

Enabling Secure AI Operations for Critical Energy Infrastructure Through 100% Offline AI with AirgapAI and Intel Core Ultra

Executive Summary

Challenge: A Major Regional Energy Utility operating nuclear power generation and SCADA grid operations needed secure, offline AI capabilities to support operational technology (OT) staff with instant access to procedures, troubleshooting guidance, and asset information—all while meeting stringent NERC CIP critical infrastructure requirements and ensuring zero data exposure outside air-gapped environments.

Solution: Intel and Internal Technologies deployed AirgapAI™ powered by Intel Core Ultra AI PCs with OpenVINO optimization, enabling grid operations personnel to access trusted operational knowledge, query compliance documentation, and reconcile asset data—all while maintaining 100% air-gapped security with no network dependencies.

Results:

- 78x improvement in AI accuracy versus traditional RAG pipelines
- 100% offline operation meeting NERC CIP and nuclear facility security mandates
- Up to 4.9x faster inference and 112x faster first-token latency with OpenVINO

- Instant procedure lookups reducing 15-30 minute manual searches to seconds
- Perpetual licensing model eliminating recurring subscription costs

Technology Stack: Intel Core Ultra 7 with NPU + OpenVINO | Blockify® + AirgapAI™

The Strategic Imperative: AI-Powered Critical Infrastructure Operations

AI is rapidly becoming a strategic asset for energy utilities and critical infrastructure operators. To maintain grid reliability and operational safety, SCADA operations personnel must access the right information, at the right time, in a safe, secure, and trusted manner—while being absolutely certain every insight is factually correct and compliant with NERC CIP, OSHA, and nuclear regulatory requirements.

For a Major Regional Energy Utility managing nuclear power generation and serving millions of electric customers across its service territory, the operational challenge is acute. Grid operations teams work in environments where accurate, fast, and secure data access isn't just nice to have—it's essential for maintaining system reliability and public safety. Every operational decision must reference current procedures, incorporate lessons learned from historical operations, and address regulatory requirements with precision.

Together, Intel and Iternal Technologies have partnered to provide a unique solution that supports this Regional Energy Utility's Operational Technology and SCADA Grid Operations teams via AirgapAI, transforming operational efficiency while maintaining the ironclad data security that critical infrastructure demands.

The Challenge: AI in Air-Gapped Critical Infrastructure Environments

Why Traditional AI Approaches Fall Short

Nuclear facilities and SCADA operations environments present unique challenges for AI deployment that traditional cloud-based solutions simply cannot address:

Regulatory and Security Constraints:

- NERC CIP (Critical Infrastructure Protection) mandates strict controls on data flows
- Nuclear facility operations require complete isolation from external networks
- Zero tolerance for data exfiltration—even encrypted cloud transmission is unacceptable
- Audit requirements demand complete transparency into AI processing

Operational Realities:

- Operations personnel need instant access to procedures during critical situations
- Asset data scattered across spreadsheets, JSON configuration files, and legacy systems
- Time-sensitive decisions cannot wait for cloud latency or connectivity issues
- Remote and isolated environments may have limited or no network connectivity

The Traditional Approach Pain Points:

- Cloud-based AI solutions immediately disqualified due to security requirements
- On-premise AI requires expensive data center infrastructure
- Manual procedure lookups consume 15-30 minutes per query
- Asset reconciliation across disparate systems is error-prone and time-consuming
- Compliance documentation searches delay operational decisions

Without an effective approach to content lifecycle, the organization risks relying on an AI that will never be fully accurate. It's a case of garbage in, garbage out—and if you can't trust your AI to continually be correct, you can't trust it at all because the mistakes are unpredictable.

Why AI Matters for Energy Operations

Beyond simple search and queries, operational technology professionals need AI that can synthesize information from procedures, compliance documentation, and asset databases, generate contextually accurate guidance, and ensure compliance with regulatory standards—all without any network connectivity.

Traditional Process Pain Points:

- Hours spent searching through procedure manuals for specific operational guidance
- Manual reconciliation of asset data across multiple spreadsheets and systems
- Risk of outdated procedures or specifications leading to operational errors
- Inconsistent knowledge access across shifts and locations due to information silos
- Delayed response times during critical operational situations

- Sensitive infrastructure data and configurations requiring strict protection

The energy sector operates under constant scrutiny from regulators, with NERC CIP violations carrying significant penalties. Any AI solution must not only deliver productivity gains but do so while maintaining—or enhancing—the organization's security posture.

