BLOCKCHAIN FOR OPTIMIZED SECURITY & ENERGY MANAGEMENT (BLOSEM)

NATIONAL ENERGY TECHNOLOGY LABORATORY

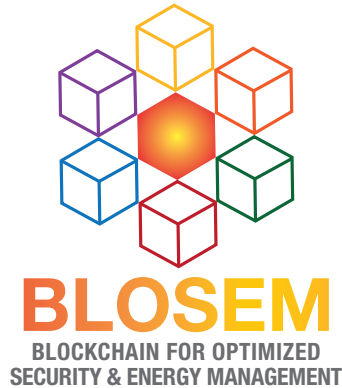**GRID** MODERNIZATION INITIATIVE
U.S. Department of Energy

BLOSEM
BLOCKCHAIN FOR OPTIMIZED SECURITY & ENERGY MANAGEMENT

BLOSEM is an NETL-led U.S. Department of Energy (DOE) project that is sponsored by the Grid Modernization Initiative (GMI) and is co-funded by the Office of Fossil Energy and Carbon Management (lead), the Office of Nuclear Energy, and the Office of Electricity. BLOSEM is a multi-lab collaboration established to test, evaluate, and mature blockchain-based concepts for device security, secure communications, and grid resilience.

PARTNERS

AMES LABORATORY *Creating Materials & Energy Solutions* U.S. DEPARTMENT OF ENERGY

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Pacific Northwest NATIONAL LABORATORY

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RESEARCH OBJECTIVES

Create a first-of-a-kind blockchain-based cybersecurity testing environment that features end-to-end integration including generation (inclusive to all sources), transmission, and distribution

Feature a novel, systems-based approach to evaluating blockchain-based applications by creating tangible metrics and guidance for performance benchmarks

Create a longstanding foundational reference architecture for grid cybersecurity illustrating how blockchain can be used in a meaningful way

## ACCELERATING BLOCKCHAIN TECHNOLOGY DEVELOPMENT

The BLOSEM team is focused on identifying and demonstrating specific use cases that leverage inherent features of blockchain and ledger-based technologies to prevent, detect, and mitigate cyberattacks. Additionally, BLOSEM is using standardized metrics and testing to de-risk and accelerate the deployment of validated cyber-physical security concepts from the laboratory to the utility sector.

INDUSTRY ADVISORS

IBM, Electric Power Research Institute (EPRI), Hitachi America Ltd., Energy Web Foundation (EWF), DERP TECH, Rimation, Inc., Carnegie Mellon University, General Electric, Exelon, SoCal Edison, United States Military Academy (West Point), National Institute of Standards & Technology (NIST), Institute of Electrical and Electronics Engineers (IEEE), and Nevermore Security

PROJECT FACTS

TOTAL FUNDING:	$3.75M ($3M government share; $750K industry cost share)
SPONSORS:	Office of Fossil Energy and Carbon Management Office of Nuclear Energy Office of Electricity
PROJECT PERIOD OF PERFORMANCE:	May 1, 2020 - April 30, 2022
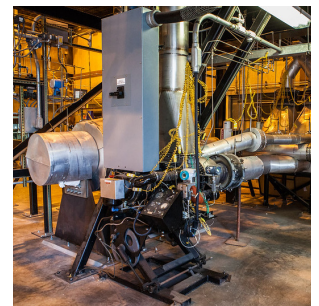
BLOSEM Unified Testing Platform (UTP)

Objectives:

- Enable the ability to rapidly connect blockchain solutions to grid emulation environments
- Decouple the dependencies of grid emulation environments to specific blockchain solutions
- Enable the flow of data and commands in a use case-agnostic manner to enable extensibility to new system configurations
- Build this support into widely used platforms VOLTTRON™ for hardware-in-the-loop and HELICS for co-simulation
- Provide design documentation, software, and a hosting environment for future use case demonstrations

Functionality:

- Connectivity: interfaces for requests and events
- Control and Data Flow: processing and routing of data from source to destination
- Time Synchronization and Management: synchronization of shared data within concurrent environments
- Testing Infrastructure: services for recording and analyzing metrics
- System Automation and Data Orchestration: configuring resources and connections to decrease deployment time

Use Case 1: Supply Chain Security, Life Cycle Monitoring, and Real-Time Auditing

Multi-stakeholder architecture for asset traceability and records of life cycle activities that supports common responsibilities within operations:

- Asset Life Cycle Management (software and hardware)
  - Auditing and Tracking (ordered asset vs receipt)
  - Vulnerability Management
  - Patch and Configuration Management
  - Maintenance and Operations Monitoring
- Cyber Incident Response
- Risk Assessment — operations and remediation

Use Case 2: DER Coordination and Control: Supporting Secure Wholesale Market Participation and Information Exchange with Generation

Architecture supporting distributed energy resources (DER) aggregator participation:

- Demonstrating BLOSEM UTP components
- Facilitating distributed communications architecture across disparate DER owners and energy entities
- Establishing trust anchors with integrity and confidentiality through blockchain
- Initiating flexible access controls and addressing grid constraints
- Addressing tier-bypassing (FERC Order 2222)