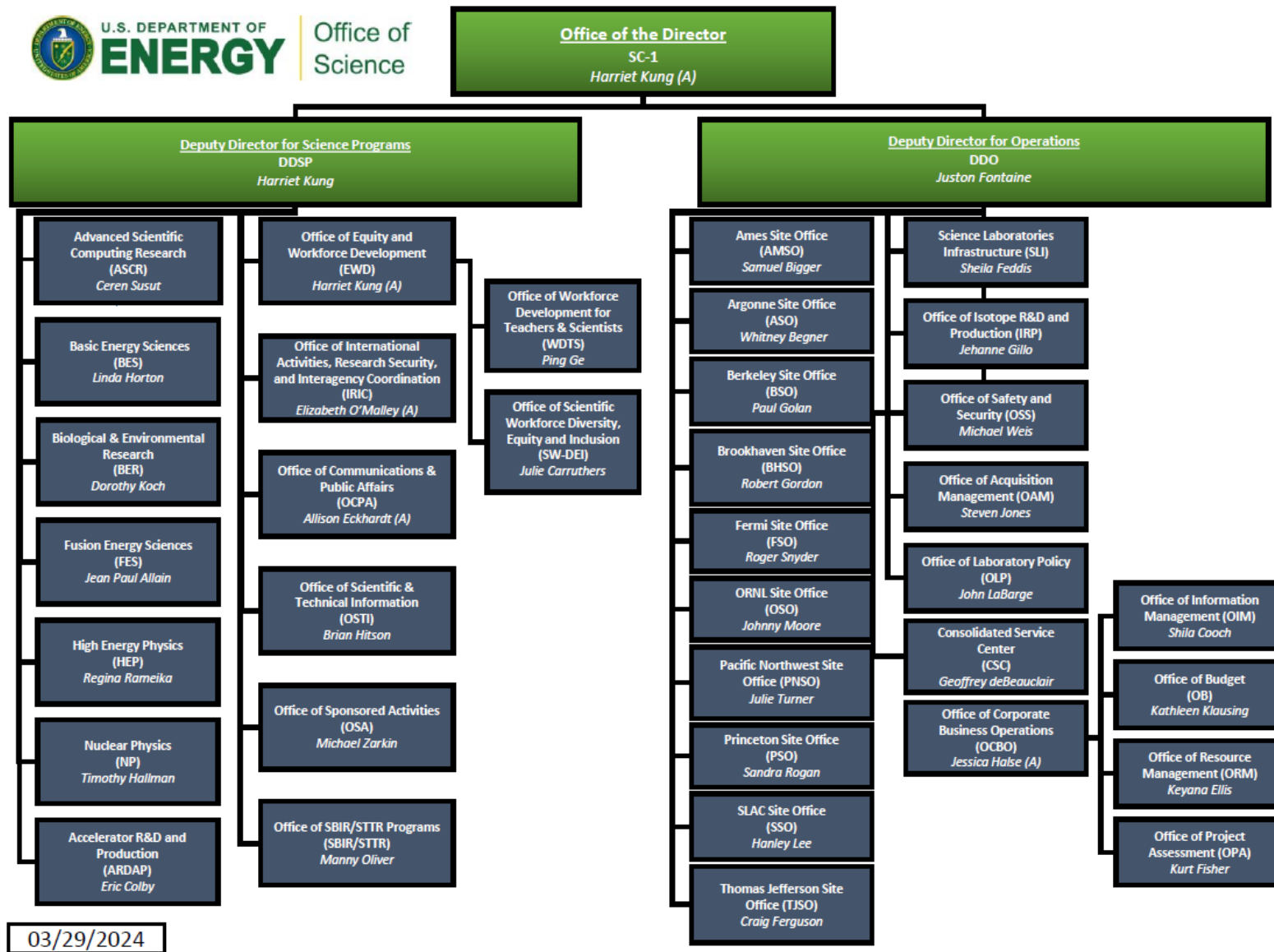


U.S. DEPARTMENT OF  
**ENERGY**