The Solution: AirgapAI on Intel Core Ultra AI PCs

Blockify® Data Optimization

Blockify is Iternal's patented data ingestion and optimization system that improves AI accuracy by up to 78x (7,800%). Through a three-pronged approach of ingestion, distillation, and taxonomy creation, Blockify transforms the utility's operational procedures, compliance documentation, and technical specifications into a single source of truth—distilled to just 2.5% of original size while virtually eliminating AI hallucinations.

For this Regional Energy Utility, Blockify processed:

- SCADA operational procedures and troubleshooting guides
- Nuclear facility safety and compliance documentation
- Asset configuration data (including JSON-formatted records)
- Grid operations technical specifications
- Regulatory compliance frameworks and audit requirements
- Historical operational knowledge and lessons learned

AirgapAI™ Edge Inference with Intel Core Ultra + OpenVINO

AirgapAI is a powerful, network-independent AI solution designed to run 100% locally on Intel Core Ultra-equipped AI PCs. By operating completely offline, AirgapAI upholds stringent data-protection standards—no external connection is required, minimizing potential vulnerabilities and ensuring sensitive operational data, asset configurations, and infrastructure information never leaves the organization's control.

Key Capabilities Requested and Delivered:

- **JSON File Support:** Direct ingestion of JSON-formatted asset and configuration data—no conversion required
- **Markdown Support:** Native support for technical documentation formats
- **Local LLM Flexibility:** Ability to use and fine-tune open-source language models
- **Role-Based Access Control:** Integrated permissioning supporting data governance mandates
- **Perpetual Licensing:** One-time purchase model eliminating recurring subscription fees

Benchmark Results

Intel Core Ultra 7 265V (AI PC) Performance

Leveraging Intel Core Ultra 7 265V with OpenVINO optimization, AirgapAI processing achieves up to 4.9x faster inference speed and up to 112x faster

first-token latency compared to generic implementations. The ability to process 4,860 pages of operational content per month demonstrates the capability to start small and scale.

Processing Performance:

- **Total Operational Content Processed:** ~125,000 words (procedures, compliance docs, asset data)
- **Blockify Processing Time:** ~17.4 hours on AI PC (one-time ingestion)
- **Total Optimized Blocks:** ~89 chunks
- **Tokens per Second:** 2.66 tokens/second (AI PC baseline)
- **OpenVINO Optimized:** Up to 34.27 tokens/second with GPU acceleration
- **Vector Search Speed:** 10 million records in <1.5 seconds

Accuracy Improvements: Beyond speed, Blockify's approach increased the precision of vector searches and RAG models, virtually eliminating hallucinations and improving LLM accuracy by approximately 78x (7,800 percent) compared with a traditional RAG pipeline.

Intel OpenVINO Optimization

Intel's OpenVINO toolkit unlocks the true potential of Intel Core Ultra hardware, delivering:

- **Up to 4.9x faster inference speed** compared to generic implementations
- **Up to 112x faster first-token latency** for immediate responsiveness
- **Up to 9.2x higher ingestion throughput** for large document processing

The OpenVINO optimization enables a "Better and Best" dynamic: the Intel NPU delivers efficient, high-performance processing for sustained workloads while preserving battery life, while the integrated GPU provides maximum burst performance for demanding tasks.

The Blockify Workflow

Technical Process for Operational Content

The Blockify workflow steps included:

1. **Chunking the Text:** Source documents (procedures, compliance docs, JSON asset files) divided into smaller content chunks based on a proprietary algorithm. Chunks passed into specially configured LLM, outputting modular blocks with robust taxonomy for reuse.
2. **Embeddings:** Content blocks converted into embeddings (vector representations) capturing unique context and structure, enabling content-aware retrieval within AirgapAI.
3. **Retrieval and Response Generation:** Based on user queries, the system retrieves relevant content from the Context-Aware Retrieval Database for accurate, contextually relevant responses.

Blockify's patented approach creates a single source of truth. Distilling operational content down to 2.5% of the original size allows for easy content lifecycle management and virtually eliminates hallucinations.

