WORLD-CLASS FACILITY

Start of Operations: yyyy

Location: xxxx

<Facility description here; 150 words or fewer>

Link: Link here

BROOKHAVEN GRAPHITE RESEARCH REACTOR (BGRR)

Start of Operations: 1950[1]

Location: Brookhaven National Laboratory, Upton, New York[2]

The Brookhaven Graphite Research Reactor (BGRR) was the world's first reactor built solely to perform scientific research on peaceful uses of the atom.[3] The reactor's primary mission was to produce neutrons for scientific experimentation and to refine reactor technology. At the time, the BGRR could accommodate more simultaneous experiments than any other reactor.[4]

Researchers used the BGRR's neutrons as tools for studying atomic nuclei and the structure of solids, and to investigate many physical, chemical and biological systems. Scientists also studied the effects of radiation on materials. An estimated 25,000 irradiations were performed over the reactor's lifetime, on specimens ranging from seeds to art treasures. "Loop" experiments were another important area of research, in which measurements were made of the radiation-induced changes in the properties of liquids and gases as they flowed through the reactor. Radioactive isotopes produced at the BGRR were especially useful in medical diagnosis and therapy and in industrial technology.[5]

Link: https://www.bnl.gov/bgrr/

---

[1] From *Brookhaven Graphite Research Reactor*, Brookhaven National Laboratory, https://www.bnl.gov/bgrr/
[2] From *Brookhaven Graphite Research Reactor*, Brookhaven National Laboratory, https://www.bnl.gov/bgrr/
[3] From *Brookhaven Graphite Research Reactor*, Brookhaven National Laboratory, https://www.bnl.gov/bgrr/
[4] From *Our History: Reactors as Research Tools*, Brookhaven National Laboratory, https://www.bnl.gov/about/history/reactors.php
[5] From *Our History: Reactors as Research Tools*, Brookhaven National Laboratory, https://www.bnl.gov/about/history/reactors.php

SHIELDED CELLS FACILITY

Start of Operations: 1952 (First Cell Block)[6]

Location: Savannah River National Laboratory, Aiken, South Carolina[7]

The Savannah River National Laboratory's Shielded Cells Facility provides the ability to safely work with a wide variety of highly radioactive materials in support of nuclear technology development. Skilled operators are able to safely remain outside the cells and use manipulator arms to securely perform complex tasks inside the concealed environment. These manipulator arms are specially designed to handle the most delicate of tasks and endure harsh exposure to high level radiation. The SRNL Shielded Cells Facility includes the largest collection of cells with this type capability in the country.

The Shielded Cells Facility consists of sixteen 6x6-foot work stations, or cells, featuring 3-foot thick exterior walls and cell shielding windows, with the capability to handle material up to 10,000 rem/hour. The cells include specialized equipment for a variety of analytical and research tasks, including rheology studies, destructive examination, and gas analysis. The facility actively supports DOE Environmental Management missions.[8]

Link: https://www.srnl.gov/fact-sheets/srnl-shielded-cell-facility/

---

[6] From *Advanced Post-Irradiation Examination Capabilities Alternatives Analysis Report*, Idaho National Laboratory, 2012, https://inldigitallibrary.inl.gov/sites/sti/sti/5561102.pdf

[7] From *SRNL Shielded Cell Facility*, Savannah River National Laboratory, https://www.srnl.gov/fact-sheets/srnl-shielded-cell-facility/

[8] From *SRNL Shielded Cell Facility*, Savannah River National Laboratory, https://www.srnl.gov/fact-sheets/srnl-shielded-cell-facility/

BEVATRON

***Start of Operations: 1954*[9]**

Location: Lawrence Berkeley National Laboratory, Berkeley, California[10]

For nearly 40 years, the Bevatron was among the largest and highest-energy particle accelerators in the world.[11] The accelerator made major contributions in four distinct areas of research: high-energy particle physics, nuclear heavy-ion physics, medical research and therapy, and space-related studies of radiation damage and heavy particles in space.[12]

The antiproton was discovered at the Bevatron in 1955, resulting in the 1959 Nobel Prize in Physics for Emilio Segrè and Owen Chamberlain. Donald Glaser received the Nobel Prize in Physics in 1960 for the invention of the Bubble Chamber which was used at the Bevatron. Luis Alvarez received the Nobel Prize in Physics in 1968 for his work with bubble chambers at the Bevatron.[13] The site of the former Bevatron has since been designated a historic site by the American Physical Society (APS) for its exemplary contributions to physics.[14]

Link: https://photostories.lbl.gov/the-bevatron

---

[9] From *Bevatron Site Recognized for Historical Contributions to Physics*, Lawrence Berkeley National Laboratory, 2021, https://newscenter.lbl.gov/2021/06/25/bevatron-contributions-to-physics/
[10] From *Bevatron Site Recognized for Historical Contributions to Physics*, Lawrence Berkeley National Laboratory, 2021, https://newscenter.lbl.gov/2021/06/25/bevatron-contributions-to-physics/
[11] From *Bevatron Site Recognized for Historical Contributions to Physics*, Lawrence Berkeley National Laboratory, 2021, https://newscenter.lbl.gov/2021/06/25/bevatron-contributions-to-physics/
[12] From *The Bevatron: 40 Years of Science*, Lawrence Berkeley National Laboratory, https://photostories.lbl.gov/the-bevatron
[13] From *The Bevatron: 40 Years of Science*, Lawrence Berkeley National Laboratory, https://photostories.lbl.gov/the-bevatron
[14] From *Bevatron Site Recognized for Historical Contributions to Physics*, Lawrence Berkeley National Laboratory, 2021, https://newscenter.lbl.gov/2021/06/25/bevatron-contributions-to-physics/

EXPERIMENTAL BOILING WATER REACTOR (EBWR)

Start of Operations: 1956 [15]

Location: Argonne National Laboratory, Lemont, Illinois [16]

In 1952, Argonne engineer Samuel Untermyer suggested that direct boiling reactors might be practical, ultimately leading Argonne to build a series of experimental boiling water reactors in Idaho. Using the results of these experiments, Argonne then built a prototype boiling water reactor power plant, the Experimental Boiling Water Reactor (EBWR), at its Illinois site. Operations with EBWR proved that a direct cycle boiling water reactor system could operate, even at power levels five times its rated heat output, without serious radioactive contamination of the steam turbine.

