Open AI Energy Initiative

FAQ

Open AI Energy Initiative: Reliability Solutions

1. What is the announcement?

On Feb. 1, 2021, C3 AI, Shell, Baker Hughes, and Microsoft are announcing the launch of the Open AI Energy Initiative (OAI), the first enterprise-class, open ecosystem of AI-based offerings purpose-built for the energy industry.

To start, OAI offers an initial set of reliability solutions including BHC3 Reliability and proven, domain-specific modules from Shell and Baker Hughes to address equipment and process reliability challenges in the energy industry.

The OAI provides a springboard for energy operators, independent software vendors, equipment manufacturers, and service providers to offer additional interoperable solutions including AI and physics-based models, libraries, and data connectors to third parties.

OAI will expand in the future to other areas of the value chain such as process optimization, sustainability, asset integrity, scheduling optimization, and supply chain.

2. Why now?

With the advent of AI, there has been a massive shift in the type, velocity, and volume of data available to produce real-time predictive insights. Today's legacy maintenance and efficiency optimization systems weren't designed to manage the petabytes of external data needed on a daily basis to solve issues such as precision equipment failure detection, precision system anomaly detection, failure mode identification, best mitigation action recommendation, time-to-fail, and severity predictions.

The existing solutions have limited predictive capability, scalability, and interoperability and cannot effectively meet the business demands of the industry, resulting in a significant opportunity to enhance and optimize operations across the energy value chain, from upstream, midstream, and downstream to retail and marketing. OAI is designed to help the industry address these ecosystem challenges by launching an open ecosystem with AI-enabled solutions that have built-in domain knowledge, advanced predictive capabilities, scalability, extendibility, and interoperability.

OAI starts with a set of reliability solutions because equipment and process reliability are a common challenge across the energy value chain and because C3 AI, Shell, and Baker Hughes have a successful history of implementing reliability and predictive maintenance solutions.

3. What problems do OAI and OAI Reliability Solutions solve?

OAI addresses overall energy ecosystem challenges and OAI Reliability Solutions address equipment and process reliability challenges.

The energy value chain has disparate, rules-based, and custom systems and practices that have limited predictive capabilities and scalability. The OAI addresses these ecosystem challenges with an initial set of scalable, flexible, and AI-enabled solutions. The ecosystem pain points and corresponding OAI benefits are:

Issues

OAI Benefits

Fragmented Systems Data in multiple disparate systems	**Unified Systems** One unified data image that supports multiple AI-enhanced applications
Lack of Scalability Not scalable across different processes, equipment types, and operations	**Enterprise Scalability** Scalable AI-based solutions that easily extend to different processes, equipment types, and large fleets
Custom Integrations Expensive integrations that rely on multiple technologies and skillsets	**Full Interoperability** Open, standardized APIs and pluggable interface models that support solutions from operators, independent software vendors, equipment manufacturers, and service providers
Limited Vendor Support Vendors only provide support for their own systems	**End-to-End Support Ecosystem** Baker Hughes and C3 AI ecosystem deploys, implements, integrates, and supports commercial OAI solutions, accelerated by BHC3 Applications and the BHC3 AI Suite
Siloed Domain Expertise No platform or ecosystem for sharing codified SME knowledge	**Integrated Domain-Specific Solutions** Codified, turnkey domain-specific knowledge, tools, and models that directly address specific process and equipment types

OAI starts with an initial set of reliability solutions because equipment and process reliability are a common challenge across the energy value chain. Studies have shown that 92% of all shutdowns and process upsets are unplanned; 40% of these are caused by non-critical equipment despite being monitored by legacy energy industry software. The time- and labor-intensive process to identify and evaluate risks, coupled with the overwhelmingly large number of alerts, make it difficult for operators to prioritize maintenance needs.

At-scale deployment of AI-powered reliability solutions leveraging domain-specific modules is key to unlocking significant economic value in operational savings across the energy industry, eliminating health, safety, and environment issues, and transitioning to net-zero emissions. OAI also creates a springboard for additional AI-enabled solutions from operators, independent software vendors, original equipment manufacturers, and service providers.

4. Is the OAI ecosystem restricted to current partners?

OAI is a broader, open ecosystem that makes it possible for customers and partners to commercially make available domain-specific solutions that run on the BHC3 AI Suite to accelerate adoption of AI-based solutions.

