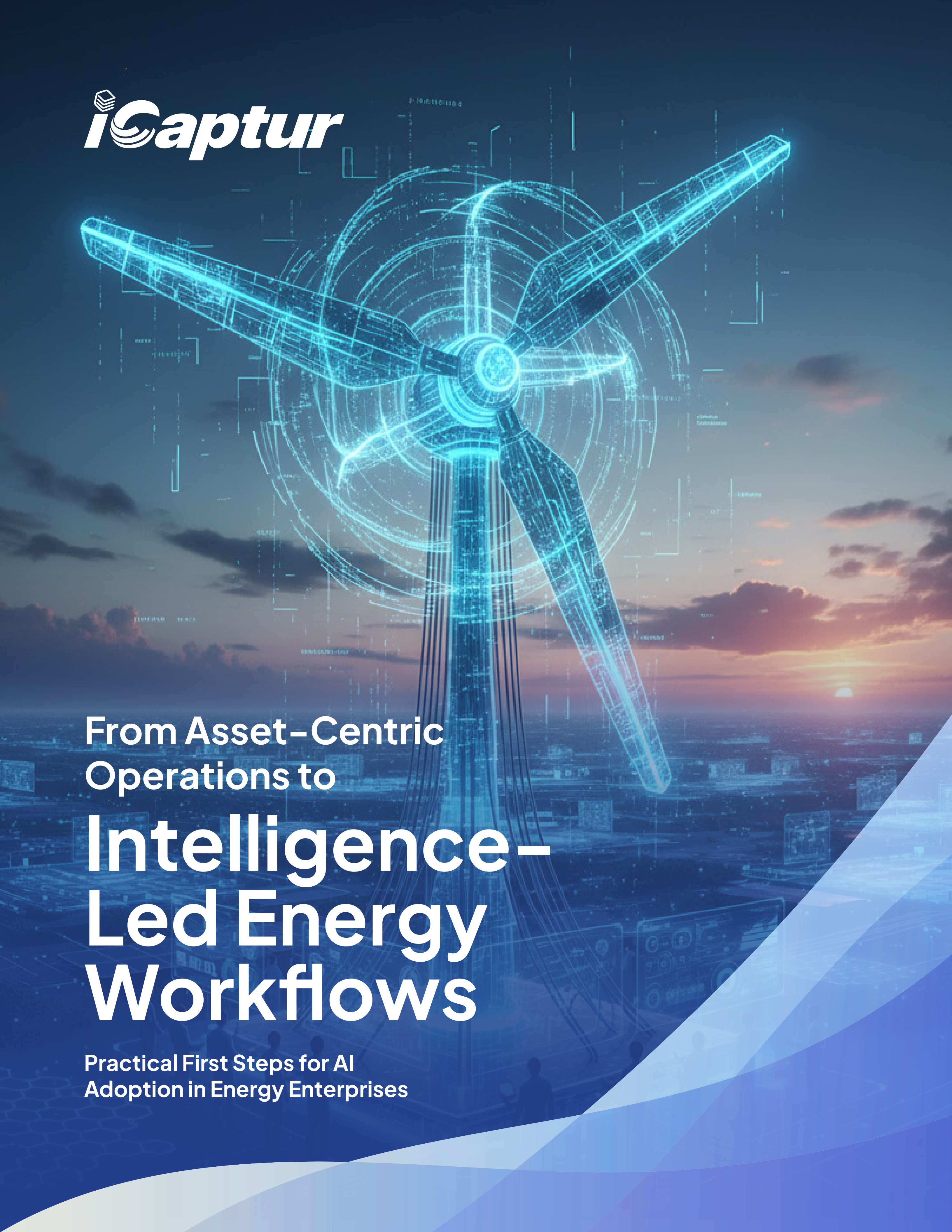

From Asset-Centric Operations to Intelligence-Led Energy Workflows

Practical First Steps for AI Adoption in Energy Enterprises

EXECUTIVE PERSPECTIVE: WHY AI IN ENERGY IS AN OPERATIONS IMPERATIVE

Energy enterprises have invested heavily in digital systems over the last two decades. Asset registers, engineering repositories, maintenance platforms, inspection tools, and compliance systems are now standard across the industry. From the outside, operations appear modern and digitized.

70–80%

of operational and engineering data

20–30%

of their time simply locating the right technical information

Yet a closer look reveals a different reality.