EBWR operated with a range of fuels, plates and rods, and various uranium enrichments before using a largely plutonium core, and provided valuable information on plutonium recycle operation of water reactors. When closed in 1967, EBWR had established a reputation as the forerunner of many commercial nuclear energy plants. One of those is the Commonwealth Edison facility at Dresden, IL, which in 1960 became the first privately operated nuclear energy plant. [17]

Link: https://www.ne.anl.gov/About/reactors/lwr3.shtml

---

[15] From *Argonne's Major Nuclear Energy Milestones*, Argonne National Laboratory, https://www.anl.gov/nse/argonnes-major-nuclear-energy-milestones

[16] From *Argonne's Major Nuclear Energy Milestones*, Argonne National Laboratory, https://www.anl.gov/nse/argonnes-major-nuclear-energy-milestones

[17] From *Reactors Designed by Argonne National Laboratory*, Argonne National Laboratory, https://www.ne.anl.gov/About/reactors/lwr3.shtml

ALTERNATING GRADIENT SYNCHOTRON (AGS)

Start of Operations: 1960[18]

Location: Brookhaven National Laboratory, Upton, New York[19]

The Alternating Gradient Synchrotron (AGS) was built on the innovative concept of the alternating gradient, or strong-focusing, principle, was developed by Brookhaven physicists in the 1950s. This breakthrough concept in accelerator design allowed scientists to accelerate protons to energies that would have been otherwise unachievable. The AGS became the world's premiere accelerator when it reached its design energy of 33 billion electron volts (GeV) in July of 1960.

Until 1968, the AGS was the highest energy accelerator in the world. AGS discoveries earned researchers three Nobel Prizes (for the muon-neutrino, a symmetry-breaking called CP violation and the J/psi particle) and today it still serves as the injector for Brookhaven's Relativistic Heavy Ion Collider. It also remains the world's highest intensity high-energy proton accelerator. The AGS and its accompanying Booster accelerator are the only U.S. heavy ion accelerators suitable for simulating the biological effects of space radiation.[20]

Link: https://www.bnl.gov/about/history/accelerators.php

---

[18] From *A History of Leadership in Particle Accelerator Design*, Brookhaven National Laboratory, https://www.bnl.gov/about/history/accelerators.php
[19] From *A History of Leadership in Particle Accelerator Design*, Brookhaven National Laboratory, https://www.bnl.gov/about/history/accelerators.php
[20] From *A History of Leadership in Particle Accelerator Design*, Brookhaven National Laboratory, https://www.bnl.gov/about/history/accelerators.php

HIGH FLUX ISOTOPE REACTOR (HFIR)

Start of Operations: 1966[21]

Location: Oak Ridge National Laboratory, Oak Ridge, Tennessee[22]

The High Flux Isotope Reactor (HFIR) is a light-water cooled and moderated research reactor that began full-power operations in 1966 at the design power level of 100 megawatts. Currently, HFIR operates at 85 megawatts to provide state-of-the-art facilities for neutron scattering, materials irradiation, and neutron activation analysis and is the world's leading source of elements heavier than plutonium for research, medicine, and industrial applications. The neutron-scattering instruments installed on the four horizontal beam tubes are used in fundamental studies of materials of interest to solid-state physicists, chemists, biologists, polymer scientists, and materials scientists.

Recently, a number of improvements at HFIR have increased its neutron scattering capabilities to 14 state-of-the-art neutron scattering instruments. These upgrades include the installation of larger beam tubes and shutters, a high-performance liquid hydrogen cold source, and a cold-neutron guide system. The installation of the cold source provides beams of cold neutrons for scattering research that are as bright as any in the world.[23]

Link: https://neutrons.ornl.gov/hfir

---

[21] From *Office of Science User Facilities: High Flux Isotope Reactor,* Department of Energy, https://science.osti.gov/bes/suf/User-Facilities/Neutron-Scattering-Facilities/HFIR
[22] From *Office of Science User Facilities: High Flux Isotope Reactor,* Department of Energy, https://science.osti.gov/bes/suf/User-Facilities/Neutron-Scattering-Facilities/HFIR
[23] From *Office of Science User Facilities: High Flux Isotope Reactor,* Department of Energy, https://science.osti.gov/bes/suf/User-Facilities/Neutron-Scattering-Facilities/HFIR

ADVANCED TEST REACTOR (ATR)

Start of Operations: 1967[24]

Location: Idaho National Laboratory, Idaho Falls, Idaho[25]

The Advanced Test Reactor (ATR) is the only U.S. research reactor capable of providing large-volume, high-flux thermal neutron irradiation in a prototype environment. The reactor's singular design makes it possible to study the effects of intense neutron and gamma radiation on reactor materials and fuels. ATR is a one-of-a-kind pressurized water test reactor. As a test reactor, it operates at very low pressures and temperatures compared to a large commercial nuclear power plant. Instead of heat, the main product of a test reactor is the neutrons it produces; ATR uses a beryllium reflector to help concentrate neutrons in the core.

Over the years, ATR has provided vital irradiation testing capability supporting the U.S. Navy's nuclear propulsion program. Testing at ATR also supports reactor research around the world to extend the life of current nuclear power plants, develop designs for advanced reactors, and test new types of stronger nuclear fuels that reduce waste generation and proliferation risks.[26]

Link: https://inl.gov/advanced-test-reactor/

---

[24] From *Advanced Test Reactor*, Idaho National Laboratory, https://inl.gov/advanced-test-reactor/
[25] From *Advanced Test Reactor*, Idaho National Laboratory, https://inl.gov/advanced-test-reactor/
[26] From *Advanced Test Reactor*, Idaho National Laboratory, https://inl.gov/advanced-test-reactor/

MAIN RING

Start of Operations: 1972[27]

Location: Fermi National Accelerator Laboratory, Batavia, Illinois [28]

Fermilab began operations in Illinois in 1967, built on 6,800 acres of land near the town of Batavia, Illinois. Fermilab's first big machine was a particle accelerator about four miles in circumference called the Main Ring.[29] Physicist Robert Wilson, Fermilab's founding director, broke ground for the Main Ring in 1969. The first beam of 200-billion-electron-volt protons circled its four-mile circumference in 1972, and the Main Ring reached its operating energy of 400 billion electron volts later that year.[30]

In 1977, physicist Leon Lederman used the accelerator's particle beams in experiments that revealed the bottom quark, the first quark of the third generation of elementary particles that are nature's ultimate building blocks. From 1983 to 1997, the Main Ring served as an injector to the Tevatron collider, where in 1995, physicists discovered the bottom quark's partner, the top quark, in collisions between protons and antiprotons, their antimatter counterparts.[31]

Link: https://history.fnal.gov/historical/accelerator/main_ring_farewell_forever.html

---

[27] From *'Hail and Farewell' to Historic Main Ring at Fermilab, Batavia, IL,* Fermi National Accelerator Laboratory, 1997, https://news.fnal.gov/1997/09/hail-farewell-historic-main-ring-fermilab-batavia-il/