Business Use Cases for Energy Operations

Instant Procedure Lookup and Guidance: Enable operations personnel to instantly query operational procedures, troubleshooting guides, and safety protocols—transforming 15-30 minute manual searches into seconds and ensuring critical information is always at hand during operational situations.

Asset Data Reconciliation and Normalization: Ingest and query JSON-formatted asset data, spreadsheets, and configuration files to identify duplicates, normalize entries, and maintain accurate inventories—eliminating hours of manual cross-referencing across disparate systems and file shares.

Compliance Documentation Queries: Provide instant access to NERC CIP requirements, OSHA regulations, and nuclear facility compliance documentation—ensuring operations decisions are made with full regulatory context and reducing audit preparation time.

Shift Handoff and Knowledge Transfer: Generate comprehensive shift briefings and ensure consistent knowledge transfer across operations teams—maintaining operational continuity regardless of personnel changes and eliminating knowledge silos.

Incident Response and Troubleshooting: Surface relevant historical incidents, root cause analyses, and resolution procedures during operational events—accelerating response times and ensuring consistent application of lessons learned.

Technical Specification Retrieval: Enable instant access to equipment specifications, maintenance procedures, and technical documentation—supporting field operations and reducing downtime during maintenance activities.

Security and Compliance: Meeting NERC CIP Requirements

For an organization operating critical energy infrastructure including nuclear generation, data security isn't optional—it's mandated by law and essential to public safety.

AirgapAI's Security Architecture:

- **100% Local Processing:** All AI inference occurs on the Intel Core Ultra AI PC—no data transmission to cloud services

- **Zero Network Dependency:** Operates in fully air-gapped environments as required by nuclear facility security
- **Complete Data Isolation:** Operational procedures, asset configurations, and infrastructure information never leave organizational control
- **NERC CIP Alignment:** Architecture designed to support Critical Infrastructure Protection requirements
- **Audit-Ready Operations:** Complete transparency into AI processing for compliance verification

By operating completely offline, AirgapAI upholds the stringent data-protection standards that critical infrastructure demands—no external connection is required, minimizing potential vulnerabilities and ensuring sensitive information remains strictly private.

Deployment Architecture Options

Phase 1: AI PC Edge Deployment (Current) Individual Intel Core Ultra AI PCs running AirgapAI locally, ideal for:

- Initial deployment and validation
- Individual operator workstations
- Remote or isolated facilities
- Minimal infrastructure requirements

Phase 2: Local Server Enhancement (Future Roadmap) AirgapAI clients connected to local GPU-powered servers for enhanced capability:

- Larger, more powerful language models
- Centralized knowledge management
- Still 100% air-gapped and on-premise
- Services opportunity for deployment partner

Maximizing AI Investment with The AI Strategy Blueprint

Technology alone doesn't guarantee AI success—85% of enterprise AI investments fail to deliver expected results. Iternal enhances its technology deployment with *The AI Strategy Blueprint*, a complete framework for AI transformation written by Iternal's CEO based on seven years of enterprise deployment experience.

The Blueprint addresses the 70% of AI success that depends on people and processes:

- **5x revenue gains** compared to competitors stuck in pilot programs
- **Governance frameworks** that enable speed rather than create barriers
- **Crawl-walk-run deployment strategies** that prove value before scaling risk
- **ROI quantification methodologies** that satisfy CFO scrutiny

This strategic foundation ensures the Energy Utility extracts maximum value from their AirgapAI deployment rather than joining the majority of failed AI initiatives.

Accelerating Adoption with Internal AI Academy

The fastest path to AI ROI is workforce capability. Internal enhances its technology with the AI Academy (edu.internal.ai)—comprehensive AI fluency training that accelerates how quickly operations professionals can leverage AirgapAI:

- **610+ courses** spanning every major industry and job role
- **Three proficiency tiers** - Beginner, Advanced, and Expert tracks
- **Real-time AI feedback** - Prompts scored and critiqued for immediate improvement
- **Verified certificates** - Independently verifiable credentials demonstrating competency
- **Universal application** - Skills transfer to any AI platform

By combining foundational education with interactive practice, AI Academy ensures the operations team can fully leverage their technology investment from day one.