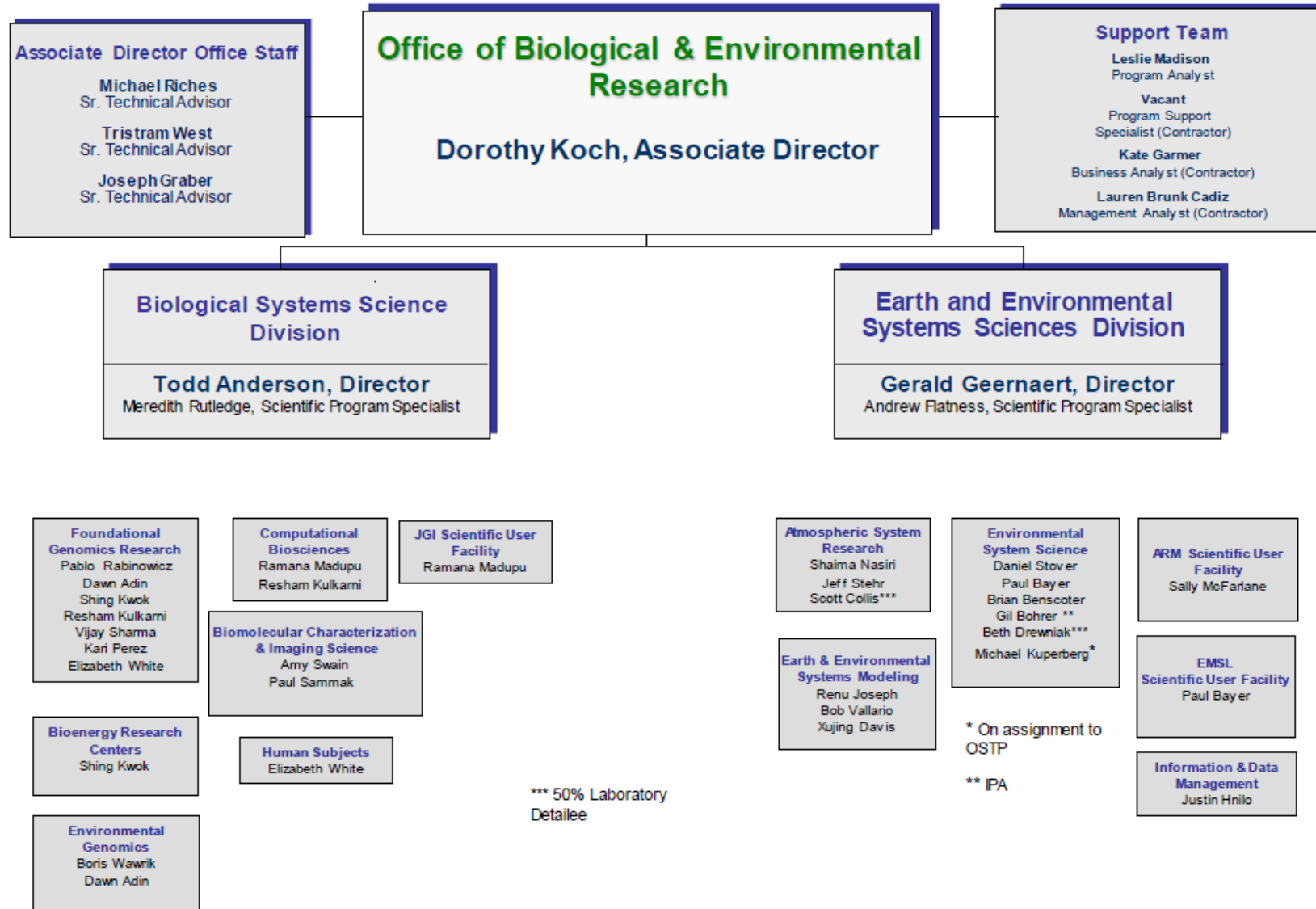
Office of  
Science

[Energy.gov/science](https://energy.gov/science)