[28] From *'Hail and Farewell' to Historic Main Ring at Fermilab, Batavia, IL,* Fermi National Accelerator Laboratory, 1997, https://news.fnal.gov/1997/09/hail-farewell-historic-main-ring-fermilab-batavia-il/

[29] From *The Birth of Fermilab*, Fermi National Accelerator Laboratory, 2017, https://news.fnal.gov/2017/01/the-birth-of-fermilab/

[30] From *'Hail and Farewell' to Historic Main Ring at Fermilab, Batavia, IL,* Fermi National Accelerator Laboratory, 1997, https://news.fnal.gov/1997/09/hail-farewell-historic-main-ring-fermilab-batavia-il/

[31] From *'Hail and Farewell' to Historic Main Ring at Fermilab, Batavia, IL,* Fermi National Accelerator Laboratory, 1997, https://news.fnal.gov/1997/09/hail-farewell-historic-main-ring-fermilab-batavia-il/

STANFORD SYNCHOTRON RADIATION LIGHT SOURCE (SSRL)

Start of Operations: 1974[32]

Location: SLAC National Accelerator Laboratory, Menlo Park, California[33]

The Stanford Synchrotron Radiation Lightsource (SSRL) was built in 1974 to make use of the intense x-ray beams from the Stanford Positron Electron Asymmetric Ring (SPEAR) that was built for particle physics. The SPEAR 3 upgrade, completed in 2008, provided major improvements that increased the brightness of the ring for all experimental stations. A research program is conducted at SSRL with emphasis in both the x-ray and ultraviolet regions of the spectrum.

SSRL offers intense x-ray radiation that allows the development of new instrumentation over such as x-ray microscopy and scientific applications in important areas of nanoscience. More generally, it will become increasingly important in the future to create micro- or nano- sized x-ray beams with high-intensity, well defined polarization and time structure. Such studies promise unique insight into materials such as: (1) materials under extreme conditions; (2) materials that exhibit nanoscale dynamics; (3) artificial nanostructures; and (4) biological crystals which only exist on the microscale. [34]

Link: https://www-ssrl.slac.stanford.edu/content/about-ssrl/about-stanford-synchrotron-radiation-lightsource

---

[32] From *Office of Science User Facilities: Stanford Synchotron Radiation Light Source,* Department of Energy, https://science.osti.gov/bes/suf/User-Facilities/X-Ray-Light-Sources/SSRL

[33] From *Office of Science User Facilities: Stanford Synchotron Radiation Light Source,* Department of Energy, https://science.osti.gov/bes/suf/User-Facilities/X-Ray-Light-Sources/SSRL

[34] From *Office of Science User Facilities: Stanford Synchotron Radiation Light Source,* Department of Energy, https://science.osti.gov/bes/suf/User-Facilities/X-Ray-Light-Sources/SSRL

PLUTONIUM FACILITY BUILDING 4 (PF-4)

Start of Operations: 1978[35]

Location: Los Alamos National Laboratory, Los Alamos, New Mexico[36]

Since the Manhattan Project, Los Alamos has been involved in the manufacture of plutonium pits. These pits form the cores of nuclear weapons; a compressed pit generates a nuclear explosion. Los Alamos produced the first plutonium pits in 1945. At the direction of the National Nuclear Security Administration, the Laboratory is ramping up its pit production capability to be able to manufacture at least 30 pits per year by 2030.

Plutonium Facility Building 4 (PF-4) is the only plutonium facility in the nation currently capable of producing plutonium pits. Although the facility was initially established for plutonium research and development purposes, in 2003, PF-4 produced the nation's first war reserve pit since the closure of the Rocky Flats plant in 1992. From 2007 to 2011, 31 pits for W88 warheads were manufactured at PF-4. PF-4 is being renovated to handle the increase in production work necessary to produce 30 pits per year.[37]

Link: https://discover.lanl.gov/publications/national-security-science/2023-summer/plutonium-infrastructure/

---

[35] From *Plutonium Infrastructure*, National Security Science, Los Alamos National Laboratory, 2023, https://discover.lanl.gov/publications/national-security-science/2023-summer/plutonium-infrastructure/
[36] From *Plutonium Infrastructure*, National Security Science, Los Alamos National Laboratory, 2023, https://discover.lanl.gov/publications/national-security-science/2023-summer/plutonium-infrastructure/
[37] *Plutonium Infrastructure*, National Security Science, Los Alamos National Laboratory, 2023, https://discover.lanl.gov/publications/national-security-science/2023-summer/plutonium-infrastructure/

TOKAMAK FUSION TEST REACTOR (TFTR)

Start of Operations: 1982[38]

Location: Princeton Plasma Physics Laboratory, Princeton, New Jersey[39]

The Tokamak Fusion Test Reactor (TFTR) operated at the Princeton Plasma Physics Laboratory (PPPL) from 1982 to 1997. TFTR set a number of world records, including a plasma temperature of 510 million degrees centigrade -- the highest ever produced in a laboratory, and well beyond the 100 million degrees required for commercial fusion.

In 1993, TFTR became the world's first magnetic fusion device to perform extensive experiments with plasmas composed of 50/50 deuterium/tritium -- the fuel mix required for practical fusion power production. Consequently, in 1994, TFTR produced a world-record 10.7 million watts of controlled fusion power, enough to meet the needs of more than 3,000 homes. These experiments also emphasized studies of behavior of alpha particles produced in the deuterium-tritium reactions. The extent to which the alpha particles pass their energy to the plasma is critical to the eventual attainment of sustained fusion.[40]

Link: https://www.pppl.gov/tokamak-fusion-test-reactor

---

[38] From *Tokamak Fusion Test Reactor,* Princeton Plasma Physics Laboratory, https://www.pppl.gov/tokamak-fusion-test-reactor

[39] From *Tokamak Fusion Test Reactor,* Princeton Plasma Physics Laboratory, https://www.pppl.gov/tokamak-fusion-test-reactor

[40] From *Tokamak Fusion Test Reactor,* Princeton Plasma Physics Laboratory, https://www.pppl.gov/tokamak-fusion-test-reactor

TEVATRON

***Start of Operations: 1983*[41]**

Location: Fermi National Accelerator Laboratory, Batavia, Illinois[42]

For 25 years, the Tevatron was the world's most powerful particle collider.[43] It accelerated beams of protons and antiprotons to 99.999954 percent of the speed of light around a four-mile circumference. The two beams collided at the centers of two 5,000-ton detectors positioned around the beam pipe at two different locations. The collisions reproduced conditions in the early universe and probed the structure of matter at a very small scale.[44]