Industry studies consistently show that **roughly 70–80% of operational and engineering data in energy organizations remains locked inside unstructured formats** such as drawings, schematics, PDFs, inspection reports, and technical manuals. This information exists, but it is not readily usable. It cannot be easily searched, connected, or analyzed across systems

As a result, critical knowledge about assets often lives outside operational workflows.

The impact of this fragmentation is not theoretical. Delayed access to asset information has a measurable cost. Field engineers, planners, and inspectors routinely spend **hours per task searching for, validating, or re-creating information** that already exists somewhere else in the organization. Industry benchmarks indicate that knowledge workers in asset-heavy industries can lose **20–30% of their time** simply locating the right technical information. In operational environments, these delays cascade into longer maintenance cycles, postponed inspections, extended outages, and increased safety and compliance risk.

This is why AI in energy should be viewed first as an **operations imperative**, not a technology initiative.

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When engineering drawings can be understood by systems, when inspection reports can be analyzed consistently, and when asset knowledge can flow across teams, operations become faster, safer, and more predictable.

The initial value of AI does not come from automation or autonomy. It comes from making technical information usable at scale. When engineering drawings can be understood by systems, when inspection reports can be analyzed consistently, and when asset knowledge can flow across teams, operations become faster, safer, and more predictable.

Importantly, early AI success in energy is not disruptive. It does not replace engineers or override established processes. Instead, it supports reliability, safety, and operational clarity by removing friction from how work already happens.

Seen this way, the evolution is straightforward:

Most energy organizations have achieved digitization. The next competitive step is transforming static technical information into structured intelligence that can actively support operations.

RETHINKING AI ADOPTION FOR ENERGY ENVIRONMENTS

AI is often discussed in abstract or extreme terms. Either it is portrayed as a future silver bullet or dismissed as risky and impractical for regulated, asset-heavy environments. Neither view reflects operational reality.

In energy organizations, AI does not replace engineers, operators, or inspectors. It supports them.

Early adoption focuses on reducing manual effort, improving information access, and strengthening decision-making. The goal is not to automate judgment but to remove friction from workflows that depend on technical knowledge.

Energy environments are complex by design. Assets are long-lived. Documentation spans decades. Regulations demand traceability and auditability. Any successful AI approach must work within these constraints, not around them.

This means AI maturity builds progressively. Organizations do not jump from static documents to autonomous operations in one step. They layer intelligence where it adds immediate value, learn from results, and expand with confidence.

When expectations are reset this way, AI becomes far more practical and far less risky.

STARTER AI USE CASES FOR ENERGY COMPANIES

3.1 Making Engineering Drawings and Technical Documents Machine-Readable

Use-case

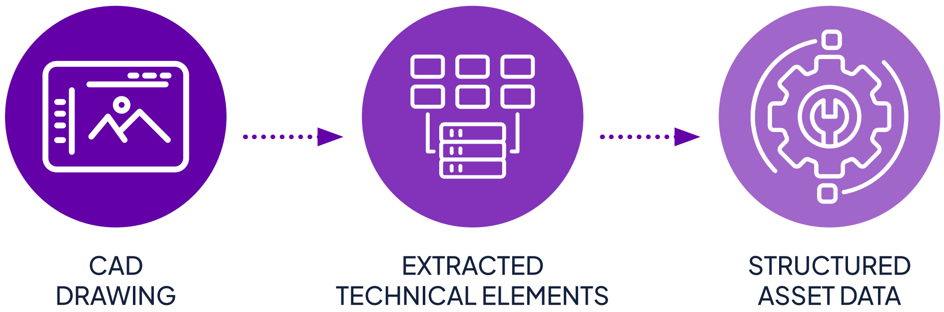
Engineering drawings, CAD files, and technical schematics are at the very core of how energy assets are designed, operated, and maintained. Yet all too often, they remain statically filed and require a person to interpret them. AI allows these documents to be read and interpreted for the first time, transforming them into structured and searchable information that can then be reused across engineering, maintenance, and compliance workflows.

Examples

- Extraction of equipment identifiers, dimensions, and annotations from drawings
- Structuring legacy drawings to be more easily searchable and referential
- Supporting maintenance planning, inspections, and regulatory checks

Why this is a strong starting point

- Already, a very high volume of drawings exists within most energy organizations.
- Unlock immediate productivity gains for Engineering and Operations.
- No changes needed for core operational systems



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3.2 Turning Operational Documents into Actionable Data

Use-case

Operating documents like inspection results, work orders, permits, and compliance data hold a lot of information, but the insight is largely trapped in the text format of the document. AI technology allows for the processing of these documents in a systematic manner, converting free-form text comments into organized information for faster team response.