# Office of Science Organization Chart



# BER Organization Chart



October 2023

# BERAC Completed Membership

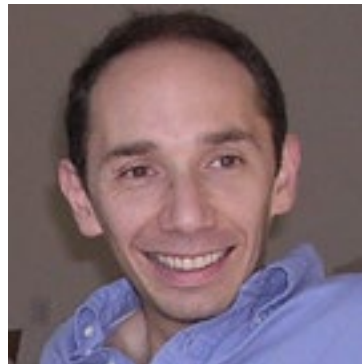
*Thank you!*



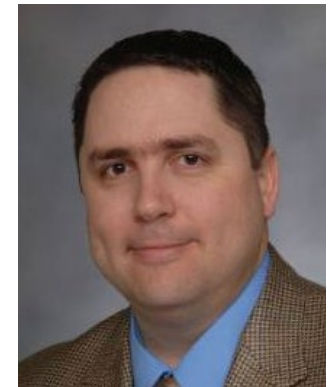
**Jerry Meehl**  
National Center for  
Atmospheric Research



**Sarah Assmann**  
Pennsylvania State University



**Daniel Segre**  
Boston University



**Ramon Gonzalez**  
University of South Florida

# *New* BERAC Membership

*Pending*



# BERAC Member - Awards



**Ana Barros**

University of Illinois Urbana-Champaign

*2024 Ven Te Chow Award from the ASCE Environmental and Water Resource Institute*



**Sonia Kreidenweis**

Colorado State University

*Elected to National Academy of Engineering, February 2024*



**Xiaohong Liu**

Texas A&M University

*2023 American Geophysical Union Fellow*

# BERAC Member - Awards



## **Kristala Prather**

University of Colorado, Massachusetts Institute of Technology  
Division of Biochemical Technology (BIOT) of the American  
Chemical Society (ACS), *2024 Marvin J. Johnson Award in Microbial  
and Biochemical Technology*



## **Matthew Shupe**

University of Colorado, NOAA ESRL  
*International Arctic Science Committee (IASC) Award for  
Service*

# BER - Awards



**Colleen Iversen**

ORNL

*2024 Women's Alliance Council*



**Hui Su**

UC Los Angeles

*2024 AMS Banner I. Miller Award*



**Ramalingam Saravanan**

Texas A&M

*2023 AGU John Tyndall History of Global  
Environmental Change Lecture award*



# BER - Awards

## New Fellows (AGU and AMS)



**Claudia Tebaldi**

PNNL Joint Global Change Research Institute  
*2023 AGU Fellow*



**Adam Sobel**

Columbia University  
*2023 AGU Fellow*



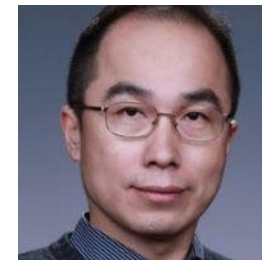
**Suzana Camargo**

Columbia University  
*2023 AGU Fellow*



**William Collins**

LBL  
*2024 AMS Fellow*



**Yun Qian**

PNNL  
*2024 AMS Fellow*



**Jonathan Jiang**

Cal Tech  
*2024 AMS Fellow*

# Associate Director

## Background



**Dr. Dorothy Koch**

BER Associate Director

October 2023

- 2019 to 2023: National Oceanic and Atmospheric Administration (NOAA), in National Weather Service (NWS) and then Weather Program Office (WPO)
- 2010 to 2019: Program Manager for BER within the Earth System Modeling portfolio
- Research Scientist at Columbia University with the National Aeronautics and Space Administration (NASA) Goddard Institute for Space Studies (GISS)
- PhD in Geology and Geophysics from Yale University

# BER Strategy (2025-2035)

## Articulate:

- BER's unique role to address pressing environmental and biological challenges and opportunities
- Umbrella plan for BER, including cross-BER synergies