The Tevatron informed some of the most important fundamental discoveries of our time, such as the existence of the top quark and five baryons, which helped to test and refine the Standard Model of particle physics and shape our understanding of matter, energy, space and time. The Tevatron research program also yielded countless achievements in detector, accelerator and computing technology.[45]

Link: https://www.fnal.gov/pub/tevatron/index.html

---

[41] From *The Tevatron: 28 Years of Discovery and Innovation*, Fermi National Accelerator Laboratory, https://www.fnal.gov/pub/tevatron/

[42] From *The Tevatron: 28 Years of Discovery and Innovation*, Fermi National Accelerator Laboratory, https://www.fnal.gov/pub/tevatron/

[43] From *Alvin Tollestrup, National Medal of Technology Winner, Dies at Age 95*, Fermi National Accelerator Laboratory, 2020, https://history.fnal.gov/historical/people/tollestrup_dies.html

[44] From *The Tevatron: 28 Years of Discovery and Innovation: Accelerator*, Fermi National Accelerator Laboratory, https://www.fnal.gov/pub/tevatron/tevatron-accelerator.html

[45] From *The Tevatron: 28 Years of Discovery and Innovation*, Fermi National Accelerator Laboratory, https://www.fnal.gov/pub/tevatron/

SATURN ACCELERATOR

Start of Operations: 1987 [46]

Location: Sandia National Laboratories, Albuquerque, New Mexico [47]

The Saturn accelerator is a modular, high-power, variable-spectrum, x-ray simulation source.[48] Its major function is to produce X-rays to test the effectiveness of countermeasures used to protect electronics and other materials against X-ray radiation from nuclear weapons. The machine, used broadly as a physics research testbed, provides data that can be used either directly or as input for computer simulations, and it can fire twice a day.

In 1990, in what proved to be one of Saturn's most high-profile endeavors, it hosted its first wire-array tests, which pulsed millions of amperes in nanoseconds through a number of wires each thinner than a human hair. The success of these tests led to installation of wire-array hardware on the larger Z machine at Sandia, with gains in X-ray output that astonished the world and led to Z's consideration as a potentially reliable way to create electricity essentially from seawater, the world's largest natural resource.[49]

Link: https://www.sandia.gov/pulsed-power/research-facilities/saturn-and-hermes/

---

[46] From *Big Machines: Two Radiation Generators Mark Major Milestones in Helping Protect the US*, Sandia National Laboratories, 2011, https://newsreleases.sandia.gov/saturn-hermes/

[47] From *Big Machines: Two Radiation Generators Mark Major Milestones in Helping Protect the US*, Sandia National Laboratories, 2011, https://newsreleases.sandia.gov/saturn-hermes/

[48] From *Saturn and HERMES III Accelerators*, Sandia National Laboratories, https://www.sandia.gov/pulsed-power/research-facilities/saturn-and-hermes/

[49] From *Big Machines: Two Radiation Generators Mark Major Milestones in Helping Protect the US*, Sandia National Laboratories, 2011, https://newsreleases.sandia.gov/saturn-hermes/

HIGH EXPLOSIVES APPLICATIONS FACILITY (HEAF)

Start of Operations: 1989[50]

Location: Lawrence Livermore National Laboratory, Livermore, California[51]

The High Explosives Applications Facility (HEAF) is a National Nuclear Security Administration Center of Excellence for the research, development, synthesis, formulation, and characterization of explosives. HEAF is a unique facility capable of executing the full breadth and depth of explosive and energetic material research and development. Research activities in HEAF support the development of new explosives through synthesis and formulation laboratories, explosives properties testing, additive manufacturing of explosives, advanced diagnostics development, experiments for basic research, a microdetonics laboratory for studies at the micrometer scale, and multiple firing tanks for explosives testing at larger scales.

HEAF has seven large fully contained firing tanks for testing explosive quantities from less than 1 gram up to 10 kilograms (22 pounds). The facility also has a 100-mm propellant-driven gun capable of firing projectiles at up to 2,500 meters per second and a two-stage, light gas gun capable of firing projectiles at 5,500 meters per second.[52]

Link: https://sd.llnl.gov/facilities/hydrodynamic-explosives-testing/high-explosives-applications-facility

---

[50] From *High Explosives Applications Facility*, Lawrence Livermore National Laboratory, https://sd.llnl.gov/facilities/hydrodynamic-explosives-testing/high-explosives-applications-facility
[51] From *High Explosives Applications Facility*, Lawrence Livermore National Laboratory, https://sd.llnl.gov/facilities/hydrodynamic-explosives-testing/high-explosives-applications-facility
[52] From *Unique Facilities: High Explosives Applications Facility*, Lawrence Livermore National Laboratory, https://st.llnl.gov/research/unique-facilities

SOLAR ENERGY RESEARCH FACILITY (SERF)

Start of Operations: 1993[53]

Location: National Renewable Energy Laboratory, Golden, Colorado[54]

NREL's Solar Energy Research Facility (SERF) is a state-of-the-art research facility for developing technologies that convert sunlight into electricity. SERF houses 42 laboratories where employees pursue research in photovoltaics (PV), superconductivity and related material sciences. Laboratories in SERF's west module are used to develop semiconductor material for high-efficiency crystalline solar cells, labs in the center module are used to fabricate prototype solar cells, and labs in the east module are used to characterize the performance of solar cells made by NREL researchers, industry partners and universities.

SERF was designed and built to use less energy and take advantage of sunlight, and it incorporates energy-saving features that make it one of the government's most energy-efficient buildings. An audit of the building's energy use showed that energy costs for lighting, heating and cooling, and auxiliary power equipment were 51% lower than similar buildings, while total energy costs for the building are 36% lower than the federal standard.[55]

Link: https://www.nrel.gov/pv/solar-energy-research-facility.html

[53] From *NREL's Solar Energy Research Facility... Converting Sunlight into Electricity*, National Renewable Energy Laboratory, https://www.nrel.gov/docs/gen/fy99/24870.pdf

[54] From *NREL's Solar Energy Research Facility... Converting Sunlight into Electricity*, National Renewable Energy Laboratory, https://www.nrel.gov/docs/gen/fy99/24870.pdf

[55] From *NREL's Solar Energy Research Facility... Converting Sunlight into Electricity*, National Renewable Energy Laboratory, https://www.nrel.gov/docs/gen/fy99/24870.pdf

CONTINUOUS ELECTRON BEAM ACCELERATOR FACILITY (CEBAF)

Start of Operations: 1994[56]

Location: Thomas Jefferson National Accelerator Facility, Newport News, Virginia[57]

