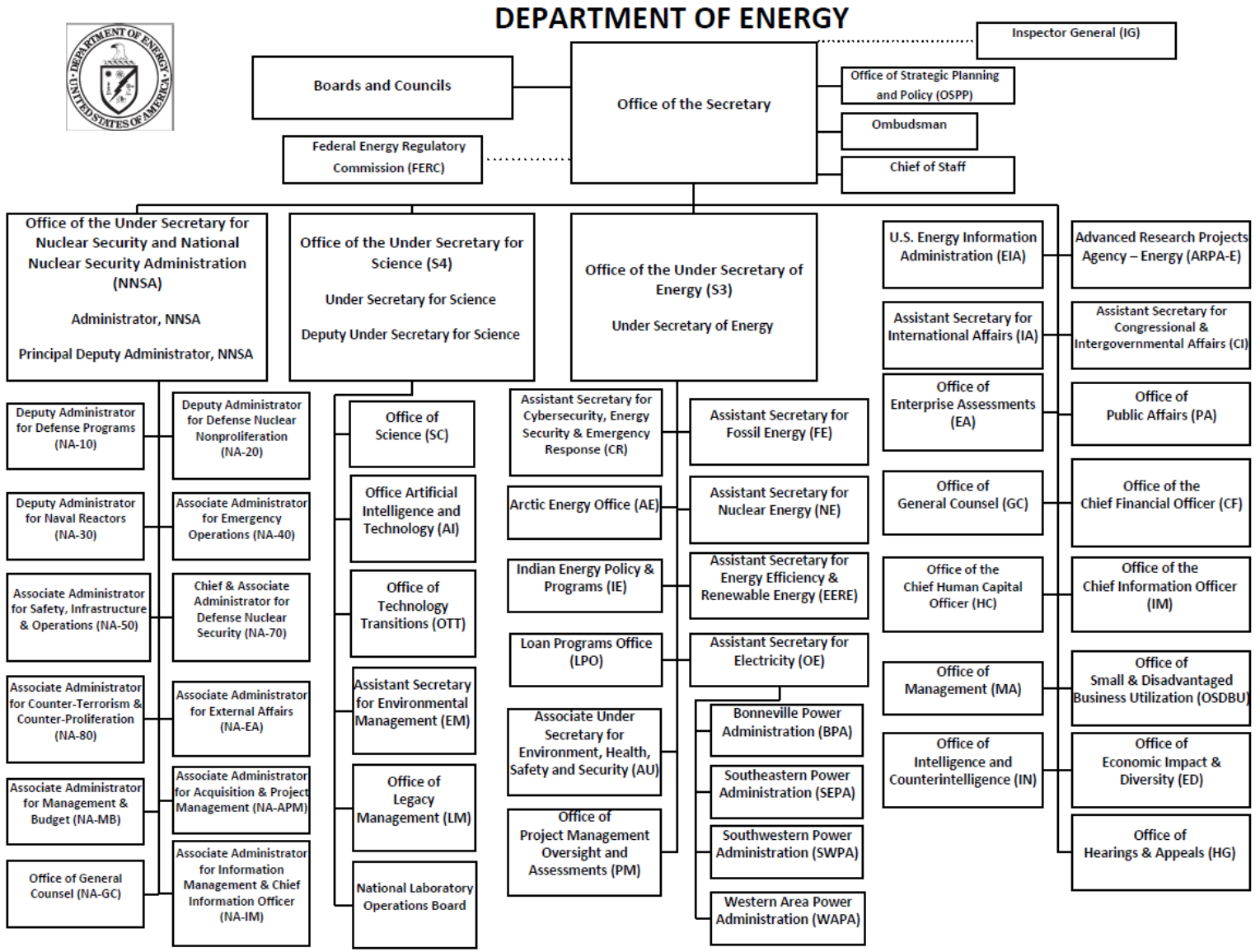
Department of Energy (DOE)
Missions for America

U.S. Department of Energy Org Chart

DOE LEADERSHIP

- **Secretary:**
  Dan Brouillette
- **Deputy Secretary:**
  Mark Menezes
- Under Secretary of Energy
- Under Secretary for Science
- NNSA Administrator



U.S. Department of Energy's Core Missions (32)

Energy (18)

- Fossil Energy (3)
- Energy Efficiency and Renewable Energy (11)
- Nuclear Energy
- Electric Energy (2)
- Energy Cyber-security

U.S. Energy Information Agency (1)

Science (9)

- Office of Science (7)
- Environmental Management
- Legacy Management

Nuclear Security (3)

Advanced Research Projects Agency – Energy (1)

energy.gov

Clean Coal & Carbon Management

- **The mission of DOE's Office of Clean Coal and Carbon Management (FE-20) is to drive R&D and adoption of advanced, affordable, reliable energy systems and products from coal and other fossil resources with carbon-neutral or net-negative emissions.**

- **Coal is an abundant and reliable source of energy.**

- **Coal related industries create important jobs in the American economy.**

Program Budget: FY2020 $490.8M

Key Locations:

- National Energy Technology Laboratory
  - Pittsburgh, PA, Morgantown, WV
  - Albany, OR

Key terms:

- CoalFIRST
- Hydrogen
- Carbon Capture, Utilization & Storage (CCUS)
- Critical Minerals
- Coal to Products

Oil and Natural Gas (ONG)

- **DOE's Oil and Natural Gas (FE-30) program seeks to maximize the value of domestic oil and gas resources for the public and to ensure the responsible production and delivery of these resources.**
- **The oil and gas program conducts research on:**
  - **increasing resource recovery**
  - **reducing emissions**
  - **improving safety through generating knowledge**
  - **improving understanding of geology**
  - **developing new technologies and materials for use in the production, transportation, storage of oil and natural gas.**

Program Budget: FY2020 $97M

Key Locations for FE / Oil and Natural Gas:

- National Energy Technology Laboratory
- 17 DOE Field Laboratory projects in oil producing states across the country

Key terms:
- Conventional Oil and Gas
- Unconventional Oil and Gas
- Shale
- Wells
- Hydraulic Fracturing

Petroleum Reserves (PR)

- **DOE's Petroleum Reserves program (FE-40) protects the U.S. economy from severe petroleum supply and demand interruptions by maintaining inventories and spare capacity to mitigate the economic impacts from such disruptions.**
  - **America's Strategic Petroleum Reserve (SPR) has the world's largest storage capacity of oil with 797 million barrels in tanks and underground salt caverns.**
  - **SPR holds enough oil to meet America's import oil needs for over 1,000 days.**

Program Budget: FY2020 $229M

Key Locations for FE / Petroleum Reserves:

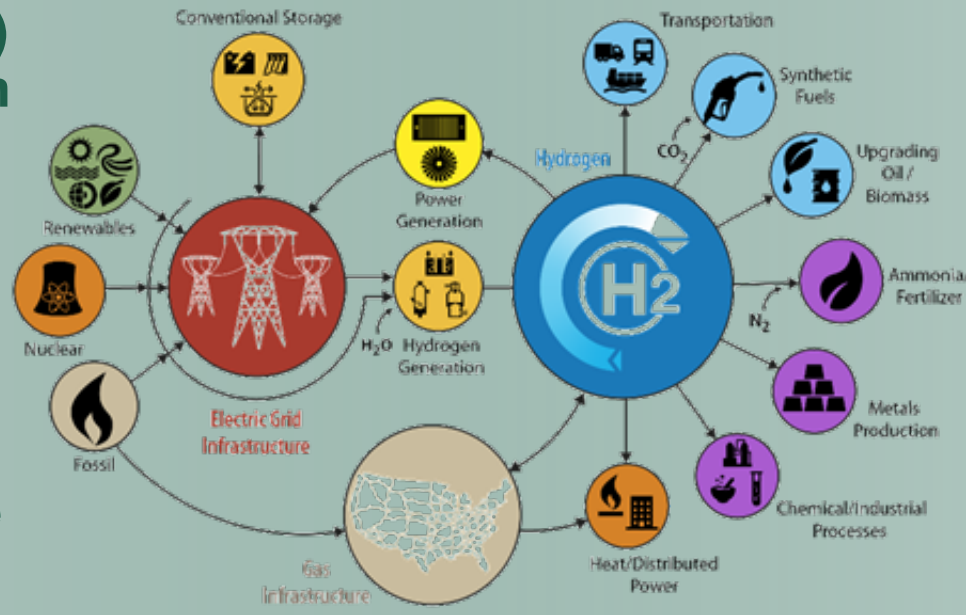
- Project Management Office outside of New Orleans, LA
- 4 SPR sites located along the Gulf Coast in TX (2 sites) and LA (2 sites)
- Elk Hills Naval Petroleum Reserve Field – 1 located near Bakersfield, CA

Key terms:

- Strategic Reserves
- Crude Oil
- Disruption
- Supply and Demand
- Environmental Cleanup

Hydrogen and Fuel Cells Technologies

- **The Hydrogen and Fuel Cell Technologies Office (HFTO) conducts research, development and demonstrations in fuel cells, hydrogen production, delivery, infrastructure and storage in order to reduce technology barriers in cost, efficiency, reliability, performance and manufacturing.**
  - **Hydrogen can be stored for long periods and easily transported.**
  - **It can also be burned like natural gas or used in fuel cells to create electricity.**
  - **Both ways produce power and no pollution.**



Program Budget: FY2020 $150M

Key locations for HFTO:

- A renewable hydrogen system co-located with a computing center using fuel cell power (Texas).
- A hydrogen production, storage and utilization system that supports stationary power, refueling of fuel cell vehicles, and grid optimization controls (Florida).
- An end-to-end, integrated-scale, carbon-free hydrogen production storage and utilization system at a nuclear power plant (Mid-West).

