



U.S. DEPARTMENT *of* ENERGY



Systems Analysis

Strong expertise in systems analysis at the National Energy Technology Laboratory (NETL) advances American innovation by optimizing decision-making for complex, multiscale energy systems. Comprehensive technical and economic analyses allow decision-makers to realize a project's full potential, to pursue high-risk technology developments that support further industrial development, and to deploy commercialized technology solutions. Through divisions directly aligned with NETL's Centers of Excellence (CoE) in Coal, Oil & Gas, Critical Minerals & Advanced Alloys, and Geothermal, NETL's Systems Analysis team supports work across the CoE.



Systems Analysis

Coal

Optimizing efficiencies in the American coal industry

Through a variety of capabilities, this division supports the U.S. Department of Energy's (DOE) and the Coal CoE's goals to modernize, optimize, and grow the American coal industry. Advanced materials system analyses assesses the performance and economic viability of novel materials, driving significant efficiency gains and competitive advantage. Additionally, techno-economic analyses provide the strategic direction necessary to prioritize future notices of funding opportunity and establish benchmarks for validating performance. Finally, optimizing coal waste valorization with artificial intelligence and machine learning (AI/ML) tools unlocks value from legacy and active coal waste piles by identifying pathways to recover valuable critical materials and enabling electricity coproduction.

Oil & Gas

Ensuring abundant oil and natural gas production and secure infrastructure

This division conducts analysis to drive optimization of oil and gas systems, aligning with NETL's Oil & Gas CoE. The division offers robust capabilities: subsurface analysis determines the national resource adequacy through assessment and reservoir analysis; process systems engineering uses advanced optimization to valorize produced water and maximize power cycle efficiency; technoeconomic analysis evaluates performance and cost metrics against project design and prioritizes opportunities for improvement; life cycle analysis quantifies the cradle-to-grave energy and material flows, identifying the return on energy investment; and market analysis tracks global supply chains and commercial demands to align research with industry needs and to specify market opportunities.

Critical Minerals & Advanced Alloys

Catalyzing an affordable, reliable, and secure domestic supply chain

Working with NETL's Critical Minerals & Advanced Alloys CoE, this division conducts analysis to drive innovation and commercialization across domestic critical minerals supply chains. Subsurface analysis leverages advanced imaging and AI/ML to characterize unconventional resources and derisk extraction; process systems engineering uses advanced optimization/simulation, AI/ML, and digital twins to maximize mineral recovery and accelerate the discovery of high-performance alloys with minimum cost; lifecycle analysis quantifies cradle-to-grave material flows and energy use, identifying opportunities to reduce waste and improve efficiency; and market analysis examines the current and potential market landscape, including supply, demand, and domestic import reliance of both raw and embedded material to align research with industry needs and market opportunities.

Geothermal

Unlocking large-scale geothermal energy deployment

This division supports the Geothermal CoE to reduce costs, risks, and barriers by delivering data-driven insights on geothermal scaling and guiding technology innovation to enhance exploration and production. This division takes a multidisciplinary analytical approach spanning subsurface reservoir engineering with AI/ML workflows that map the geometry of underground fractures and identify potential high fluid flow paths. This is integrated with technoeconomic analysis, life cycle analysis, digital twins, and energy markets and infrastructure modeling to quantify how dispatchable geothermal power supports infrastructure modernization, grid reliability, and job creation.



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NETL's systems analysis capabilities are a cornerstone of DOE's strategy to secure the nation's energy future. By providing U.S. industry with comprehensive evaluation of the most complex energy systems from the subprocess to the global scale and the related technical, economic, policy, and resource risks along the value chain, NETL can identify effective R&D investment choices.