The Continuous Electron Beam Accelerator Facility (CEBAF) provides high quality beams of polarized electrons that allow scientists to extract information on the quark and gluon structure of protons and neutrons.[58] CEBAF is based on superconducting radiofrequency (SRF) technology, and was the first large-scale application of SRF technology in the world. The CEBAF energy was recently upgraded from 6 GeV to 12 GeV, and an additional experimental area was added to support the highest-energy experiments.[59]

Much of the nature of the visible matter in the universe is determined by the theory known as quantum chromodynamics, or QCD. QCD describes the interactions among quarks and gluons as they exist in composite particles known as hadrons, in the quark-gluon plasma, and inside nuclei. The 12 GeV CEBAF upgrade provides unprecedented capability to illuminate the nature of QCD and the origin of confinement via a quantitative understanding of the internal structure of nucleons. [60]

Link: https://www.jlab.org/accelerator

---

[56] From *Office of Science User Facilities: Continuous Electron Beam Accelerator Facility,* Department of Energy, https://science.osti.gov/np/Facilities/User-Facilities/CEBAF
[57] From *Office of Science User Facilities: Continuous Electron Beam Accelerator Facility,* Department of Energy, https://science.osti.gov/np/Facilities/User-Facilities/CEBAF
[58] From *Office of Science User Facilities: Continuous Electron Beam Accelerator Facility,* Department of Energy, https://science.osti.gov/np/Facilities/User-Facilities/CEBAF
[59] From *Accelerator Science: Advancing Accelerator Science, Technology, and Operations*, Thomas Jefferson National Accelerator Facility, https://www.jlab.org/accelerator
[60] From *Office of Science User Facilities: Continuous Electron Beam Accelerator Facility,* Department of Energy, https://science.osti.gov/np/Facilities/User-Facilities/CEBAF

ADVANCED PHOTON SOURCE (APS)

Start of Operations: 1996[61]

Location: Argonne National Laboratory, Lemont, Illinois[62]

The Advanced Photon Source (APS) is one of only four third-generation, hard x-ray synchrotron radiation light sources. The 1,104-meter circumference facility—large enough to house a baseball park in its center—includes 34 bending magnets and 34 insertion devices, which has a capacity of at least 68 beamlines for experimental research. Instruments on these beamlines attract researchers to study the structure and properties of materials.

The brightness and energy of x-ray beams are critical properties for research. Higher brightness means more x-rays can be focused onto a smaller, laser-like spot, allowing researchers to gather more data in greater detail in less time. Higher energies allow x-rays to penetrate deeper inside materials to reveal crucial information about a material’s structure and function. The combination of high brightness and high energy allows the observation and imaging—in real time—of fast and ultrafast technologically important processes, including fuel sprays, magnetic switching, and biological processes in living organisms.[63]

Link: https://www.aps.anl.gov/About/Welcome

---

[61] From *Office of Science User Facilities: Advanced Photon Source,* Department of Energy, https://science.osti.gov/bes/suf/User-Facilities/X-Ray-Light-Sources/APS
[62] From *Office of Science User Facilities: Advanced Photon Source,* Department of Energy, https://science.osti.gov/bes/suf/User-Facilities/X-Ray-Light-Sources/APS
[63] From *Office of Science User Facilities: Advanced Photon Source,* Department of Energy, https://science.osti.gov/bes/suf/User-Facilities/X-Ray-Light-Sources/APS

ENVIRONMENTAL MOLECULAR SCIENCES LABORATORY (EMSL)

Start of Operations: 1997[64]

Location: Pacific Northwest National Laboratory, Richland, Washington[65]

From microbes to molecules, researchers at the Environmental Molecular Sciences Laboratory (EMSL) use nature as inspiration to address some of the most critical challenges facing our nation and the world—clean and reliable energy, improved carbon storage capabilities, and controlled biological transformation of environmental contaminants. Studying nature at the molecular level provides critical information about the drivers of large-scale environmental functions. Studies of the processes and interdependencies between proteins and other biological molecules help researchers understand how microbes and plants affect soils, watersheds, ecosystems, regional climate, and, ultimately, Earth systems.[66]

EMSL provides the scientific community with a problem-solving environment enabling researchers to use multiple combinations of capabilities to obtain a mechanistic understanding of physical, chemical, and intra- and inter-cellular processes and interactions, and to incorporate this information into numerical models to understand how biological, environmental, atmospheric, and energy systems function at higher spatial- and temporal scales, and to address complex challenges facing DOE and the nation.[67]

Link: https://www.pnnl.gov/environmental-molecular-sciences-laboratory

---

[64] From *Office of Science User Facilities: Environmental Molecular Sciences Laboratory,* Department of Energy, https://science.osti.gov/ber/Facilities/User-Facilities/EMSL
[65] From *Office of Science User Facilities: Environmental Molecular Sciences Laboratory,* Department of Energy, https://science.osti.gov/ber/Facilities/User-Facilities/EMSL
[66] From *Facility: Environmental Molecular Sciences Laboratory*, Pacific Northwest National Laboratory, https://www.pnnl.gov/environmental-molecular-sciences-laboratory
[67] From *Office of Science User Facilities: Environmental Molecular Sciences Laboratory,* Department of Energy, https://science.osti.gov/ber/Facilities/User-Facilities/EMSL

JOINT GENOME INSTITUTE (JGI)

***Start of Operations: 1997*[68]**

Location: Lawrence Berkeley National Laboratory, Berkeley, California[69]

The Joint Genome Institute (JGI) was created in 1997 to unite the expertise and resources in DNA sequencing, informatics, and technology development pioneered at the DOE genome centers to accelerate the completion of its commitment to the Human Genome Project. JGI was the first to publish the sequence analysis of the target chromosomes 5, 16, and 19, in the journal *Nature*. Following this accomplishment, the JGI advanced basic science by sequencing scores of microbial species and model organisms and contributing this information freely to the public databases.

In 2004, the JGI established itself as a national user facility, which has grown to now serve a worldwide community of users – those who apply for JGI resources and are engaged in active projects. The vast majority of JGI proposals are relevant to the DOE science mission areas of bioenergy, global carbon cycling, and biogeochemistry.[70]

Link: https://jgi.doe.gov/about-us/history/

[68] From *History: The Evolution of JGI as a National User Facility*, Joint Genome Institute, Lawrence Berkeley National Laboratory, https://jgi.doe.gov/about-us/history/
[69] From *History: The Evolution of JGI as a National User Facility*, Joint Genome Institute, Lawrence Berkeley National Laboratory, https://jgi.doe.gov/about-us/history/
[70] From *History: The Evolution of JGI as a National User Facility*, Joint Genome Institute, Lawrence Berkeley National Laboratory, https://jgi.doe.gov/about-us/history/

NATIONAL SPHERICAL TORUS EXPERIMENT (NSTX)

Start of Operations: 1999[71]

Location: Princeton Plasma Physics Laboratory, Princeton, New Jersey[72]

The National Spherical Torus Experiment (NSTX) aims to establish the potential of the spherical torus configuration as a means of achieving practical fusion energy. The magnetic field in NSTX forms a plasma that is a torus since there is a hole through the center, but where the outer boundary of the plasma is almost spherical in shape.[73]

Since the facility first came online in 1999[74], it set standards for creating and controlling the superheated and electrically charged gases called plasmas that fuel nuclear fusion and are many times hotter than the 10 million-degree-Centigrade core of the sun.[75] This includes: setting a world record for initiating a 160,000 ampere plasma current; confirming the existence of a long-theorized form of plasma turbulence driven by variation of the electron temperature across the plasma; and achieving a toroidal beta (related to the economics of fusion power production) three times the best achieved in conventional tokamaks.