## Initial steps:

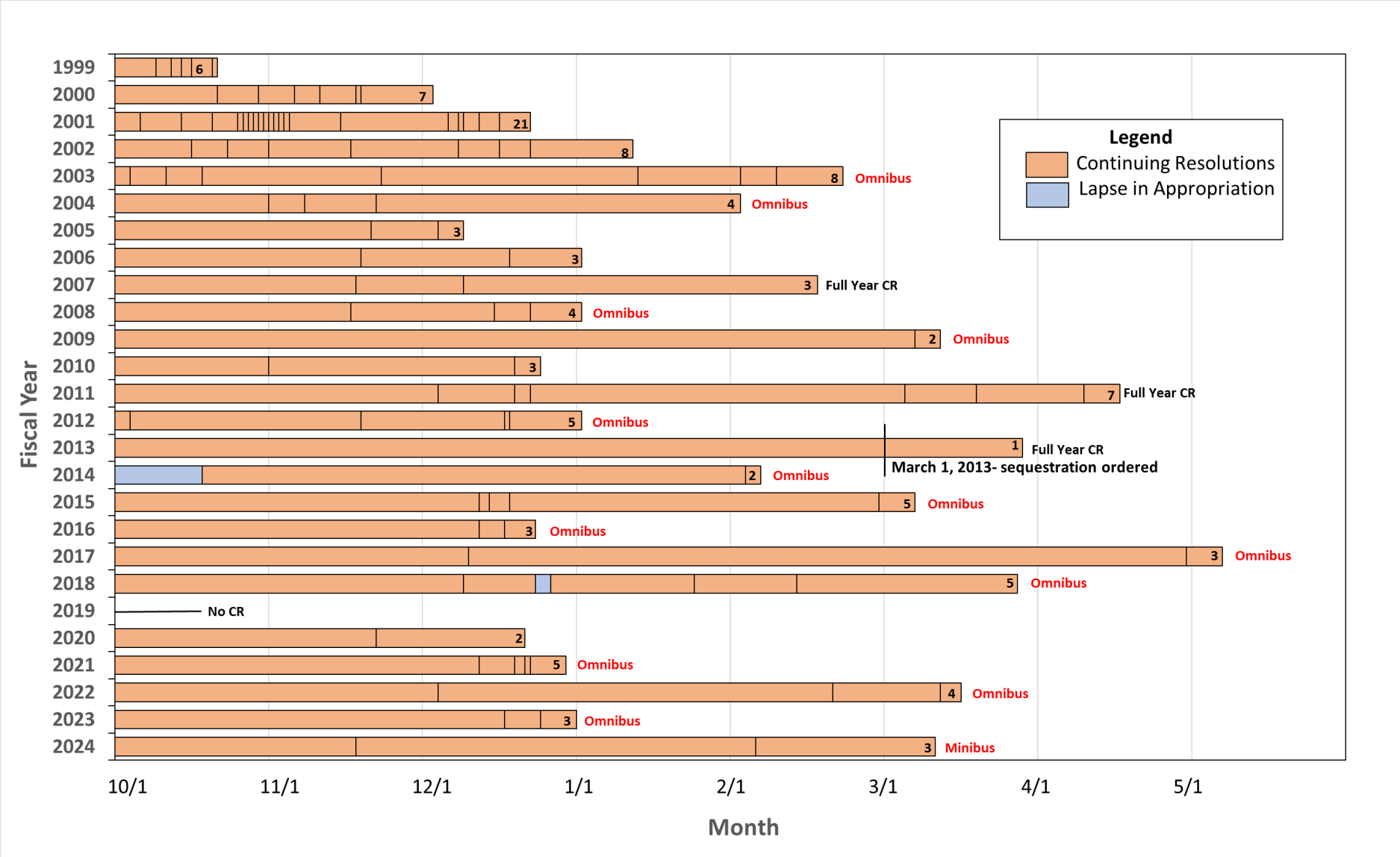
- All-hands staff retreat (March 2024)
- Solicit input from the Labs (March 2024)
- Work with existing materials from BERAC, BER workshops, SC/DOE materials

## Next steps:

- Draft vision, mission, values and strategic priorities
- Iterate with staff, SC leadership
- Update BERAC in fall



# Duration and Number of Continuing Resolutions Each Fiscal Year



# FY 2025 President's Request

Biological and Environmental Research	FY 2023	FY 2024	FY 2025
	Enacted	Enacted	Request
Genomic Science	328,685	319,435	316,420
Biomolecular Characterization and Imaging Science	45,000	45,750	43,910
Biological Systems Facilities & Infrastructure	90,000	92,250	93,565
<b>Biological Systems Science</b>	<b>463,685</b>	<b>457,435</b>	<b>453,895</b>
Atmospheric System Research	36,000	39,584	35,750
Environmental System Sciences	120,800	127,000	155,020
Earth and Environmental Systems Modeling	115,500	111,281	114,610
Earth and Environmental Systems Sciences Facilities and Infrastructure	172,700	154,700	166,950
<b>Earth and Environmental Systems Sciences</b>	<b>445,000</b>	<b>432,565</b>	<b>472,330</b>
<b>Program Subtotal</b>	<b>908,685</b>	<b>890,000</b>	<b>926,225</b>
<b>24-SC-31, Microbial Molecular Phenotyping Capability (M2PC), PNNL</b>	...	10,000	19,000
<b>Construction Subtotal</b>	...	10,000	19,000
<b>Total Biological and Environmental Research</b>	<b>908,685</b>	<b>900,000</b>	<b>945,225</b>