Key Terms:

- H2@Scale
- Electrolysis
- Fuel Cell
- Hydrogen
- Catalyst
- Water-splitting
- Electrochemical
- Materials compatibility
- PEM
- PGM
- Balance of plant
- Membranes
- HySteel

Bioenergy Technologies

- **The Bioenergy Technologies Office (BETO) works with others to target the rapid development of efficient new systems and networks that:**
  - **Reliably produce large quantities of diverse biomass**
  - **Foster advanced technologies to cost-effectively convert biomass and waste (including plastics) to biofuels, bioproducts, and biopower**
  - **Support the integration of process steps and subsequent scale-up of pilot, demonstration, and pioneer commercial plants.**

Program Budget: FY2020 $259.5M

Key Locations for BETO:

- Lawrence Berkeley National Laboratory, Berkeley, CA (Advanced Biofuels and Bioproducts Process Dev. Unit.)
- Idaho National Laboratory, Idaho Falls, ID (UnitBiomass Feedstock National User Facility.)
- Pacific Northwest National Laboratory, Richland, WA (Fixed Bed Upgrading and Separations System facility.)
- National Renewable Energy Laboratory, Golden, CO (Thermal and Catalytic PDU and Integrated Biorefinery Research Facility.)

Key Terms:

- Biofuel
- Bioproducts
- Biorefinery
- Ethanol
- Biodiesel
- Biomass
- Biopower
- Pyrolysis
- Intermediates
- RINs
- Agile Biofoundry
- Co-Optima
- CCPC
- ChemCatBio
- SAFs
- BOTTLE
- FCIC

Vehicle Technologies

- **The Vehicle Technologies Office (VTO) pursues a diverse research portfolio, focused on:**
  - **Vehicle efficiency, energy storage, lightweight materials**
  - **New mobility technologies to improve the overall energy efficiency and affordability of the transportation system.**
    - **supporting initiatives to lower battery pack cost to below $100/kWh**
    - **decreasing EV recharge time to less than 15 minutes for a 300 mile range**
    - **reducing the weight, size, and cost of lithium-metal batteries.**

Program Budget: FY2020 $396M

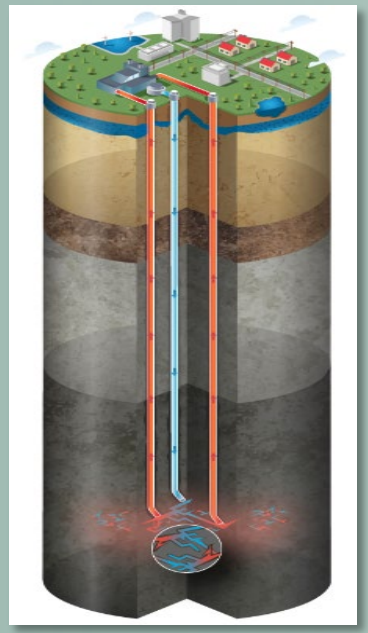
Key locations for VTO: nationwide

Key Terms:

- Electric Vehicles
- Batteries
- Electrification
- EV/Grid Integration
- XFC
- Power Electronics
- EEMS
- Mobility
- CAVs
- Lightweight Materials
- Advanced Combustion
- Co-Optima
- Alternative Fuels
- FuelEconomy.Gov
- Clean Cities
- AFDC
- Passenger, Commercial & Off-road Vehicles

Geothermal

- **The Geothermal Technologies Office (GTO) works to reduce the costs and risks associated with geothermal development by supporting innovative technologies that address key exploration and operational challenges.**
- **GTO strives toward a realistic potential of 60 GW of power capacity by 2050, with intermediate goals of lowered costs for drilling, increased ability to find "hidden" geothermal systems, marked progress in commercial viability of near-field and deep/greenfield Enhanced Geothermal Systems and Deep Direct Use.**



Program Budget: FY2020 $110M

Key Locations for GTO:

- Milford, UT: site for Frontier Observatory for Research in Geothermal Energy (FORGE).
- Lead, SD: mile-deep site for EGS Collab in former gold mine.
- Lawrence Berkeley National Lab, Sandia National Laboratories, National Renewable Energy Lab, and 5 other National laboratories.

Key Terms:

- *GeoVision* report
- Enhanced Geothermal Systems, FORGE, EGS Collab
- Hydrothermal Resources, Play Fairway, Machine Learning
- Low Temperature, heat pumps, Deep Direct Use
- Energy Storage Grand Challenge
- Critical Materials
- Efficient Drilling for Geothermal Energy

Solar Energy Technologies

- SETO's mission is to accelerate the development of solar technologies, while ensuring that clean, low-cost, reliable solar energy is available to all Americans and that solar improves the security, resiliency, and reliability of the electric grid.

- The Solar Energy Technologies Office (SETO) supports solar energy research in three technology areas:
  - photovoltaics
  - concentrating solar-thermal power (CSP)
  - systems integration

- SETO projects encourage collaborative partnerships among industry, universities, DOE National Laboratories, federal, state, and local governments, and nongovernment organizations. The office is funding more than 300 active projects throughout the country. To see where they are, visit the SETO Research Database.

Program Budget: FY2020 enacted $280M

Key terms:
- Photovoltaics
- Concentrating solar power
- Soft costs
- Solar cell
- Solar radiation
- Solar-plus-storage
- Community solar

Wind Energy Technologies Office

- **The Wind Energy Technologies Office (WETO) supports research and development to advance technologies for offshore, land-based, and distributed wind energy and its integration with the electric grid.**
- **WETO also supports research to gain knowledge about and address siting and environmental challenges. WETO aims to drive down the cost of wind energy through competitively-selected, cost-shared projects, carried out in collaboration with industry, academia, and National Laboratories.**

Program Budget: FY2020 enacted $104M

Key Locations for WETO:

- National Renewable Energy Laboratory: Golden, CO
- Sandia National Laboratories: Albuquerque, NM
- Pacific Northwest National Laboratory; Richland, WA
- Wind Technology Testing Center: Charlestown, MA
- Scaled Wind Farm Technology (SWiFT) Facility: Lubbock, TX
- Oak Ridge National Laboratory: Oak Ridge, TN
- Energy Innovation Center: Charleston, SC

Key terms:

- Wind energy/wind power
- Wind turbine
- Floating offshore wind
- Distributed wind
- Tall wind
- Systems integration
- Resource characterization
- National Wind Technology Center

Water Power Technologies Office

- **The Water Power Technologies Office (WPTO) enables research, development, and testing of emerging technologies to advance marine energy as well as next-generation hydropower and pumped-storage systems for a flexible, reliable grid.**
- **WPTO promotes innovative technologies for domestic power generation from water resources across the United States, such as hydropower, waves, tides, and ocean and river current.**
- **The Marine and Hydrokinetics (MHK) Program conducts transformative early-stage research that advances the development of reliable, cost-competitive MHK technologies and reduces barriers to technology deployment.**

Program Budget: FY20 enacted $148M

Key Locations for Water Power:

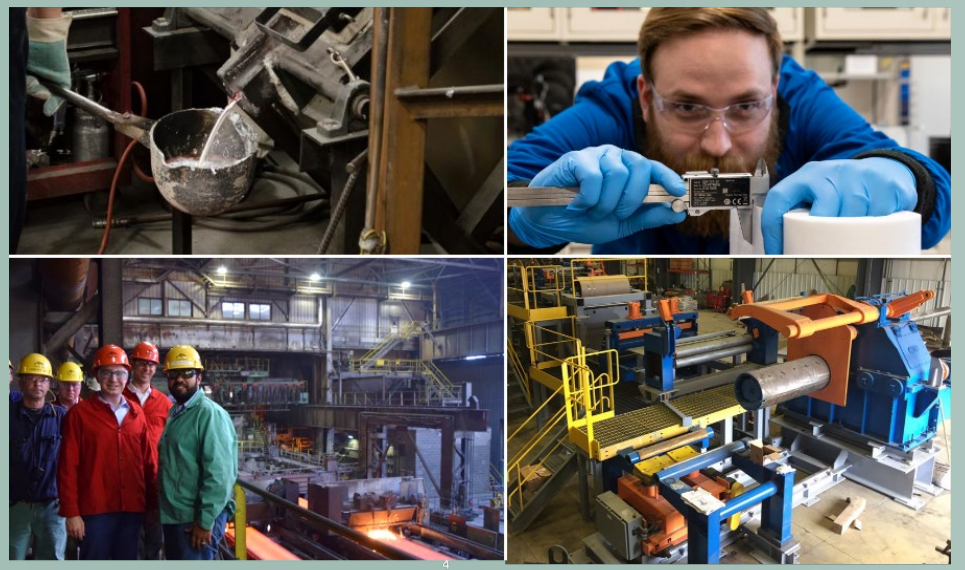
- Argonne National Laboratory: Lemont, IL
- Idaho National Laboratory: Idaho Falls, ID
- National Renewable Energy Laboratory: Golden, CO
- Oak Ridge National Laboratory: Oak Ridge, TN
- Pacific Northwest National Laboratory: Richland, WA
- Sandia National Laboratories: Albuquerque, NM