Link: https://www.pppl.gov/sites/g/files/toruqf286/files/2021-04/NSTX.pdf

---

[71] From *Sixty Years of Progress Toward 'Putting a Star in a Jar,'* Princeton Plasma Physics Laboratory, 2012, https://www.pppl.gov/sites/g/files/toruqf286/files/2021-04/NSTX.pdf
[72] From *Sixty Years of Progress Toward 'Putting a Star in a Jar,'* Princeton Plasma Physics Laboratory, 2012, https://www.pppl.gov/sites/g/files/toruqf286/files/2021-04/NSTX.pdf
[73] From *About NSTX-U*, Princeton Plasma Physics Laboratory, https://sites.google.com/a/pppl.gov/nstx-u/overview
[74] From *PPPL Timeline*, Princeton Plasma Physics Laboratory, https://www.pppl.gov/timeline
[75] From *Sixty Years of Progress Toward 'Putting a Star in a Jar,'* Princeton Plasma Physics Laboratory, 2012, https://www.pppl.gov/sites/g/files/toruqf286/files/2021-04/NSTX.pdf

OAK RIDGE LEADERSHIP COMPUTING FACILITY (OLCF)

***Start of Operations: 2005*[76]**

Location: Oak Ridge National Laboratory, Oak Ridge, Tennessee[77]

The Oak Ridge Leadership Computing Facility (OLCF), in coordination with the Argonne Leadership Computing Facility (ALCF), provides leadership-class supercomputing resources that are orders of magnitude more powerful than the systems typically used for open scientific research. The OLCF began operations in 2005 and was charged with developing an unclassified computing resource 100 times more powerful than the systems of the day. Since then, with regular upgrades, the OLCF continues to deliver the world's most capable computer systems – including Frontier, the world's first exascale computer.[78]

Approximately 500 peer-reviewed research articles based directly upon LCF projects are published annually, including several in high-impact journals.[79] OLCF simulations have improved the safety and performance of nuclear power plants, turbomachinery, and aircraft; accelerated development of new drugs and advanced materials; and informed design of an international fusion reactor. The simulations have explored hurricanes, biofuels, neurodegenerative diseases, and clean combustion for power and propulsion.[80]

Link: https://www.olcf.ornl.gov/about-olcf/overview/

---

[76] From *Office of Science User Facilities: Oak Ridge Leadership Computing Facility,* Department of Energy, https://science.osti.gov/ascr/Facilities/User-Facilities/OLCF
[77] From *Office of Science User Facilities: Oak Ridge Leadership Computing Facility,* Department of Energy, https://science.osti.gov/ascr/Facilities/User-Facilities/OLCF
[78] From *Office of Science User Facilities: Oak Ridge Leadership Computing Facility,* Department of Energy, https://science.osti.gov/ascr/Facilities/User-Facilities/OLCF
[79] From *Office of Science User Facilities: Oak Ridge Leadership Computing Facility,* Department of Energy, https://science.osti.gov/ascr/Facilities/User-Facilities/OLCF
[80] From *About OLCF*, Oak Ridge National Laboratory, https://www.olcf.ornl.gov/about-olcf/overview/

RADIOLOGICAL EVIDENCE EXAMINATION FACILITY (REEF)

***Start of Operations: 2006*[81]**

Location: Savannah River National Laboratory, Aiken, South Carolina[82]

Savannah River National Laboratory is home to the Radiological Evidence Examination Facility (REEF), a ~6,000 sq. ft. radiological/nuclear partner lab for the Federal Bureau of Investigation (FBI) to conduct traditional forensics on evidence containing or suspected of containing radiological and nuclear materials. SRNL uses ISO 17025 accredited methods recognized by the FBI, including sample management and quantitative/qualitative analysis of radioactive samples. The scientific staff has extensive experience and practice in analyzing diverse radioactive/SNM material.

SRNL provides casework support and hosts local, national, and international training exercises for the FBI Hazardous Evidence Analysis Team (HEAT). Capabilities of HEAT include: Trace Evidence, DNA, Explosives, Firearms, Tool Marks, Latent Print, Questioned Documents, Computer Analysis Response Team, and Forensic Imaging. The Mobile Digital Radiography Isotope Identification System (MoDRIIS), funded by the FBI, is also located at SRNL and provides the capability to examine and confirm shipping container content for potential hazards and nuclear material content.[83]

Link: https://www.srnl.gov/fact-sheets/radiological-evidence-examination-facility-reef/

---

[81] From *FBI and Savannah River National Laboratory Put Science to Work to Protect the Nation*, Federal Bureau of Investigation, 2010, https://archives.fbi.gov/archives/news/pressrel/press-releases/fbi-and-savannah-river-national-laboratory-put-science-to-work-to-protect-the-nation

[82] From *Radiological Evidence Examination Facility (REEF) Factsheet*, Savannah River National Laboratory, https://www.srnl.gov/fact-sheets/radiological-evidence-examination-facility-reef/

[83] From *Radiological Evidence Examination Facility (REEF) Factsheet*, Savannah River National Laboratory, https://www.srnl.gov/fact-sheets/radiological-evidence-examination-facility-reef/

MICROSYSTEMS ENGINEERING, SCIENCE AND APPLICATIONS (MESA)

Start of Operations: 2007[84]

Location: Sandia National Laboratories, Albuquerque, New Mexico[85]

The Microsystems Engineering, Science and Applications (MESA) Complex represents the essential facilities and equipment to design, develop, manufacture, integrate, and qualify microsystems for national security needs that cannot or should not be made in industry— either because the low volumes required for these applications are not profitable for the private sector, or because of stringent security requirements for high-consequence systems.

