Facilities, Equipment and Other Resources

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California State University Bakersfield demonstrates exceptional research capacity for NSF-funded energy systems research through its strategic location in California's premier energy-producing region, transformative infrastructure investments including an $83 million Energy Innovation Building under construction, and a landmark partnership with Lawrence Livermore National Laboratory that positions the institution at the forefront of energy transition research.

Power Systems and Computational Research Laboratories

The Department of Computer and Electrical Engineering and Computer Science maintains comprehensive research facilities across the Science III building and Engineering Complex. The **Power Systems Laboratory**, supervised by Dr. Saeed Jafarzadeh, houses five LabVolt/Festo Didactic electromechanical training systems and a grant-funded home energy production training system that enable sophisticated research in renewable energy integration, microgrid applications, and smart-grid technologies. The facility supports the IS-GREEN (Investigators of Smart-Grid and Renewable Energy for Electric Networks) research group's work on power system dynamic state estimation and energy market stability analysis.

Computational infrastructure includes three dedicated GPU research servers featuring Nvidia Tesla K80, K6000 Quadro, and the latest Tesla V100S with 32GB VRAM, supporting machine learning applications for grid optimization and control systems research. The **Cybersecurity and Isolated Network Laboratory** operates a VMware vSphere server with 48 cores and 256GB RAM in an isolated environment, enabling critical infrastructure security research relevant to grid modernization efforts. Additional specialized facilities include the **Robotics and Advanced Hardware Lab** with National Instruments Elvis II+ platforms and Quanser QNET 2.0 boards for control systems applications, and the **Digital Communications and DSP Lab** equipped with signal generators, analyzers, and software-defined radios for smart grid communications research.

The department maintains redundant gigabit fiber optic connections with all critical servers protected by UPS systems in secure machine rooms. Database servers host comprehensive development environments including LAMP stack, Oracle, MySQL, and PostgreSQL systems. The State Farm Advanced Computing Lab provides 30-inch flat panel monitors with 2560×1600 resolution capability on high-performance graphical workstations, while Unix workstation labs offer 35 Dell T5400 PCs running Linux with specialized software including MATLAB, LabView, and Simulink for power systems modeling.

California Energy Research Center Capabilities

CERC serves as the institutional hub for energy research, established in 2014 with support from Chevron, Edison International, and Aera Energy. The center facilitates interdisciplinary collaboration across engineering, computer science, geological sciences, and chemistry departments. CERC's research portfolio encompasses oil, wind, solar, biofuel industries, carbon management, and energy innovation, with particular emphasis on Kern County's unique position in California's energy

transition.

Advanced analytical capabilities include a **MULTISCALE X-ray nanotomograph SKYSCAN 2211** for non-destructive 3D imaging from macroscale to sub-micron resolution, essential for materials characterization in energy applications. The **Hitachi S-3400 scanning electron microscope** with Oxford Inca EDS and Gitan ChromaCL systems enables detailed analysis of energy materials. A **PANalytical Empyrean X-Ray Diffractometer**, acquired through NSF's Major Research Instrumentation program, supports mineral identification critical for carbon sequestration research. The **Thermo Scientific iCAP RQ Quadrupole ICP-MS** with autosampler provides sub-parts-per-billion detection for environmental monitoring.

The Fab Lab offers digital fabrication capabilities including CNC router, 3D mill and scanner, laser cutter, and electronics workbench for prototype development. Environmental monitoring infrastructure includes an **Eddy Covariance Flux Tower** installed in 2021 for continuous atmospheric CO_2 and water level monitoring, providing valuable climate change research data. The **California Well Sample Repository** houses cores and samples from over 5,000 wells throughout California, representing a unique resource for carbon sequestration and geological energy storage research.

Energy Innovation Building Transforming Research Capacity

The $83 million Energy Innovation Building, with groundbreaking in Fall 2025 and completion anticipated Fall 2027, will provide 38,049 assignable square feet of state-of-the-art research space. **Four collaborative research laboratories** will support interdisciplinary teams working on carbon neutrality and clean energy technologies. The facility will house specialized laboratories for various engineering areas, faculty offices, an event hall for symposiums, business incubator space, and community engagement areas.

This infrastructure investment, approved in California's 2022-2023 state budget, represents the largest single research facility development in CSUB's history. The building will serve as the permanent home for CERC and facilitate unprecedented collaboration between computer and electrical engineering, physics, chemistry, geological sciences, and economics departments. The facility design emphasizes flexibility for evolving research needs and includes provisions for industry partnerships and technology transfer activities.