Immediate Productivity with 2,800+ Quick Start Workflows

AirgapAI's technology is enhanced with more than 2,800 pre-configured Quick Start Workflows—enabling operations personnel to achieve immediate productivity gains without a learning curve.

Pre-built workflows for energy operations include:

- Procedure lookup and interpretation assistance
- Compliance documentation Q&A
- Asset data reconciliation and validation
- Incident report drafting and analysis
- Technical specification retrieval
- Shift briefing and handoff preparation

Custom workflow generation: Users can describe their work process in natural language, and AirgapAI automatically creates a custom workflow tailored to their specific needs—no technical expertise required.

These workflows transform AirgapAI from a powerful tool into an immediate productivity multiplier for every member of the operations team.

Cost-Effective AI Deployment

Perpetual Licensing Model

Unlike cloud-based AI solutions with recurring subscription fees, AirgapAI offers a perpetual licensing model that dramatically reduces total cost of ownership:

- **One-Time License Purchase:** No ongoing subscription fees per user or per query
- **No Cloud Costs:** Zero data egress charges, API fees, or usage-based pricing
- **Leverage Existing Hardware:** Runs on standard Intel Core Ultra AI PCs
- **No Mandatory Maintenance Contracts:** Professional services available but not required
- **Predictable Budgeting:** Fixed costs enable accurate long-term planning

Hardware Refresh Opportunity

The deployment of AI-capable workstations creates a natural opportunity to modernize operational technology infrastructure:

- **Strategic Replacement:** Prioritize AI PC deployment for key personnel
 - **Gradual Rollout:** Start with 5-10 core users, expand based on demonstrated value
 - **Dual Benefit:** Productivity gains from AI plus general performance improvements
 - **Future-Proofed:** Hardware capable of supporting evolving AI capabilities
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What This Means for You: Scalable AI Inference for Future Growth

By uniting Intel Core Ultra with OpenVINO optimization—delivering up to 4.9x faster inference and 112x faster first-token latency—and Iternal Technologies' Blockify and AirgapAI, energy utilities can harness AI at the edge, turning decades of operational procedures, compliance documentation, and asset data into actionable insights without ever exposing sensitive information to third-party clouds.

Together, Intel and Iternal help Energy Utilities:

- **Automate Data Ingestion & Curation:** Process operational documentation while slashing inaccuracies with Blockify's 78x accuracy improvement

- **Drive Compliant Operations:** Ensure every AI-generated response respects NERC CIP, OSHA, and nuclear regulatory requirements
- **Accelerate Decision-Making:** Surface trusted answers in seconds with OpenVINO-optimized inference
- **Protect Critical Infrastructure Data:** Keep all operational information within organizational boundaries with 100% offline operation

Enhancing Technology with Complete AI Enablement:

- **Maximize Investment:** The AI Strategy Blueprint ensures your deployment succeeds where 85% of AI initiatives fail
- **Accelerate Adoption:** AI Academy training builds workforce capability for faster time-to-value
- **Immediate Productivity:** 2,800+ Quick Start Workflows eliminate the learning curve for operations teams
- **White-Glove Support:** Optional AI Assist Bundle provides end-to-end deployment services

AI has moved from conceptual to operational in energy utilities. Whether enabling instant procedure lookups, accelerating asset reconciliation, or supporting compliance verification, Intel and Internal deliver the secure, accurate, and scalable framework energy operations teams need to maintain operational excellence and regulatory compliance.

Summary: The Right Solution for Critical Infrastructure AI

Security-First Architecture:

- 100% air-gapped operation with zero network dependencies
- NERC CIP aligned security architecture

- Complete data isolation for nuclear and grid operations environments

Operational Excellence:

- 78x improvement in AI accuracy eliminating hallucinations
- Instant procedure and compliance documentation access
- Streamlined asset data reconciliation and normalization

Cost-Effective Deployment:

- Perpetual licensing model with no recurring fees
- Runs on standard Intel Core Ultra AI PCs
- Scalable from individual users to enterprise deployment

Future-Ready Platform:

- Support for JSON, Markdown, and evolving file formats
- Local server enhancement path for larger models
- Rapid development cycle with continuous feature updates

The Intel AI PC, powered by Internal AirgapAI, delivers exactly what critical infrastructure operations require—secure, accurate, and reliable AI that operates completely offline while maintaining the trust and compliance essential to energy sector operations.