Key terms:

- Water power
- Hydropower
  - Pumped storage hydropower
  - HydroWIRES
- Marine renewable energy, marine energy, or marine and hydrokinetics
  - TEAMER
  - Powering the Blue Economy

Advanced Manufacturing

- **The Advanced Manufacturing Office (AMO) is dedicated to improving the energy and material efficiency, productivity, and competitiveness of manufacturers across the industrial sector.**
- **AMO's areas of focus include:**
  - **accelerating the development of new materials and processes capitalizing on advanced sensors and controls for intelligent manufacturing**
  - **enabling the circular economy to extend the life of raw materials**
  - **and attracting, developing, and growing tomorrow's manufacturing workforce.**



Program Budget: FY2020: $395M

Key Locations for AMO:

- Oak Ridge National Laboratory, Oak Ridge, TN
- Ames Laboratory, Ames, IA
- Lawrence Berkeley National Laboratory, Berkeley, CA
- National Renewable Energy Laboratory, Golden, CA
- Lawrence Livermore National Laboratory, Livermore, CA

Key terms:

- Advanced composites
- Additive manufacturing
- Circular economy
- Critical materials
- High performance computing
- Process intensification
- Smart manufacturing

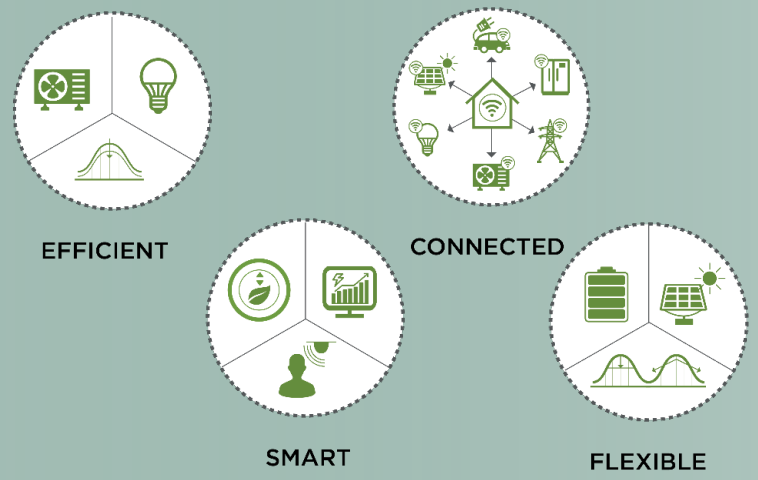
Building Technologies

The Building Technologies Office (BTO) is addressing energy costs to American businesses and consumers through research and development.

- **BTO is enhancing the affordability, environmental and overall energy performance of buildings today and into the future.**
- **BTO is driving improvements in new construction and retrofits to make buildings more sustainable, resilient and affordable.**

Office Budget: FY2020 $285M

Characteristics of Grid-Interactive Efficient Buildings



Key Locations for BTO (beyond DC, Golden):

- Lawrence Berkeley National Laboratory (LBNL): Berkeley, CA
- National Renewable Energy Laboratory (NREL): Golden, CO
- Oak Ridge National Laboratory (ORNL): Oak Ridge, TN
- Pacific Northwest National Laboratory (PNNL): Richland, WA

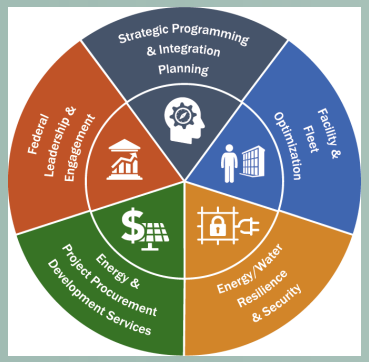
Key Terms:

- Energy use intensity
- Energy efficiency
- Demand flexibility
- Grid-interactive Efficient Buildings
- Advanced Building Construction
- Building Codes
- Appliance Standards
- Field Validation

Federal Energy Management Program

Energy (S3) - EERE

- **The Federal Energy Management Program (FEMP) works with federal agencies and private stakeholders to identify affordable solutions and best practices to strengthen the nation's energy and water infrastructure.**
  - **FEMP assists federal agencies in addressing the infrastructure repair backlog by leveraging energy saving contracts for financing with no up-front capital costs to the federal government**
  - **FEMP also provides technical assistance to agencies for optimizing facility design, installation and maintenance of energy and water projects, and systematic prioritized risk-informed planning and project identification.**



Key Locations for FEMP

Program Budget: FY2020 $40M

- U.S Federal Government Agencies
- Department of Defense Installations
- White House Council on Environmental Quality and Office of Management and Budget
- Pacific Northwest National Laboratory (PNNL), Richland, WA
- National Renewable Energy Laboratory (NREL), Golden, CO
- Oak Ridge National Laboratory (ORNL), Oak Ridge, TN
- Lawrence Berkeley National Laboratory (LBNL), Berkeley, CA

Key Terms:

- Strategic Energy Management
- Resilient-Efficient-Secure
- Facility Related Control Systems
- Energy Storage and Microgrids
- Technology Integration and Validation
- Workforce Development
- Distributed Energy Resources and Grid Interface
- Performance Contracts
- Agency Collaboration

Weatherization and Intergovernmental

- **Weatherization and Intergovernmental Programs (WIP) enables strategic investments through state and local partnerships to lower energy for all American communities.**
- **WIP's two primary programs are:**
  - **The Weatherization Assistance Program**
  - **The State Energy Program.**
    - The State Energy Program (SEP) was established in the Energy Policy & Conservation Act of 1975 to support core programs in state energy offices to advance their energy priorities and innovative policies and programs. Funding and technical assistance assist states to develop, demonstrate, and disseminate best practices.

Program Budget: FY2020 $371M

Key Locations for FES:

- DOE HQ and Golden Field Office
- DOE Labs: LBNL, NREL, ORNL

Key Terms:

- Weatherization
- State Energy Offices
- Better Buildings
- State & Local Solutions Center

Nuclear Energy

- **The Office of Nuclear Energy (NE) mission is to advance nuclear energy science and technology to meet U.S. energy, environmental, and economic needs.**
- **NE works to make nuclear energy more cost effective, accelerate advanced reactor deployment, make nuclear fuel cycles more sustainable, encourage a resilient supply chain, and promote a strong nuclear workforce.**
- **Existing U.S. nuclear plants prevent almost 500 million metric tons of carbon dioxide emissions each year—the equivalent of taking 100 million cars off the roads.**
- **They also operate at by far the highest capacity factor of any energy source at 93 percent, giving us access to electricity around the clock.**

Program Budget: FY2020 $824M

Key locations for NE:

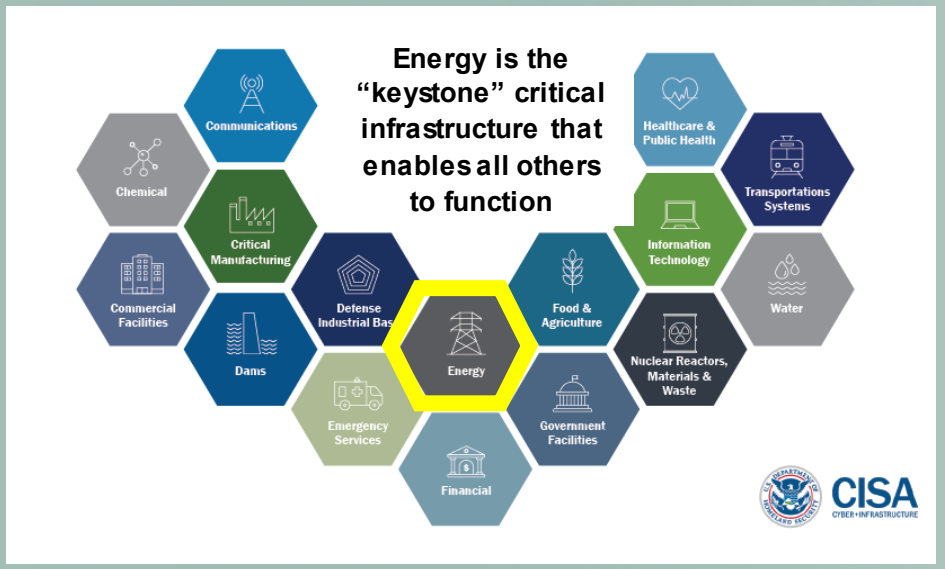
- Idaho National Laboratory, Idaho Falls, ID
- Argonne National Laboratory, Lemont, IL
- Oak Ridge National Laboratory, Oak Ridge, TN
- Pacific Northwest National Laboratory, Richland, WA