OAI launches an initial set of reliability solutions centered around BHC3 Reliability, but OAI is also a springboard for future energy industry ecosystem launches, including in the areas of process optimization, sustainability, asset integrity, scheduling optimization, and supply chain.

We invite third parties to join the OAI ecosystem.

5. Why are the OAI and OAI Reliability Solutions important?

OAI is a step change for the energy industry. There are several existing classic equipment-specific predictive maintenance solutions, but they focus on specific classes of equipment, involve significant configuration and maintenance manual effort, and do not scale well.

The AI and data aggregation capabilities of the BHC3 AI Suite and BHC3 Reliability, and the domain specific solutions from Shell, Baker Hughes, and others, focus on enterprise and facility-scale deployment of reliability solutions that learn from existing operations to improve overall plant availability and increase operational efficiency.

6. What is BHC3 Reliability?

BHC3 Reliability is the foundation for the unified reliability framework that underpins OAI. BHC3 Reliability is an application that provides reliability, process, and maintenance engineers AI-enabled insights to address process and equipment performance risks.

BHC3 Reliability integrates enterprise-scale data from disparate data sources to identify anomalies across systems, provide prioritized alerts to operators, recommend prescriptive actions, and enable collaboration across the enterprise using machine learning approaches, domain-specific failure mode libraries, pre-defined asset templates, and AI-powered diagram parsing.

7. What type of reliability capabilities do OAI Reliability Solutions provide?

OAI Reliability Solutions augment BHC3 Reliability with domain-specific solutions from energy operators, service providers, equipment providers and independent software vendors to accelerate the delivery of availability and process efficiency improvements.

OAI Reliability Solutions include proven and tested C3 AI-native and C3 AI-pluggable equipment- and process-specific modules with pre-trained AI models, asset and process templates, codified subject matter expertise, low-latency data connectors, thermodynamic and operating parameter libraries, global health monitoring services, deep diagnostics, failure prevention recommendations, and prescriptive actions.

8. What do Shell, Baker Hughes, and Microsoft bring to the OAI?

Shell, Baker Hughes, and Microsoft are the anchor partners in the OAI, and are making reliability modules immediately available.

Shell makes available codified domain knowledge and proven AI-enabled solutions, including:

• Shell Asset Data Lake – Extract and integrate historical and real-time streaming data from PI systems with minimum latency at scale

• Shell Predictive Maintenance Rotating Equipment – Monitor the health of compressors, dry seal gas and pumps, identify asset risk in advance, and mitigate risks through AI-prioritized alerts and recommended asset-specific actions

• Shell Predictive Maintenance Control Valves – Monitor the health of control valves, identify assets at risk in advance, and mitigate risks through AI-prioritized alerts and recommended remedy actions

• Shell Predictive Maintenance Subsea Electrical Submersible Pumps (ESP) – Monitor the health of ESPs, identify assets at risk in advance, and mitigate risks to avoid ESP trips through AI-prioritized alerts and recommended actions

Baker Hughes makes available codified equipment and services knowledge and proven AI-enabled solutions, including:

• System 1 Condition Monitoring – Plant-wide turbomachine health monitoring and asset protection system that connects processes and assets into a holistic view and visualize performance insights

• iCenter – Turbomachinery Advanced Digital Services – Three global iCenters provide 24/7 monitoring, and engineering services support using advanced diagnostics and analytics, for over 1,500 assets globally

• ValvAware for Valve Lifecycle Management – OEM-agnostic control valve fleet maintenance prioritization application and comprehensive performance monitoring service for all valves

Microsoft Azure provides a reliable, flexible, and scalable cloud infrastructure for OAI solutions.

9. What are the key benefits of the OAI and OAI Reliability Solutions?

OAI creates an open ecosystem for AI-enabled and domain-specific solutions that are scalable, flexible, extendible, and interoperable.

OAI Reliability Solutions offers the following key benefits:

• Interoperate reliability capabilities across AI/ML, data model, and user workflows from multiple operators, independent software vendors, and equipment providers using an open and standards-based unified framework.

• Supercharge failure detection performance and actionability of the reliability solutions by leveraging codified subject matter expert knowledge from leading operators and services companies such as Shell and Baker Hughes. Operators can integrate domain-specific libraries, physics-based insights, tailored workflows, and a monitoring database of over 1,500 assets.