Microsystems extend the information processing capabilities of silicon integrated circuits to add functions such as sensing, actuation, and communication—all integrated within a single package. The MESA Complex integrates the scientific, engineering, and computational disciplines necessary to produce functional, robust, integrated microsystems. MESA combines silicon processing, packaging and integration, and fabrication of compound-semiconductor devices under one roof. This suite of facilities encompasses approximately 400,000 square feet and includes cleanroom facilities, laboratories, and offices.[86]

Link: https://www.sandia.gov/mesa/home-of-the-mesa-complex/

---

[84] From *TourSandia: Microsystems Engineering, Science, and Applications*, Sandia National Laboratories, https://tours.sandia.gov/mesa_info.html

[85] From *Microsystems Engineering, Science and Applications (MESA) Makes it Real*, Sandia National Laboratories, https://www.sandia.gov/mesa/home-of-the-mesa-complex/

[86] From *Microsystems Engineering, Science and Applications (MESA) Makes it Real*, Sandia National Laboratories, https://www.sandia.gov/mesa/home-of-the-mesa-complex/

NATIONAL IGNITION FACILITY (NIF)

***Start of Operations: 2009*[87]**

Location: Lawrence Livermore National Laboratory, Livermore, California[88]

The National Ignition Facility (NIF) is the world's highest-energy laser. NIF's 192 powerful laser beams, housed in a 10-story building the size of 3 football fields, can deliver more than 2 million joules of ultraviolet laser energy in billionth-of-a-second pulses onto a target about the size of a pencil eraser.[89] NIF generates temperatures in the target of more than 180 million degrees Fahrenheit and pressures of more than 100 billion Earth atmospheres. Those extreme conditions cause hydrogen atoms in the target to fuse and release energy in a controlled thermonuclear reaction.[90]

NIF scientists conduct experiments necessary to ensure America's nuclear weapons stockpile remains safe, secure, and reliable without underground testing. NIF also provides unique experimental opportunities to enhance our understanding of the universe by creating the same states of high-energy-density matter that exist in the centers of planets, stars, and other celestial objects.[91]

Link: https://lasers.llnl.gov/about/what-is-nif

---

[87] From *National Ignition Facility & Photon Science FAQs*, Lawrence Livermore National Laboratory, https://lasers.llnl.gov/about/faqs

[88] From *National Ignition Facility & Photon Science FAQs*, Lawrence Livermore National Laboratory, https://lasers.llnl.gov/about/faqs

[89] From *National Ignition Facility & Photon Science FAQs*, Lawrence Livermore National Laboratory, https://lasers.llnl.gov/about/faqs

[90] From *What is the National Ignition Facility?*, Lawrence Livermore National Laboratory, https://lasers.llnl.gov/about/what-is-nif

[91] From From *National Ignition Facility & Photon Science FAQs*, Lawrence Livermore National Laboratory, https://lasers.llnl.gov/about/faqs

LINAC COHERENT LIGHT SOURCE (LCLS)

Start of Operations: 2010[92]

Location: SLAC National Accelerator Laboratory, Menlo Park, California [93]

The Linac Coherent Light Source (LCLS) is the world's first hard x-ray free electron laser facility. This is a milestone for x-ray user facilities that advances the state-of-the-art from storage-ring-based third generation synchrotron light sources to a Linac-based light source. The LCLS provides laser-like radiation in the x-ray region of the spectrum that is 10 billion times greater in peak power and peak brightness than any existing coherent x-ray light source. [94]

LCLS takes X-ray snapshots of atoms and molecules at work, providing atomic resolution detail on ultrafast timescales to reveal fundamental processes in materials, technology and living things. It delivers 120 X-ray pulses per second, each one lasting just quadrillionths of a second, or femtoseconds - a timescale at which the motion of atoms can be seen and tracked. LCLS snapshots can then be strung together into "molecular movies" that show chemical reactions as they happen. [95]

Link: https://lcls.slac.stanford.edu/

---

[92] From *Office of Science User Facilities: Linac Coherent Light Source (LCLS),* Department of Energy, https://science.osti.gov/bes/suf/User-Facilities/X-Ray-Light-Sources/LCLS
[93] From *Office of Science User Facilities: Linac Coherent Light Source (LCLS),* Department of Energy, https://science.osti.gov/bes/suf/User-Facilities/X-Ray-Light-Sources/LCLS
[94] From *Office of Science User Facilities: Linac Coherent Light Source (LCLS),* Department of Energy, https://science.osti.gov/bes/suf/User-Facilities/X-Ray-Light-Sources/LCLS
[95] From *Linac Coherent Light Source*, SLAC National Accelerator Laboratory, https://lcls.slac.stanford.edu/overview

ENERGY SYSTEMS LABORATORY (ESL)

Start of Operations: 2012[96]

Location: Idaho National Laboratory, Idaho Falls, Idaho[97]

Research at Idaho National Laboratory's Energy Systems Laboratory ranges from laboratory-scale science to full-scale operations. Three related energy system programs use the majority of the space: the Biomass Feedstock National User Facility (BFNUF), Energy Storage and Advanced Vehicles, and Energy Systems Integration.

The BFNUF is a technical leader for developing bioenergy feedstock supply systems, and its flagship Process Development Unit has a modular and reconfigurable design that helps companies find the best way to convert feedstock into fuel. The Energy Storage group plays an important role in developing advanced batteries, including a Battery Test Center for independent, third-party battery testing, while the Electric Vehicle Infrastructure Laboratory enables collaborations with industry to test charging systems and help establish benchmarks for future technology. The Power and Energy Real-Time Laboratory (PERL) has advanced capabilities for modeling the power grid, including integrating power systems hardware and software into simulations (hardware and controller-in-the-loop).[98]

Link: https://factsheets.inl.gov/FactSheets/EnergySystemsLaboratory.pdf

---

[96] From *Energy Systems Laboratory Factsheet*, Idaho National Laboratory, https://factsheets.inl.gov/FactSheets/EnergySystemsLaboratory.pdf
[97] From *Energy Systems Laboratory Factsheet*, Idaho National Laboratory, https://factsheets.inl.gov/FactSheets/EnergySystemsLaboratory.pdf
[98] From *Energy Systems Laboratory Factsheet*, Idaho National Laboratory, https://factsheets.inl.gov/FactSheets/EnergySystemsLaboratory.pdf

ENERGY SYSTEMS INTEGRATION FACILITY (ESIF)

Start of Operations: 2013[99]

Location: National Renewable Energy Laboratory, Golden, Colorado[100]

The Energy Systems Integration Facility (ESIF) is a first-of-its-kind research user facility that merges three specialized components: an ultra-energy efficient workplace that consumes 74% less energy than the national average for office buildings, one of the world's most energy efficient high performance computing data centers, and sophisticated high-bay laboratory spaces with outdoor test areas. All of the labs in the 182,500-square-foot building are connected by a research electrical distribution bus, which functions as a power integration circuit capable of connecting multiple sources of energy with experiments.[101]