Key Terms:

- Nuclear reactor
- Advanced reactor
- SMR
- Microreactor
- Accident tolerant fuel
- Versatile Test Reactor
- HALEU

Electric Power

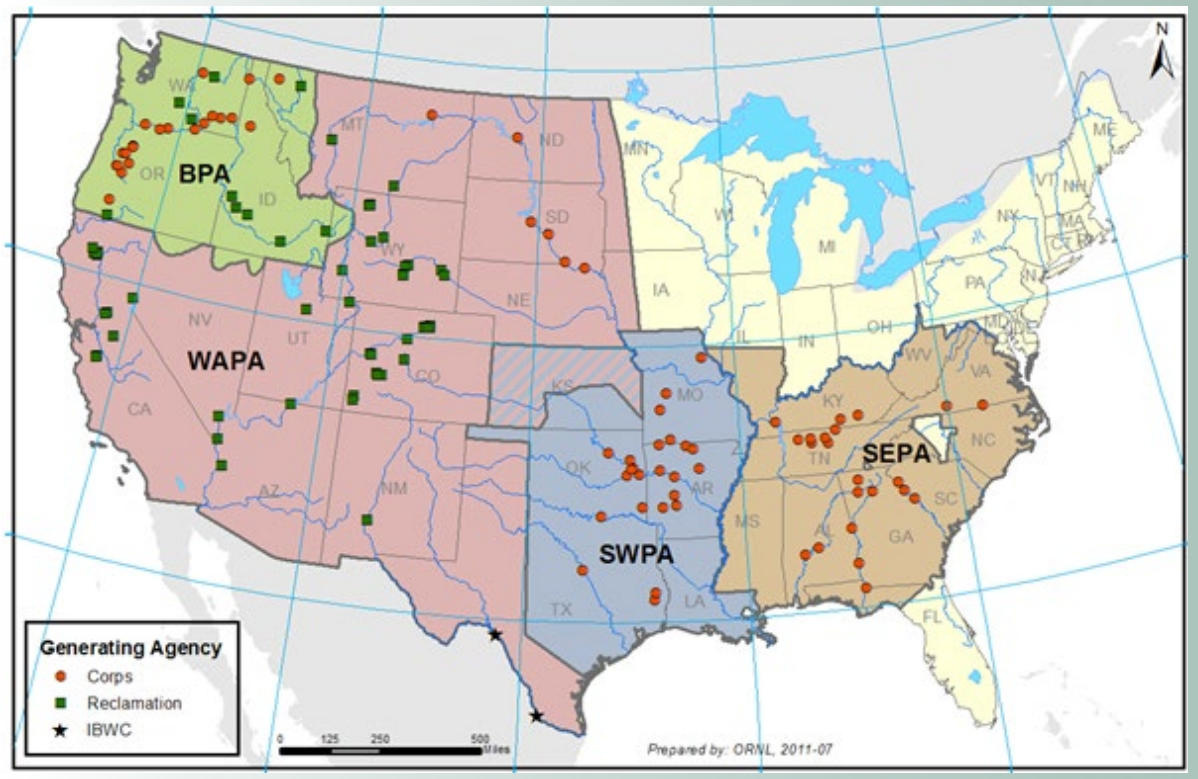
- The Office of Electricity (OE) works with key partners including the utility industry; the Department of Defense; State, Local, Tribal and Territorial governments and many others to manage risk of power disruptions to safeguard the defense of the Homeland, the projection of U.S. military power, and the energy-dependent American way of life.
  - OE pursues the research and development of technologies intended to strengthen energy assurance. OE develops risk mitigation strategies for critical defense facilities and their associated defense critical electric infrastructure in order to protect all American citizens.
  - OE also supports the Secretary of Energy's authority to implement Emergency Grid Security Orders under the Federal Power Act Sec. 202(C) authority.



Program Budget: FY2020 $190M

Power Marketing Administrations

The Power Marketing Administrations (PMAs) are agencies within DOE whose primary mission is to market hydroelectric power produced at Federal Dams. These multipurpose water projects are owned and operated primarily by the Department of Interior's Bureau of Reclamation and the U.S. Army Corps of Engineers.



FY 2019 PMA Statistics	Transmission Lines (miles)	Substations	Poweplants	Installed Capacity (MW)	Powe & Transmission Revenue (million $)	Sales (billion kWh)	Percent of Sales in Marketing Area	States Served	Customers
Bonneville	15,209	261	31	22,458	$3,656	74.5	27%	8	143
Southeastern	N/A	N/A	22	3,392	$304.5	9.1	1%	11	477
Southwestern	1,380	26	24	2,193.5	$217.4	7.4	7%	6	102
Western	17,325.5	324	57	10,570	$1,036	36.9	4.6%	15	700
Total	33,923	605	135	38,613.5	5,542	135.5	N/A	33	1,422

Four PMAs that each operate in a different region

1. **Bonneville Power Administration (BPA)**
2. **Southeastern Power Administration (SEPA)**
3. **Southwestern Power Administration (SWPA)**
4. **Western Area Power Administration (WAPA)**

In FY 2019, DOE's four PMAs marketed power primarily from 133 Federal hydro power plants with maximum operating capabilities of 38,613 megawatts, approximately three percent of the Nation's power plant capacity.

CESER: Securing Energy Infrastructure for the Nation

- **DOE's Office of Cybersecurity, Energy Security, and Emergency Response (CESER) mission is to improve the security of the US energy infrastructure against all hazards.**

  - **It is comprised of the Infrastructure Security and Energy Restoration (ISER) and Cybersecurity for Energy Delivery System (CEDS) program offices.**
  - **CESER is fully aligned with the National Cyber Strategy and is developing new and expanded capabilities to coordinate response operations, maintain situational awareness, and to provide analysis of threats and incidents affecting the energy sector through a Headquarters based watch office function and the DOE Integrated Security Center (DISC) in Colorado.**

Program Budget: FY2020 $165M ($95M CEDS, $48M ISER, $13M PD)

Key terms:
- Infrastructure security
- R&D investments
- Cybersecurity capabilities
- Response coordination
- Threat mitigation
- Situational awareness
- Energy restoration
- Recovery operations
- Emergency Support Function (ESF) 12

Advanced Scientific Computing Research

- **The Advanced Scientific Computing Research program (ASCR) helps the U.S. maintain world-leading computing and networking capabilities by supporting research, development, and deployment of new computing and network technologies. As we prepare to deploy America's first exascale supercomputers (capable of a billion-billion operations per second), we are laying the groundwork for continued U.S. leadership though a major Office of Science research effort in the fast-developing field of Quantum Information Science.**
  - **Advanced computing gives us the ability to study systems that are too large, too small, too complex, too fleeting, or simply too dangerous to explore through experiment.**

Program Budget: FY2020 $980M

Key terms:
- Leadership Computing
- Advanced Networking
- Computational Science
- Applied Math
- Exascale
- Artificial Intelligence
- Quantum Information Science

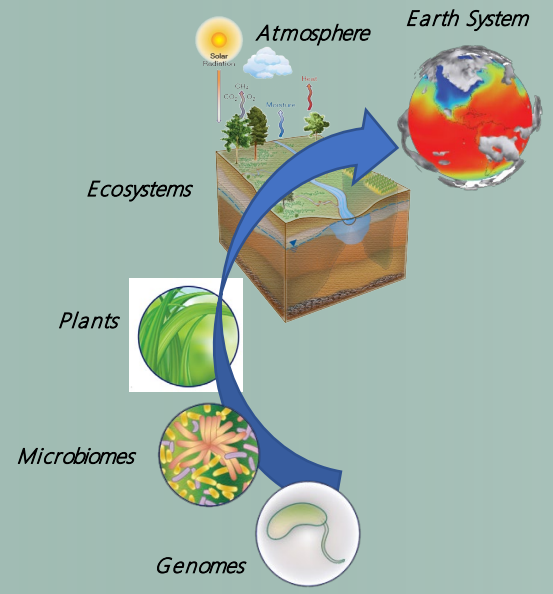
Key Locations for ASCR:

- Leadership Computing Systems at Oak Ridge and Argonne National Laboratories.
- Energy Sciences Network (Esnet), the Nation's premier science network stretching across the U.S. and the Atlantic.
- National Energy Research Scientific Computing Center (NERSC), at Lawrence Berkeley National Laboratory.

Biological and Environmental Research

Science (S4) – SC

- **Biological and Environmental Research (BER) biological research seeks to transform plants to produce bioenergy and bioproducts.**
- **BER environmental research explores the science of the atmosphere, soil biochemistry, water cycling, and how they combine to accurately model the Earth system.**
  - BER research helped map the human genome and pioneered research that led to Earth system models
  - BER funded scientists are making key discoveries on conversion of plant biomass into bioenergy and bioproducts..