Examples

- Determining inspection findings and recommendations
- Organizing safety observations and compliance data
- Reducing Manual Work in Review and Follow-up

Key outcome

Enhanced access to key operational data, thereby facilitating faster action and better-informed decisions.

3.3 Modernizing Asset and Operations Systems with Intelligence

Use-case

Asset management and business systems are only as good as the information upon which they depend. AI uses its ability to detect gaps, inaccuracies, and outdated information in the information related to assets.

Examples

- Detecting missing/incorrect values of asset attributes
- Pointing out “obsolete drawings” and “incomplete histories”
- Enabling maintenance planning and prioritization

Positioning

AI enhances existing systems and their performances without necessarily replacing them.

3.4 Building Purpose-Specific Applications for Energy Workflows

Use-case

Many operational issues are extremely specific and cannot be solved by enterprise systems alone. AI allows one to develop targeted applications to address specific groups or users in particular tasks or processes.

Examples

- Asset history review tools before maintenance operations
- Software for planning inspections
- Dashboards with operational risk visibility

Why this works early

- Broad scope, but unclear ownership
- '*Speed of Implementation' + '*Speed of Results'
- Extensive value for frontline and planning teams

3.5 Connecting Intelligence Across Engineering, Operations, and Compliance

Use-case

Engineering, operational, and legal teams might use different sets of systems and documents to manage the same assets. AI allows these viewpoints to integrate because structured intelligence can now move from these teams and into the systems.

Examples

- Organized drawing dataset inputting the asset systems
- Inspection insights to inform maintenance decisions
- Fewer manual handoffs among teams

Key insight

It is an incremental process and a real-world workflow that helps an organization build connectivity.

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3.6 Generative AI as an Operational Knowledge Layer

Use-case

Generative AI enables better access to institutional knowledge with its ability to easily converse with accepted technical documents and standards using natural language.

Examples

Querying technical manuals and procedures

Summarizing asset documentation

Supporting training and onboarding

Guardrails

Controlled and approved data sources

Read-only usage

Human decision-making retained

3.7 Visual Intelligence for Field and Infrastructure Monitoring

Use-case

Field inspections generate large volumes of images and video that require careful review. Visual intelligence uses AI to identify visible defects, anomalies, or safety concerns in this visual data.

Examples

Identifying infrastructure defects or wear

Supporting safety and quality checks

Improving inspection accuracy and consistency

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3.8 Predictive Intelligence for Operations and Maintenance Planning

Use-case

Operations and maintenance teams rely heavily on historical performance data, but much of this data is reviewed reactively and in isolation. AI enables this information to be analyzed collectively to identify early signs of risk and degradation. At a beginner level, AI acts as a decision-support layer, highlighting trends and potential issues without changing how maintenance is executed.

Examples

- Analysis of historical failure patterns for selected asset types
- Detection of abnormal behavior based on past operating data
- Recommendations to help prioritize maintenance activities

Why this is a strong starting point

- Most organizations already store years of maintenance and operational history.
- Insights can be generated without real-time system integration.
- Outputs support existing maintenance planning processes rather than replacing them.

3.9 AI-Driven Energy Performance and Efficiency Optimization

Use-case

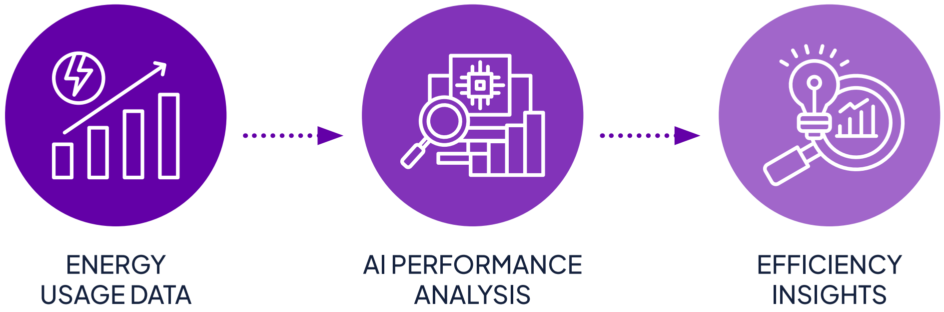
Energy consumption and process efficiency data are often reviewed periodically and at a high level, making it difficult to pinpoint where losses occur. AI allows this data to be analyzed in a structured way to establish performance baselines and surface inefficiencies. At an early stage, AI provides advisory insights that support operational and energy management teams without introducing automated control.