ESIF is a one-of-a-kind testing space that connects appliances, a home, or even a community to an end-to-end energy ecosystem. By incorporating power generation, energy storage, and end loads into the facility, researchers can simulate real-world conditions in a controlled laboratory environment. Work at the ESIF gives manufacturers, utilities, and researchers a more complete picture of a smart energy device or system's performance, leading to improvements in efficiency, safety, and design.[102]

Link: https://www.nrel.gov/esif/about.html

---

[99] From *10 Years of Leading Energy Systems Innovation*, National Renewable Energy Laboratory, 2023, https://www.nrel.gov/news/features/2023/10-years-of-leading-energy-systems-innovation.html
[100] From *10 Years of Leading Energy Systems Innovation*, National Renewable Energy Laboratory, 2023, https://www.nrel.gov/news/features/2023/10-years-of-leading-energy-systems-innovation.html
[101] From *Energy Systems Integration Facility Named Lab of the Year*, National Renewable Energy Laboratory, 2014, https://www.nrel.gov/news/press/2014/10330.html
[102] From *Smart Home and Building Systems*, National Renewable Energy Laboratory, https://www.nrel.gov/esif/smart-home-building-systems.html

SENSITIVE INSTRUMENT FACILITY (SIF)

***Start of Operations: 2016**[103]*

Location: Ames National Laboratory, Ames, Iowa[104]

In cooperation with Iowa State University, Ames National Laboratory's state-of-the-art characterization Sensitive Instrument Facility (SIF) features state-of-the-art electron microscopes housed in a vibration- and static-free environment. This uniquely constructed space enables the study of structure and chemistry at the atomic scale by isolating instruments from thermal, vibration, and electromagnetic interference. Unique details include two-feet thick concrete floors with built-in vibration dampening layers, aluminum-plate lined bays, and fiberglass reinforced concrete for electro-magnetic isolation, and vibration-free heating and ventilation. These features help ensure the instrumentation achieves the highest possible resolution.[105]

The SIF provides a suite of four electron microscopes, sample preparation spaces, control rooms, and staff support space. Sample preparation facilities include dry and wet laboratories equipped for standard metallography preparation for scanning electron microscopy and transmission electron microscopy.[106]

Link: https://sif.ameslab.gov/

---

[103] From *Building Dedication: Sensitive Instrument Facility*, Ames National Laboratory, 2016, https://sif.ameslab.gov/sif-building-dedication

[104] From *Building Dedication: Sensitive Instrument Facility*, Ames National Laboratory, 2016, https://sif.ameslab.gov/sif-building-dedication

[105] From *Sensitive Instrument Facility*, Ames National Laboratory, https://sif.ameslab.gov/

[106] From *Sensitive Instrument Facility: About*, Ames National Laboratory, https://sif.ameslab.gov/about

REACTION ANALYSIS AND CHEMICAL TRANSFORMATION FACILITY (ReACT)

Start of Operations: 2019[107]

Location: National Energy Technology Laboratory, Morgantown, West Virginia [108]

The Reaction Analysis and Chemical Transformation (ReACT) facility supports NETL's energy conversion engineering competency, which includes increasing power cycle efficiency and enabling more power generation for less fuel and fewer emissions. The ReACT facility's capabilities enable researchers to work toward optimizing chemical reactor designs for specific chemical transformations. This includes investigating novel approaches, such as microwaves, to selectively energize chemical reactions. No other known facility in the world has this capability.

The ReACT facility is "fuel flexible" and able to experiment with gaseous hydrocarbon fuels, coal, liquid hydrocarbon fuels, biomass, coal and biomass mixtures, and syngas (a mixture of carbon monoxide, carbon dioxide and hydrogen) under a range of pressures. It features high-speed imaging, thermal imaging and online gas analysis capabilities. The facility builds upon NETL's prior successes in developing novel energy technologies, including chemical looping combustion, direct power extraction, and pressure gain combustion.[109]

Link: https://netl.doe.gov/sites/default/files/rdfactsheet/React%20Flyer.pdf

---

[107] From *NETL Celebrates Facilities to Support Efficient, Affordable Energy Technologies*, National Energy Technology Laboratory, 2019, https://netl.doe.gov/node/8834

[108] From *ReACT (Reaction Analysis & Chemical Transformation) Facility Factsheet*, National Energy Technology Laboratory, https://netl.doe.gov/sites/default/files/rdfactsheet/React%20Flyer.pdf

[109] From *ReACT (Reaction Analysis & Chemical Transformation) Facility Factsheet*, National Energy Technology Laboratory, https://netl.doe.gov/sites/default/files/rdfactsheet/React%20Flyer.pdf

ENERGY SCIENCES CENTER (ESC)

Start of Operations: 2021[110]

Location: Pacific Northwest National Laboratory, Richland, Washington[111]

The Energy Sciences Center opened in 2021 with a goal of helping enable a clean energy future through advances in fundamental chemistry and materials science driving the development of higher-performing, cost-effective catalysts and batteries, and other energy efficiency technologies. The 140,000-square-foot facility features a combination of research laboratories, open spaces, conference rooms, and offices for 200 staff and visitors.[112]

Three of the main laboratories include: a calorimetry laboratory, where instruments track heat transfer over time and help better understand energy production and storage; a film growth laboratory, where solid materials and films are created precisely (down to the atomic level), for applications in solar panels, microelectronics, semiconductors, and quantum computers; and a magnetic resonance laboratory, where instruments use magnetic fields to help design ways to reduce emissions, reuse waste, and remove carbon from the atmosphere.[113]

Link: https://www.pnnl.gov/projects/energy-sciences-center

---

[110] From *PNNL Energy Sciences Center Will Help Realize Clean Energy Future*, Pacific Northwest National Laboratory, 2021, https://www.pnnl.gov/news-media/pnnl-energy-sciences-center-will-help-realize-clean-energy-future
[111] From *PNNL Energy Sciences Center Will Help Realize Clean Energy Future*, Pacific Northwest National Laboratory, 2021, https://www.pnnl.gov/news-media/pnnl-energy-sciences-center-will-help-realize-clean-energy-future
[112] From *PNNL Energy Sciences Center Will Help Realize Clean Energy Future*, Pacific Northwest National Laboratory, 2021, https://www.pnnl.gov/news-media/pnnl-energy-sciences-center-will-help-realize-clean-energy-future
[113] From *ESC Tour: Welcome to the Energy Sciences Center*, Pacific Northwest National Laboratory, https://www.pnnl.gov/projects/energy-sciences-center/tour