• Scale swiftly across the enterprise to large fleets and multiple types of equipment using asset-specific AI models relevant to fullstream oil and gas, pre-defined asset templates, prevalent systems data connectors, and diagram parsing capabilities.

• Respond to risks and anomalies in process flow and equipment performance, along with failure process upset scenarios.

• Investigate and take action using AI-recommended failure mode assessments for each identified risk. Conduct RCAs and failure mode effects analysis with all relevant data.

• Assess system and subsystem health trends over varying time intervals across configurable risk indicators.

• Collaborate across the enterprise with case management tools, including data investigations, messaging, user tagging, file upload, and external messaging (e.g., email or text).

• Aggregate process data to view all relevant data for interdependent process equipment. Understand how tags from independent systems correlate to distinct process steps.

• Track, benchmark, and rank performance of regions, facilities, systems, and equipment based on configurable health and reliability metrics.

• Optimize operations and capital expenditures by proactively planning reliability improvement projects and minimizing unplanned downtime.

• Enable end-to-end ModelOps to automate model tracking, review inference statistics, identify model drift, and monitor feature relevance over time

10. What are the key value drivers of OAI and OAI Reliability Solutions?
OAI unlocks significant economic value by activating the following levers:

• Improve recovered production due to early identification, prioritization, and resolution of equipment and process risks.

• Extend equipment life by improving operating conditions and turnaround decisions with data-driven history and risk predictions.

• Reduce unplanned downtime by proactively addressing process and equipment reliability issues. Arm operators with prescriptive actions to change operating conditions and reduce upset risks.

• Improve safety with reduced high-risk emergency repairs.

11. What are the key features of BHC3 Reliability?
BHC3 Reliability offers the following key capabilities:

• System-of-systems AI approach - Leverage AI to identify equipment and process issues that impact system-level health and operational performance. Understand how individual tags across independent systems are related to overall system health.

• Unsupervised anomaly detection - Leverage cutting-edge deep learning and ML technology to identify anomalies in process flow, equipment, and sensor performance to estimate time-to-failure or remaining useful life.

• Root cause identification - Prescribe failure mode recommendations to guide reliability engineers to enable faster, more consistent, and traceable root cause investigations.

• Continuous learning - Continuously learn and improve AI models based on new data and user feedback. Increase the accuracy of failure mode recommendations and anomaly detection alerts over time.

• Asset templates – Leverage pre-defined templates to rapidly construct a digital representation of your facility's asset hierarchy and calculate KPIs and KOPs.

• Diagram parsing - Generate machine-readable asset hierarchies and sensor-to-tag mappings. Users can ingest and parse P&ID diagrams using machine vision, NLP, and graph search to detect tags, tag names, and connections to equipment.

• Prioritized alerting - Focus operations on prioritized alerts and reduce the number of unnecessary alerts through AI-enabled detection and categorization of process risks.

• Visualization across process equipment - View and traverse unified process data at the aggregate system or facility level, or drill down to understand individual equipment performance.

• Seamless integration with existing tools - Create work orders and launch investigation cases directly from the application. Integrate with existing systems to enable a seamless digital reliability program.

12. How is BHC3 Reliability different from other products?

There are software solutions offering a similar basic functionality around preventing maintenance failures. However, BHC3 Reliability provides three key enhancements:

- It's built on the BHC3 AI Suite that offers platform capabilities to integrate multiple source systems and operate on the cloud or on-premises. Its model-driven architecture enables swift deployment of the application at scale

- It applies advanced machine-learning/AI techniques beyond basic rules-based methods or "standard" anomaly detection

- It scales smoothly to enable enterprise-wide digital transformation beyond reliability, including energy management, inventory optimization, and predictive maintenance.

13. Do OAI Reliability Solutions have a positive impact on the energy transition?

Yes, the OAI Reliability Solutions give operators early warning of process and equipment issues and prevent unplanned situations that could cause safety, emissions, or leakage issues

14. How does one access OAI and OAI Reliability Solutions?

The OAI Solutions are available directly from Baker Hughes and C3 AI. Baker Hughes and C3 AI ecosystem deploys, implements, integrates, and supports commercial OAI solutions, accelerated by BHC3 Applications and the BHC3 AI Suite. Please contact *sales@c3.ai* to learn more.