Program Budget: FY2020 $750M

Key locations for BER:

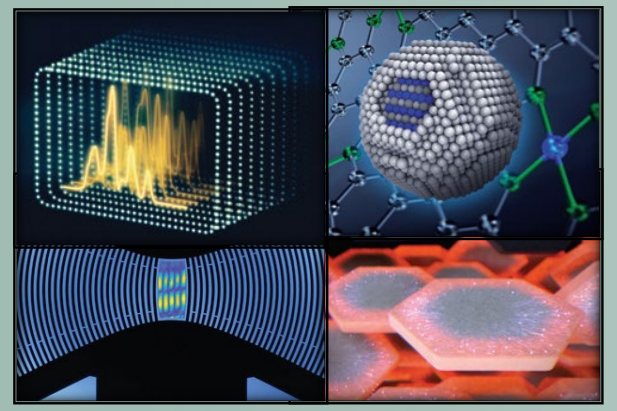
- Research at 12 DOE National Laboratories, 133 academic/non-profit/industrial institutions, and four DOE Bioenergy Research Centers
- Three scientific user facilities: Atmospheric Radiation Measurement (ARM), Environmental Molecular Sciences Laboratory (EMSL), and Joint Genome Institute (JGI)
- Field experiments span from Pole to Pole

Key Terms:

- Aerosols
- ARM
- Bioenergy & Products
- Biogeochemistry
- Cryosphere/Sea ice
- DNA
- Field experiments
- EMSL
- E3SM
- Genomics
- JGI
- Metabolomics
- Microbiome
- Molecular
- System Sciences
- Proteomics
- Water cycle

Basic Energy Sciences

- **Basic Energy Sciences (BES) discoveries drive U.S. leadership in science, sustain innovation across the American economy, raise our standard of living, and improve our security.**
  - **These scientific foundations are essential for advancing the energy, transportation, chemical, manufacturing, and microelectronics industries.**
  - **Continuous progress in basic science is critical to sustaining U.S. innovation.**



Program Budget: FY2020 $2.213B

Key locations for BES:

- Research at 15 DOE National Labs, 150 academic/non-profit/industrial institutions:
  (Approximately 40% of BES budget – 53% at Labs, 47% at universities/non-profits/industry)
- 12 BES scientific user facilities: over 16,000 users annually:
  (Approximately 45% of BES budget for operations, 15% for construction)
- The most extensive BES-supported activities are performed at major research universities and these DOE Laboratories:
  Ames Laboratory, IA; Argonne National Laboratory, IL; Brookhaven National Laboratory, NY; Lawrence Berkeley National Laboratory, CA; Oak Ridge National Laboratory, TN; Pacific Northwest National Laboratory WA; SLAC National Accelerator Laboratory, CA.

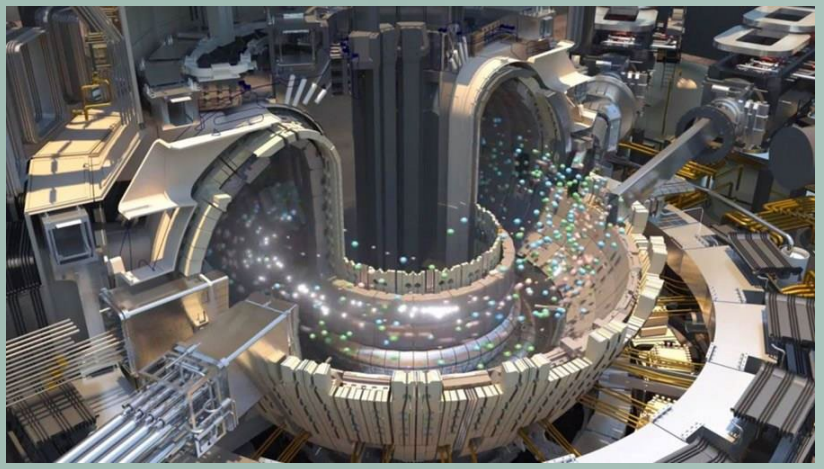
Key Terms:

- Materials
- Chemistry
- Bioscience
- Geoscience
- User facilities
- Nanoscience
- Energy Storage
- Solar Fuels
- Ultrafast Science
- Accelerators
- Synthesis
- Characterization
- Data Science
- Theory and Computation
- QIS
- Quantum materials and chemistry

Fusion Energy Sciences

- **Fusion Energy Sciences (FES) is a major federal steward of discovery research that studies basic properties and behavior of plasma, the so-called fourth state of matter, with applications to lasers, microelectronics, and astrophysical plasmas.**

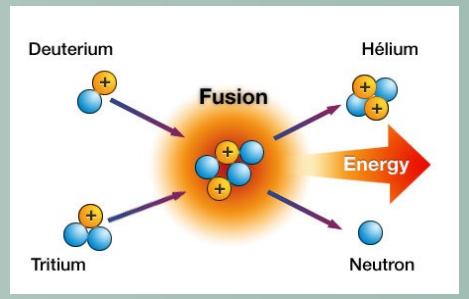
- **The DOE scientists and their international partners' research focuses on the scientific and engineering solutions that make fusion feasible with machines that can contain the fusion reactions for long periods and produce much more energy than they consume.**



Program Budget: FY2020 $671M

Key Locations for FES:

- Princeton Plasma Physics Laboratory (PPPL): Princeton, NJ
- DIII-D National Fusion Facility: San Diego, CA
- Oak Ridge National Laboratory (ORNL): Oak Ridge, TN
- International ITER Project: Cadarache, France
- Stanford Linear Accelerator (SLAC): Menlo Park, CA

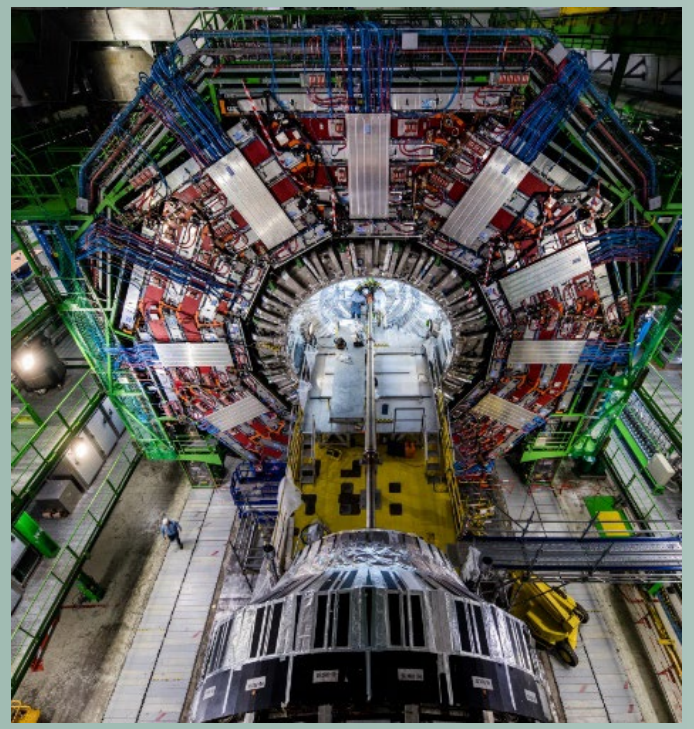


Key Terms:

- Nuclear Fusion
- Binding Energy
- Deuterium
- Tritium
- Tokamak
- Stellarator
- Inertial Fusion
- Plasma Physics
- ITER
- NSTX-U
- DIII-D
- $E=mc^2$

High Energy Physics

- **The DOE High Energy Physics (HEP) program studies particle physics.**
- **Particle physics explores what the world is made of and how it works at the smallest and largest scales and seeks new discoveries from the tiniest particles to the outer reaches of space seeking answers to:**
  - **What is the Universe made of?**
  - **What forces govern it?**
  - **How did become the way it is today?**



Program Budget: FY2020 $1.045B

Key locations for HEP:

- Fermi National Accelerator Laboratory (Fermilab): Batavia, IL
- European Organization for Nuclear Research (CERN): Geneva, Switzerland
- Sanford Underground Research Facility: Lead, SD
- Vera C. Rubin Observatory: Cerro Pachón, Chile

Key Terms:

- Antimatter
- Cosmology
- Cosmic acceleration and dark energy
- Dark matter
- Extra dimensions
- Higgs boson
- Neutrino
- Particle accelerator
- Quantum mechanics
- Standard model of particle physics

Nuclear Physics

The DOE Nuclear Power program (NP) stewards operations at multiple national accelerator user facilities to accomplish its mission of discovering, exploring, and understanding all forms of nuclear matter.

- **The aim is to understand why matter takes on the specific forms observed in nature and answer the questions: How did visible matter come into being and how does it evolve? How does subatomic matter organize itself and what phenomena emerge? Are the fundamental interactions basic to the structure of matter fully understood?**

To maintain U.S. leadership, NP builds advanced instrumentation and new tools such as the Facility for Rare Isotope Beams (FRIB) and the future Electron-Ion Collider (EIC). FRIB will uniquely afford access to eighty percent of all isotopes predicted to possibly exist in nature, including over 1,000 never produced on Earth. The EIC will provide unprecedented ability discover how the mass of everyday objects is dynamically generated by the interaction of quarks and gluons inside protons and neutrons.