Strategic Partnerships Amplifying Research Impact

The September 2023 partnership with Lawrence Livermore National Laboratory marks a transformative milestone for CSUB's energy research capabilities. This collaboration focuses on carbon management, geological carbon removal and storage, advanced materials, energy storage and transport, and hydrogen technologies. The partnership includes an inaugural carbon fellows program at LLNL with undergraduate internships, fellowships, and post-doctoral exchanges. CSUB will develop a laboratory modeled after LLNL's Laboratory of Energy Applications for the Future (LEAF), focusing on energy security, infrastructure reliability, and climate resilience.

Regional advantages stem from Kern County's unique position as California's energy capital, producing more renewable power than any other California county with a 50-50 solar-wind split while

maintaining 70% of the state's oil and gas production. This creates unparalleled opportunities for energy transition research. CSUB benefits from proximity to major transmission infrastructure including the **Tehachapi Renewable Transmission Project**, a 173-mile, 4,500 MW capacity system connecting Kern County renewables to Southern California markets. The region hosts the nation's largest wind farm (Alta Wind Energy Center, 1,548 MW) and multiple utility-scale solar projects.

The university maintains strong industry partnerships through CERC with over 30 major energy companies in the region. These relationships facilitate technology transfer, provide access to real-world testing environments, and support student research opportunities. The B3K Prosperity Initiative positions Kern County as a leading energy innovator, with goals for clean energy technology development, carbon management, and renewable fuels innovation at state, national, and international scales.

Faculty Expertise Driving Innovation

Dr. Saeed Jafarzadeh, Professor and Department Chair, leads power systems research with focus on renewable energy integration, smart grid technologies, and Type-2 fuzzy systems. His IS-GREEN research group has successfully secured NSF DUE: IUSE funding and Department of Defense grants for advanced real-time simulators. **Dr. Melissa Danforth** brings extensive machine learning and cybersecurity expertise, managing the Cybersecurity and Networking Research Lab and contributing to NSF Federal Cyber Service programs. **Dr. Anthony Bianchi** specializes in computer vision and machine learning applications, co-leading CERC's "Hyper-Scale Data Centers Powered by Renewable Energies" project that explores data centers as microgrids.

Faculty research spans power electronics, control systems, machine learning applications to grid optimization, carbon sequestration computational modeling, and renewable energy forecasting. The Master of Science in Computer Science program supports thesis research aligned with faculty expertise, producing graduates prepared for advanced energy systems research. Undergraduate research opportunities through CERC, IEEE Student Branch, and annual research symposiums create a robust pipeline of research talent.

Computing and Data Infrastructure

Research computing resources include primary department servers with Intel Xeon processors, up to 192GB RAM, and multi-terabyte storage arrays. The latest GPU server features Intel Xeon Silver 4210R with Nvidia Tesla V100S providing 32GB VRAM for deep learning applications. Cloud computing integration through AWS EC2 instances supplements on-campus resources. VMware vSphere infrastructure enables secure virtualized research environments for grid cybersecurity studies.

Software resources encompass complete Unix/Linux programming toolchains, MATLAB Distributed Computing Server, specialized power systems modeling software, and comprehensive development environments. The campus maintains 24/7 library access to research databases including ScienceDirect, IEEE Xplore, and extensive engineering-specific resources through the Walter W. Stiern Library.

Unique Research Advantages for NSF Proposals

CSUB's location provides a **real-world laboratory for energy transition research**, with immediate access to both traditional and renewable energy infrastructure. The convergence of exceptional solar resources (272 days annual sunshine), wind corridors, existing oil/gas infrastructure for carbon storage, and agricultural integration creates unique research opportunities. The university's position on major transmission corridors enables grid integration studies with real-world validation.

Existing NSF funding relationships demonstrate institutional capacity for federal research management, with successful grants exceeding $1 million for STEM education and retention. The Office of Grants, Research, and Sponsored Programs provides comprehensive pre and post-award support, with CSUB designated as one of 12 CSUs with "Research Colleges and Universities" status.

Conclusion

California State University Bakersfield offers exceptional infrastructure, strategic partnerships, and human capital for NSF-funded energy systems research. The combination of advanced laboratories, the transformative Energy Innovation Building, partnership with Lawrence Livermore National Laboratory, and location in California's energy epicenter creates unparalleled opportunities for impactful research. Faculty expertise spanning power systems, control systems, and machine learning, supported by comprehensive computational resources and industry partnerships, positions CSUB as an ideal partner for advancing national energy research priorities through NSF-funded initiatives. The institution's proven track record of federal funding success and commitment to interdisciplinary collaboration ensures effective project execution and meaningful broader impacts for both regional and national energy challenges.