# FY25 President's Request (cont'd)

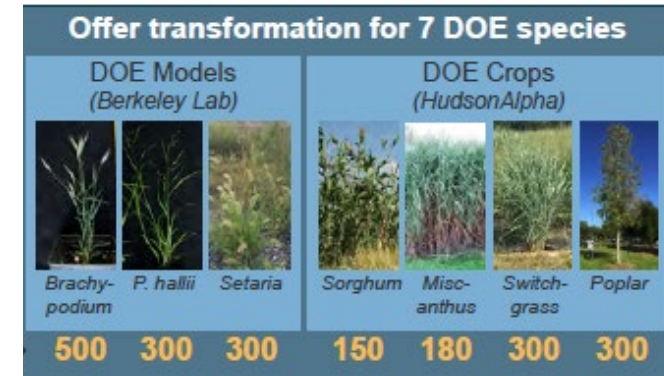
Office of Science Initiatives: Biological and Environmental Research		FY 2023	FY 2024	FY 2025
		Enacted	Enacted	Request
S	Accelerate Innovations in Emerging Technologies	5,000	5,000	...
S	Advanced Computing	5,183	20,183	20,183
S	Artificial Intelligence and Machine Learning	8,000	8,000	12,790
S	Biopreparedness Research Virtual Environment (BRaVE)	22,000	24,000	22,000
B	Climate Resilience Centers	5,000	10,000	10,000
B	Climate Science	...	...	20,000
S	Exascale Computing	15,000	...	...
S	Funding for Accelerated, Inclusive Research (FAIR)	1,935	1,935	10,000
S	Fundamental Science to Transform Advanced Manufacturing	3,000	3,000	...
B	National Virtual Climate Laboratory (NVCL)	3,000	3,000	3,000
S	Quantum Information Science	14,500	14,500	14,500
S	Reaching a New Energy Sciences Workforce (RENEW)	6,000	6,000	13,000
S	Revolutionizing Polymers Upcycling	6,250	6,250	6,250
S	SC Energy Earthshots	25,000	5,000	30,000
B	Urban Integrated Field Laboratories	22,000	23,000	23,000
<b>Total, Biological and Environmental Research</b>		<b>141,868</b>	<b>129,868</b>	<b>184,723</b>

# FY 2025 Request: Key Activities

- JGI research on plant transformation capability to design new beneficial plant functions, expand integration with KBase and the National Microbiome Data Collaborative (NMDC) for microbiome and renewable energy science.
- EMSL expands microbial molecular phenotyping science and continues construction for the microbial molecular phenotyping capability.
- Bioenergy Research Centers provide inter-BRC shared-theme research underpinning production of clean energy, chemicals and materials from sustainable biomass.
- ARM activities include community engagement at the Alabama Observatory; new Cape-K (Cloud And Precipitation Experiment at Kennaook) in Tasmania and new CoURAGE (Coast-urban-rural Atmospheric Gradient Experiment) in Baltimore, MD; a Cloud Chamber Project will be initiated to complement ARM's field observations.

## Key areas in the following slides:

- Earthshots
- Low dose
- Climate initiative
- Outreach efforts (FAIR, RENEW, CRC's, EPSCoR, NVCL, Office Hours)
- AI and quantum



# SC Energy Earthshots

- ❑ Cross SC. Fundamental research required for the stretch goals of the DOE Energy Earthshots, coordinated with the Energy Technology Offices
  - The Energy Earthshot Research Centers (EERCs) are large, multi-disciplinary national laboratory-led teams.
  - Complemented by small group awards on use-inspired fundamental research.

- ❑ BER supports 3 EERC's in 2 Shots; funding reduced in FY 2024; FY 2025 would increase funding again.