Program Budget: FY2020 $653M

Key locations for NP:

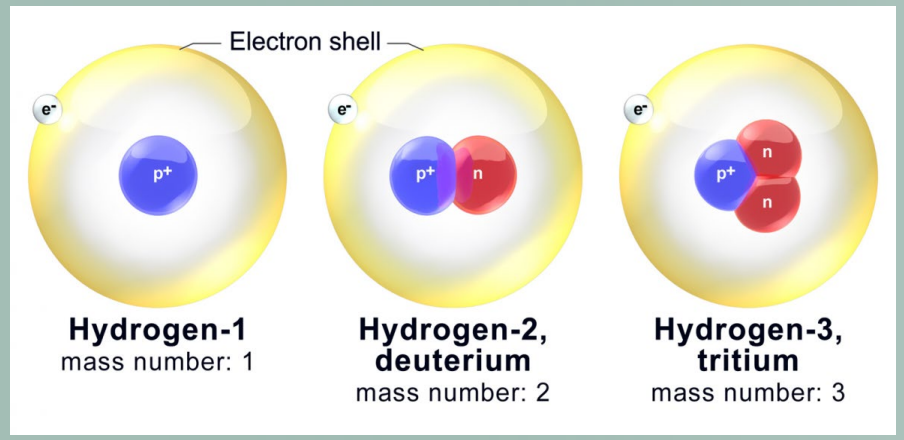
- Facility for Rare Isotope Beams: Michigan State University, East Lansing, MI
- The Relativistic Heavy Ion Collider at Brookhaven National Laboratory, NY
- Thomas Jefferson National Accelerator Facility: Newport News, VA
- Argonne Tandem Linac Accelerator System at Argonne National Laboratory, IL
- Institute for Nuclear Theory at University of Washington: Seattle, WA

Key Terms:

- Quark Gluon Plasma
- Quantum Chromodynamics
- Neutrons
- Neutron Stars
- Supernova
- Nucleosynthesis
- Spin puzzle
- Heavy Elements
- Beta Decay
- Symmetry Violation

Isotope R&D Program

- **The DOE Isotope Program (DOE IP) researches and develops new isotope production techniques of critical radioactive and stable isotopes for the Nation.**



- **Radioactive and stable isotopes are required for advancement in basic research (quantum information sciences for example), medical applications (diagnostic imaging, cancer therapies, infectious diseases), commercial applications (energy exploration), national security (threat detection, nuclear forensics), space exploration (long lived power sources), and other applications.**

Program Budget: FY2020 $62M

Key Terms:

- Isotope
- Chemical Element
- Fission
- Particle Accelerator
- Nuclear Reactor
- Radioactivity
- Isotope Enrichment
- Half-life
- Alpha(a), Gamma(g), Beta(b)-emission
- Positron Emission Tomography (PET)
- Targeted cancer therapy
- Radioisotope
- Stable Isotope
- Cancer Diagnostic

Key Locations for IP:

- Oak Ridge National Lab (ORNL): Oak Ridge, TN
- Brookhaven National Lab (BNL): Brookhaven, NY
- Los Alamos National Lab (LANL): Los Alamos, NM
- Argonne National Lab (ANL): Argonne, IL

Environmental Management

- **The mission of the Office of Environmental Management (EM) is to address the significant environmental liability resulting from decades of nuclear weapons production and government-sponsored nuclear energy research that played a key role in domestic security and prosperity.**
  - **EM conducts one of the largest environmental remediation programs in the world, helping to reduce one of largest financial liabilities the federal government faces.**
  - **Over the past 30 years, EM has completed cleanup activities at 91 out of an original 107 sites**

Program Budget: FY2020 $7.46B

Key EM locations:

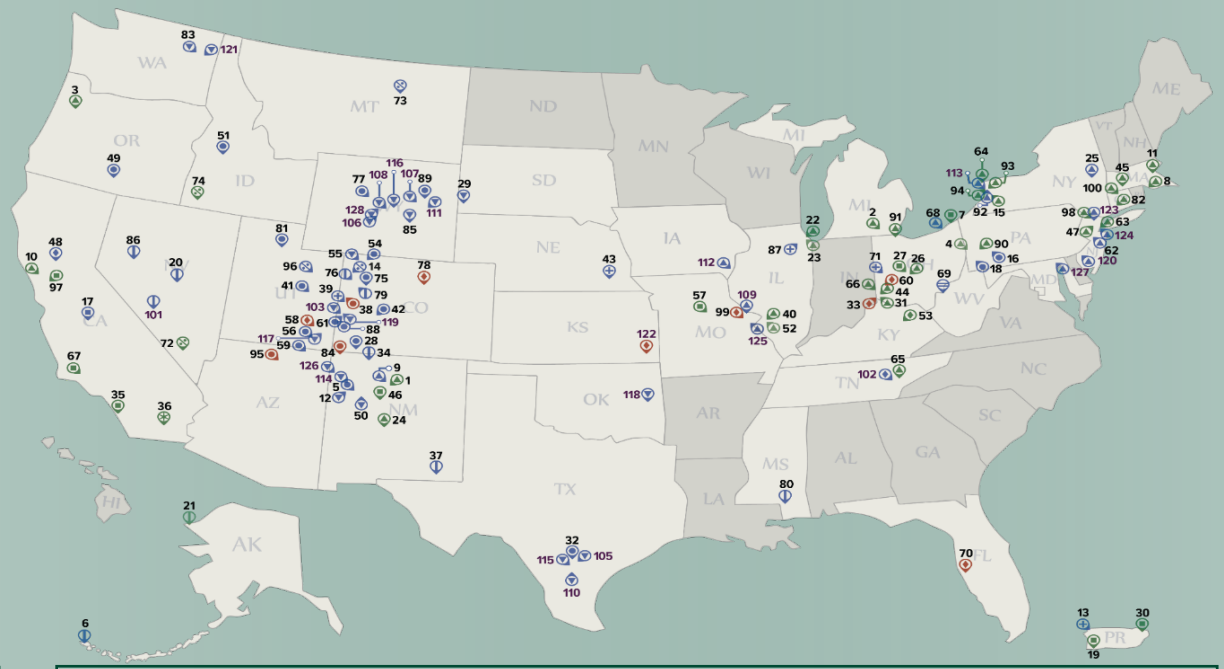
- Hanford, WA
- Savannah River Site, SC
- Waste Isolation Pilot Plant, NM
- Idaho Site, ID
- Oak Ridge Reservation, TN

Key terms:

- Tank waste
- Transuranic waste
- Low-level waste
- Deactivation and decommissioning (D&D)

Legacy Management (LM)

- **The Office of Legacy Management (LM) is the long-term caretaker of former defense-related atomic sites. These include:**
  - **Sites where the defense nuclear mission has ended, and environmental cleanup has been completed and nuclear environmental monitoring and maintenance is required.**
  - **Sites had a role in the development of the Manhattan Project, nuclear weapons development, and peace-time nuclear energy applications.**



Program Budget: FY2020 $322M

Key LM office locations:

- LM Business Center in Morgantown WV,
- LM Operations Center in Westminster, CO
- LM Field Support Center in Grand Junction, CO

Key terms:

- Asset Management
- Long Term Stewardship
- Regulatory Closure
- Remedy
- Surveillance & Maintenance
- FUSRAP
- UMTRCA I & II
- RCRA/CERCLA
- Environmental Justice
- Environmental Liability
- Beneficial Reuse
- Site Management Guide
- Program Office Strategic Plans

Office of Defense Programs

- **The National Nuclear Security Administration's Office of Defense Programs (DP) works with the Department of Defense and provides the nuclear warheads for the DoD weapons. America's nuclear weapons.**

- **DP is also responsible for the safe and secure transport of government-owned special nuclear materials in the United States.**

Program Budget: FY2020 enacted $12.6B

Key DP locations:

- Forrestal Building, Washington D.C.,
- Germantown Building, Germantown, MD,
- John A. Gordon Albuquerque Complex at Kirtland Air Force Base, Albuquerque, NM,
- Kansas City National Security Campus, Kansas City, MO
- Lawrence Livermore National Laboratory Livermore, CA
- Los Alamos National Laboratory, Los Alamos, NM
- Nevada National Security Site, North Las Vegas, NV
- Pacific Northwest National Laboratory, Richland, WA
- Pantex Plant, Amarillo, TX
- Sandia National Laboratories, Albuquerque, NM
- Savannah River Site, Aiken, SC
- Y-12 National Security Complex, Oak Ridge, TN

NNSA completed the Lifetime Extension Program of the W76-1 warhead in 2019.

Key terms:

- Deterrence
- Nuclear weapons
- Nuclear stockpile
- Stockpile stewardship
- Nuclear warheads
- Life extension program
- Modernization
- Plutonium

Office of Naval Reactors

- **The Office of Naval Reactors (NR) is responsible for the Navy Nuclear Propulsion Program. They provide militarily effective nuclear propulsion plants, ensuring safe, reliable and long-lived operation. The director of Naval Reactors serves as a Deputy Administrator in the National Nuclear Security Administration (NNSA) and is a four-star Admiral in the U.S. Navy.**

Program Budget: FY2020 enacted $1.6B

Key NR locations:

- Bettis Atomic Power Laboratory in West Mifflin, PA
- Knolls Atomic Power Laboratory in Schenectady, NY
- Kenneth A. Kesselring Site in West Milton, NY
- NR Facility within the Idaho National Laboratory, ID

Shipyard	Location
Electric Boat	Groton, Connecticut
Norfolk Naval Shipyard	Portsmouth, Virginia
Newport News Shipbuilding	Newport News, Virginia
Pearl Harbor Naval Shipyard and Intermediate Maintenance Facility	Pearl Harbor, Hawaii
Portsmouth Naval Shipyard	Kittery, Maine
Puget Sound Naval Shipyard and Intermediate Maintenance Facility	Bremerton, Washington

Key terms:

- Naval reactors
- Naval nuclear propulsion
- Nuclear Navy/nuclear powered Navy
- Nuclear submarines
- Reactor core

Defense Nuclear Nonproliferation (DNN)

Nuclear Security (S5)

- **National Nuclear Security Administration (NNSA) Office of Defense Nuclear Nonproliferation (DNN) works to prevent countries and organizations from developing nuclear weapons or nuclear materials, equipment, and technology.**
  - **Global material security areas include:**
  - **International Nuclear Security**
  - **Radiological Security**
  - **Nuclear Smuggling Detection and Deterrence**
  - **Strengthen international law enforcement, intelligence, and security agencies**
  - **Detect, disrupt, and investigate nuclear smuggling**
  - **Promote counter nuclear smuggling capabilities**
  - **Research and Development**

Program Budget: FY2020 enacted $2.2B

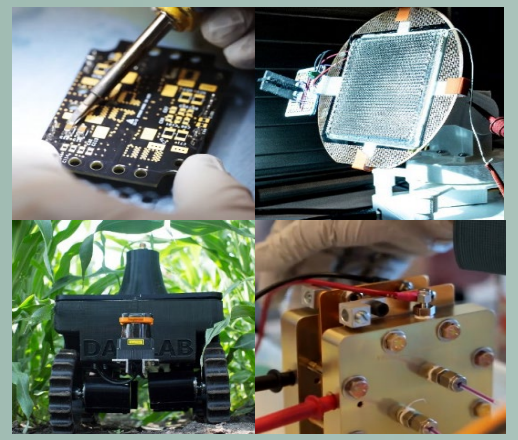
Key terms:

- Nuclear arms control
- Nonproliferation
- Counterproliferation
- Countering weapons of mass destruction
- Safeguard
- Verification
- Detection
- Nuclear smuggling
- Material minimization
- Highly enriched uranium (HEU)
- Molybdenum (Mo-99)

Key DNN Locations are found throughout the National Laboratory system and the NNSA complex.

Advanced Research Projects Agency-Energy

ARPA-E



- **Advanced Research Projects Agency-Energy (ARPA-E) focuses on high risk early-stage energy technologies that can be advanced with modest funding over a defined period of time. The Agency funds technologies that have the potential to change the way Americans get, store, and use energy.**

Program Budget: FY2020 $425M

- Since 2009:
  - ARPA-E has provided $2.4 billion in R&D funding to more than 875 projects
  - 166 projects have attracted more than $3.3 billion in private-sector follow-on funding
  - 86 companies formed from ARPA-E projects
  - 229 projects have partnered with other government agencies for further development
  - 4,021 peer-reviewed journal articles were produced from ARPA-E projects
  - 609 patents issued by the U.S. Patent and Trademark Office

Key terms:

- ARPA-E Programs
- ARPA-E Project Map
- Funding Opportunity Application (FOA)
- ARPA-E Energy Innovation Summit – Annual ARPA-E-hosted event that convenes leaders from academia, business, and government to discuss the foremost energy issues, and showcased cutting-edge energy technologies

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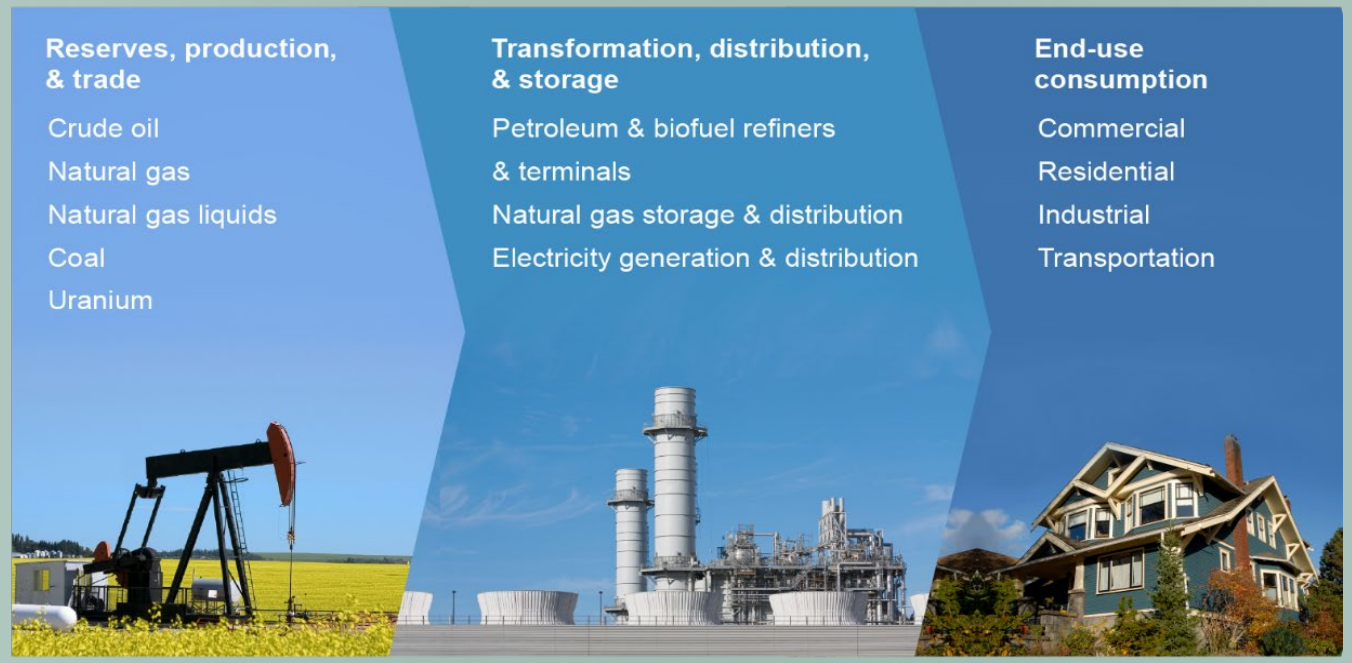
U.S. Energy Information Administration (EIA)

- **The mission of the U. S. Energy Information Administration (EIA) is to collect, analyze, and disseminate independent and impartial energy information to promote sound policymaking, efficient markets, and public understanding of energy and its interaction with the economy and the environment.**



Program Budget: FY2020 $126.8M

EIA's flagship products

- Annual Energy Outlook
- Short-Term Energy Outlook
- Today in Energy
- Weekly Natural Gas Storage Report
- (Principal federal economic indicator)
- Weekly Petroleum Status Report

By providing unbiased information, EIA increases transparency, informs policymakers, and promotes broader understanding of important energy issues–a unique and vital public service.