Carbon Negative EERC's:

- Terraforming Soil EERC (LLNL)
- RESTORation of soil Carbon by precision biological strategies (LBNL)

Offshore Wind EERC:

- Addressing Challenges in Energy: Floating Wind in a Changing Climate (PNNL)

## Affordable Home Energy Shot

50%+ Technology Cost Reduction    20% Lower Cost    Within the Decade

## Floating Offshore Wind Shot

>70% Reduction    2035

## Industrial Heat Shot

85% Reduction    2035

## Enhanced Geothermal Shot

90% Reduction    2035

## Hydrogen Shot

1 Dollar    1 Kilogram    1 Decade

## Long Duration Storage Shot

Reduce storage costs by 90%\*...  
\*from a 2020 Li-Ion baseline

...in storage systems That deliver 10+ hours of duration    ...in 1 decade

## Carbon Negative Shot

<100 Dollars    1 Ton    1 Decade

## Clean Fuels and Products

85% Reduction    2035



# Climate Science Initiative

**New in FY 2025: Robust climate-energy predictability for America's rural and semi-urban regions.**

- Extend the DOE climate prediction framework with model-data fusion, involving high resolution multi-component and interdependent climate, energy, and adaptation and mitigation pathways, to underpin efficient design and deployment of emerging DOE technologies associated with clean energy, transmission, and energy storage across diverse geographic regions.
- Apply advanced machine learning methodologies to constrain uncertainty.
- Research is informed by community and stakeholder engagement from America's rural and semi-urban regions, to complement the Urban Integrated Field Laboratories.



# Low Dose Radiation Research

Developing an integrated portfolio combining computational and experimental research to understand the effects of low dose radiation on cells, tissues and organs/organoids and bridge gaps with human epidemiological observations.

- ◆ BERAC subcommittee report will influence this activity!
- ◆ Draw on previous plans developed within BERAC, the NASEM, and previous DOE programs.
- ◆ Utilize unique DOE capabilities (user facilities, AI/ML computation, analysis capabilities).
- ◆ Support National Laboratory and academic-led projects in low dose radiation research.
- ◆ BRaVE funding will include and expand low dose radiation research to understand the genomics-level changes induced by radiation to gain insights into cellular effects.

# Outreach

Increase SC engagement with the scientific communities and communities underrepresented in the SC portfolio.

**Reaching a New Energy Sciences Workforce (RENEW):** Research foundations and training for students, postdoctoral researchers, and faculty at institutions historically underrepresented in the SC research portfolio.

- 8 awards (FY 2023)
- Active competition

**Funding for Accelerated, Inclusive Research (FAIR):** Build research capacity at institutions historically underrepresented in the SC, including MSIs and emerging research institutions (ERIs).

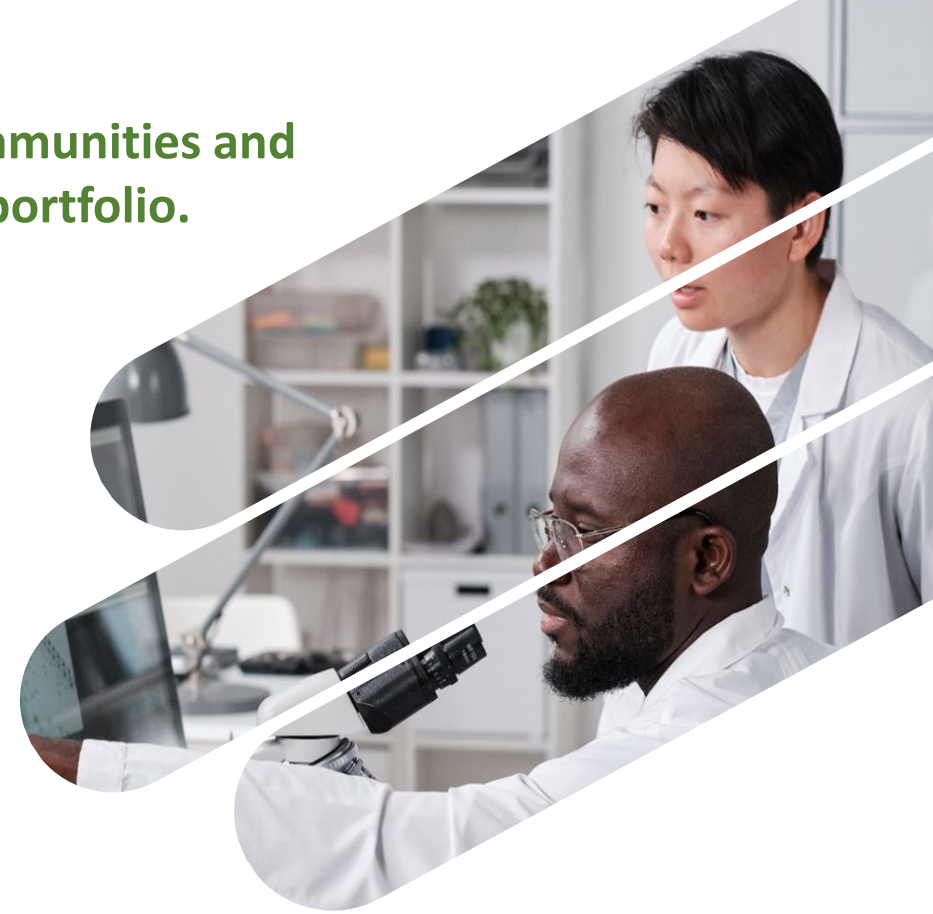
- 3 awards (FY 2023)
- Active competition

**Established Program to Stimulate Competitive Research (EPSCoR):** Enhance the capabilities of designated states and territories to conduct energy-related research.

- 10% of all grant investments

**Climate Resilience Centers (CRCs):** Extend DOE climate science by supporting Historically Black Colleges and Universities (HBCUs), non-R1 MSIs, and ERIs to address regional resilience needs.

- Current: 6 CRC's
- Future: Active competition, more centers to come



# Outreach, Cont'd

## Biological and Environmental Research (BER) Office Hours

Join us on the fourth Tuesday of each month, 2-3 pm Eastern Time, for virtual office hours to learn about our programs and ask questions.

- Tuesday, March 26, 2024 – Introduction to BER program and mission
- Tuesday, April 23, 2024 – Introduction to BER Biological Systems Science portfolio
- Tuesday, May 28, 2024 – Introduction to BER Earth and Environmental Systems Science portfolio.

<https://science.osti.gov/ber/officehours>

(Registration required for attendance)

## National Virtual Climate Laboratory (NVCL.energy.gov)

Web portal provides access to DOE climate science, connecting users to experts, programs, projects, activities and facilities in the Labs



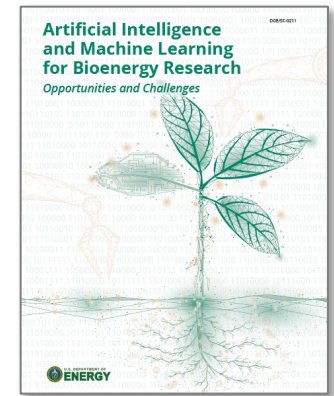
# Artificial Intelligence (AI) and Quantum

## Examples of BER AI activities:

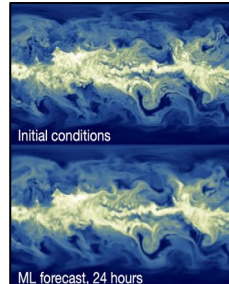
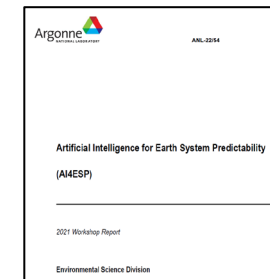
- New insights into genomic and metagenomic annotation analysis
- Predict internal cellular metabolic network dynamics influenced by changing environment
- Improve conceptualization and design of new of biological systems
- Energy Exascale Earth System Model (E3SM) component surrogates; E3SM initialization
- Improve predictions of clouds and extreme weather
- Optimize multi-model solutions for physical and human/energy components
- Data for training, quality-control, gap-filling and analysis of facility data
- Automated data analysis with specific instruments
- AI and digital twins of soil data for upscaling into models

## BER quantum activities:

- Novel approaches for biological imaging, e.g. quantum entanglement for non-destructive imaging of biological samples



Biological applications span genomic to plant systems



AI provides better model initialization and predictability



Digital twins and system analysis for soils

**THANK YOU!**