Seventeen DOE National Laboratories

Office of Science Laboratories

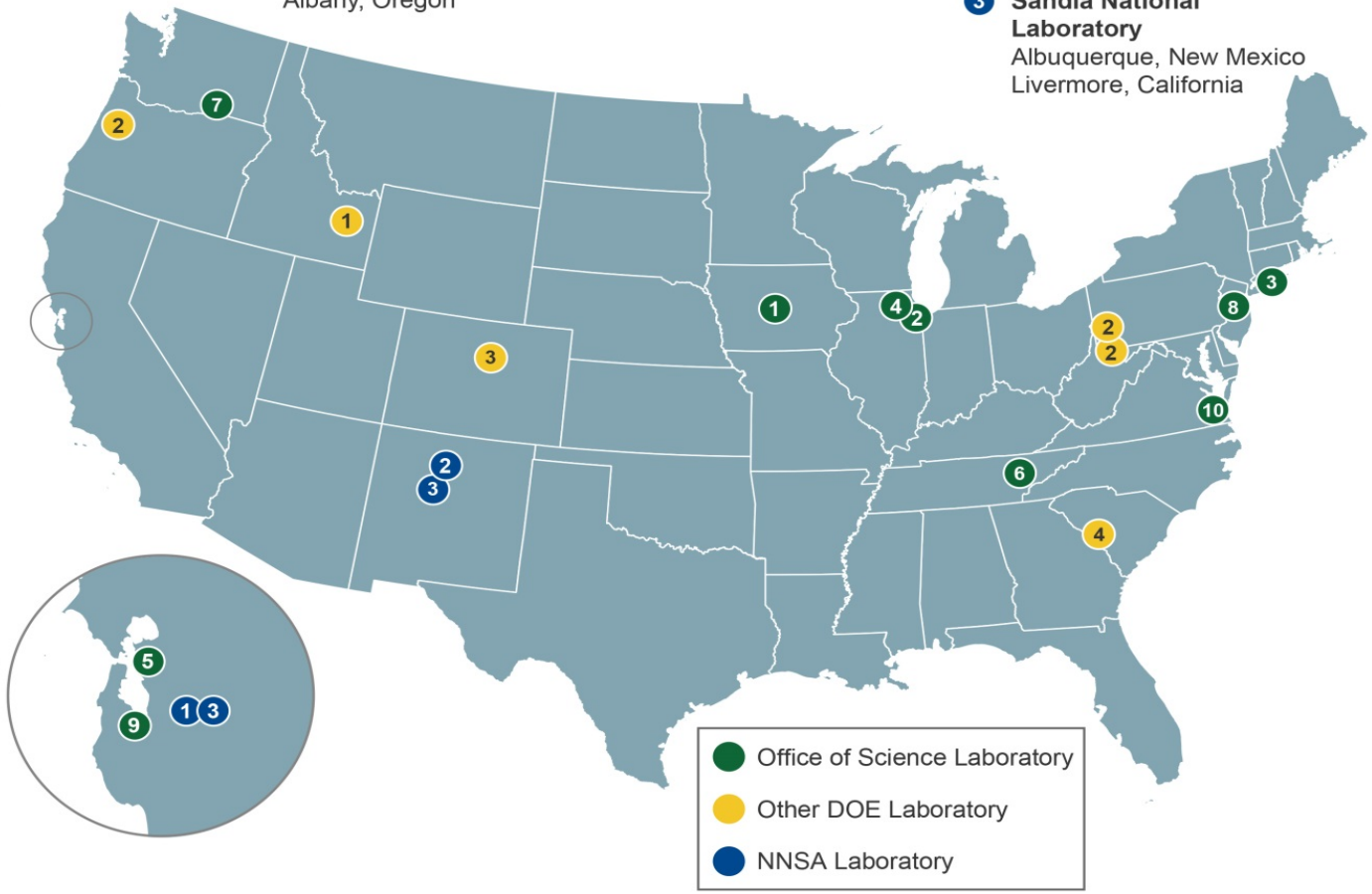
1. **Ames Laboratory**
   Ames, Iowa
2. **Argonne National Laboratory**
   Argonne, Illinois
3. **Brookhaven National Laboratory**
   Upton, New York
4. **Fermi National Accelerator Laboratory**
   Batavia, Illinois
5. **Lawrence Berkeley National Laboratory**
   Berkeley, California
6. **Oak Ridge National Laboratory**
   Oak Ridge, Tennessee
7. **Pacific Northwest National Laboratory**
   Richland, Washington
8. **Princeton Plasma Physics Laboratory**
   Princeton, New Jersey
9. **SLAC National Accelerator Laboratory**
   Menlo Park, California
10. **Thomas Jefferson National Accelerator Facility**
    Newport News, Virginia

Other DOE Laboratories

1. **Idaho National Laboratory**
   Idaho Falls, Idaho
2. **National Energy Technology Laboratory**
   Morgantown, West Virginia
   Pittsburgh, Pennsylvania
   Albany, Oregon
3. **National Renewable Energy Laboratory**
   Golden, Colorado
4. **Savannah River National Laboratory**
   Aiken, South Carolina

NNSA Laboratories

1. **Lawrence Livermore National Laboratory**
   Livermore, California
2. **Los Alamos National Laboratory**
   Los Alamos, New Mexico
3. **Sandia National Laboratory**
   Albuquerque, New Mexico
   Livermore, California



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National Labs at a Glance

Ames Lab's central location on the campus of Iowa State University fosters a longstanding collaborative relationship to explore physics, chemistry, engineering, applied mathematics, and materials in the discovery, synthesis, analysis, and use of new materials

Argonne Lab's pioneering legacy in creating the first self-sustaining nuclear chain reaction and world-class talent produces a powerful suite of facilities and tools to deliver pivotal discoveries and technologies.

Brookhaven Lab is a global powerhouse where scientists advance fundamental research in nuclear particle physics, apply photon sciences and nanomaterials research, and perform cross-disciplinary research on computation, sustainable energy, national security, and the Earth's ecosystems.

Fermilab is the premier particle physics and accelerator lab where the global physics community fuses to solve the mysteries of matter, energy, space, and time that support industry and benefit everyday applications in medical diagnostics and treatment, homeland security, energy, transportation, and advanced computing.

Idaho Lab is the chief nuclear research facility which nearly every nuclear reactor in the world owes its existence. It is home to the world's largest concentration of nuclear reactors and maintains a state-of-the-art portfolio in advanced manufacturing and transport, predictive modeling, and sustainable energy development.

Lawrence Berkeley Lab's diverse team of researchers coalesce with the University of California Berkeley to develop sustainable energy and environmental solutions, create new materials, advance the frontiers of computing, and probe the mysteries of life, matter, and the Universe.

National Labs at a Glance

Lawrence Livermore Lab strengthens our Nation's security by developing and applying world-class research, technology, and engineering across diverse mission areas spanning biosecurity, counterterrorism, defense, energy, intelligence, nonproliferation, various sciences, and weapons.

Los Alamos Lab's scientists and engineers promote global stability and security by developing solutions that support nuclear deterrence and stockpile stewardship, defend against the nuclear threats, detect emerging cybersecurity threats, and enhance energy security and sustainability.

National Energy Technology Lab is a leader in coal, oil, natural gas, and energy technology research, fulfilling its mission of enhancing the Nation's energy foundation and protecting the environment for future generations.

National Renewable Lab continues the momentum in the science and engineering of efficient, sustainable, and renewable energy technologies to discover and provide solutions that transform how we use energy.

Oak Ridge National Lab built the first continuously operating nuclear reactor during the Manhattan Project. ORNL remains at the forefront of advances in biology, chemistry, and physics, producing cutting-edge technologies in materials, medicine, nuclear energy, and computing to fuel the development of modern technologies to treat cancer and heart disease, prevent terrorism, and power deep space exploration.

Pacific Northwest Lab advances scientific discovery and creates solutions to the nation's toughest challenges in energy resiliency and national security by drawing on signature capabilities in chemistry, earth sciences, and data analytics.

National Labs at a Glance

Princeton Plasma Physics Lab scientists and engineers continue its pioneering legacy by providing the highest quality science education to future generations and leading plasma science and technology discoveries to achieve a world powered by safe, clean, and plentiful fusion energy.

Sandia Lab is the engineering arm of the Nation's nuclear weapons enterprise and serves our evolving national security challenges by developing innovative research and technology necessary to keep the U.S. homeland and its armed forces safe. These advanced technologies reliably manage the nuclear stockpile, deter nuclear proliferation, protect critical assets and infrastructure, ensure long-term energy resilience, and reduce global threats posed by nuclear, chemical, biological, and radiological materials.

Savannah River Lab protects the Nation by applying science to the energy economy, global security, and the environment. Its scientists and engineers have advanced energy storage technology, materials science, and nuclear non-proliferation, and offer trusted expertise for environmental cleanup and nuclear materials management.

SLAC Accelerator Lab is credited with discovering fundamental building blocks of matter and creating the first website in North America. Its legacy of extraordinary feat of imagination, brainpower, and collaboration resulted in the world's longest particle accelerator and a unique scientific partnership with Stanford University.

Thomas Jefferson Accelerator Facility is the youngest of the 17 labs and serves as a forefront nuclear physics research facility to an international scientific user community. At the Jefferson Lab, scientists explore the building blocks of atoms, apply advanced accelerator technologies and share knowledge through education and public outreach.

External Advisory Boards

To receive the greatest insights and experience from academia, industry and state and local governments, the Department of Energy engages external advisory boards that meet regularly in public forums to consult and advise the DOE through the following advisory committees:

Office of the Secretary
- Secretary of Energy Advisory Board (SEAB)

Office of Science
- Advanced Scientific Computing Advisory Committee (ASCAC)
- Basic Energy Science Advisory Committee (BESAC)
- Biological and Environmental Research Advisory Committee (BERAC)
- Fusion Energy Sciences Advisory Committee (FESAC)
- High Energy Physics Advisory Panel (HEPAP)
- National Quantum Initiative Advisory Committee (NQIAC)
- Nuclear Science Advisory Committee (NSAC)
- President's Council of Advisors on Science and Technology (PCAST)

Environmental Management
- Environmental Management Advisory Board (EMAB)
- Environmental Management Site-Specific Advisory Board (EMSSAB)

Energy Efficiency and Renewable Energy
- Appliance Standards and Rulemaking Advisory Committee (ASRAC)
- Biomass Research and Development Advisory Committee (BIOAC)
- Hydrogen and Fuel Cell Technical Advisory Committee (HTAC)
- State Energy Advisory Board (STEAB)

Electric Energy
- Electricity Advisory Committee (EAC)

Fossil Energy
- National Coal Council (NCC)
- National Petroleum Council (NPC)
- Methane Hydrate Advisory Committee (MHAC)

Nuclear Energy
- Nuclear Energy Advisory Committee (NEAC)

National Nuclear Security Agency
- Defense Programs Advisory Committee (DPAC)