Examples

- Establishing baseline energy performance across assets or facilities
- Identifying assets or processes with unusually high energy usage
- Providing recommendations to support efficiency and emissions review

Why this is a strong starting point

- Works with aggregated, read-only operational and energy data.
- Aligns well with existing energy reporting and review cycles.
- Delivers measurable insights with limited operational risk.



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WHAT IMPROVES WHEN AI IS APPLIED THOUGHTFULLY

In end-to-end implementations where AI has fit into real operational workflows, improvements show up rather quickly and in very practical ways. Organizations begin to see steady gains rather than transformations across daily activities.

Faster access to technical information

The search for drawings, reports, and asset records by teams takes far less time. The information that needed to be looked up manually from folder to system becomes easier to find and use, which limits delays in decision-making.

Smarter Inspections and Maintenance

With better insight into the history and condition of assets, inspections and maintenance cycles become a lot more predictable. Planners can prioritize work with an open view, and field teams arrive prepared.

Improved Compliance Readiness

Structured documentation and clearer traceability make audits and regulatory reviews less disrupting. Compliance teams spend less time assembling evidence and more time validating outcomes.

Stronger Asset Visibility across teams

Engineering, operation, and compliance teams base their efforts on a truer view of assets. This reduces rework, misalignment, and reliance on informal workarounds.

Safer, More Predictable Operations

Safety is improved and operational risk reduced when teams can get access to reliable information in good time. Decisions are based on clearer contexts than assumptions.

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WHAT "GOOD" LOOKS LIKE FOR AI IN ENERGY

For energy executives, assessing AI projects is more about fit, less about features. Good AI solutions have a couple of key traits in common.

Secure and Controlled by Design

Data processing needs to be secure, with robust access controls and auditability. AI should improve governance, not make it complex.

Ready for Compliance and Audits

There should also be a connection trail from documents or source files to their output in systems, which will serve a purpose in regulation but will not add to paperwork.

Built for Real-World Data

Energy operations rarely produce perfect documents or images. Good AI handles messy, incomplete, and inconsistent inputs without breaking workflows.

Aligned with Existing Systems

AI should integrate smoothly with current assets, maintenance, and operational platforms, improving how they perform rather than forcing replacement.

Designed to Scale Gradually

The ability to start small and expand over time is critical. Good solutions support incremental growth as confidence and value increase.

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STARTING SMALL WITHOUT OPERATIONAL RISK

Energy environments, in which reliability and safety are paramount, have natural caution around AI adoption. The most successful initiatives follow a measured approach:

Begin with Low-Risk Workflows

Start with non-invasive use cases such as document intelligence or information access, which will not impact live operations.

Keep Humans in the Loop

AI should support and not make independent decisions. Human oversight ensures trust, accountability, and operational control.

Limit the Initial Scope

Early projects should focus on narrow workflows and teams, with clear goals and success criteria.

Expand Based on Proven Value

AI should only be extended to other workflows or sites once operational benefits are demonstrated. Growth driven by results, not ambition.

CLOSING PERSPECTIVE: BUILDING INTELLIGENCE AROUND ENERGY ASSETS

The first wave of AI success in energy will not come from automation alone. It will come from turning technical knowledge into usable intelligence.

Organizations that begin with document and asset intelligence today lay the foundation for predictive and autonomous operations tomorrow. They move forward without disruption, strengthening reliability, safety, and operational clarity along the way.

The shift from asset-centric operations to intelligence-led workflows is not a leap. It is a series of practical steps. And those steps can begin now.

Resources

Suggested sources for data, stats, and operational benchmarks:

McKinsey Energy Insights
Digital transformation priorities and value creation in energy operations.

https://www.mckinsey.com/industries/oil-and-gas/our-insights/digital-transformation-in-energy-achieving-escape-velocity

Deloitte Energy & Utilities
Strategic AI benefits across energy systems and industry outlook.

https://www.deloitte.com/global/en/issues/climate/ai-for-energy-systems.html

International Energy Agency (IEA)
Digital technologies and AI's role in energy transformation.

https://www.iea.org/reports/digitalisation-and-energy

World Economic Forum (WEF)
Energy transformation insights (WEF energy transformation content)

PwC Energy Transformation
Generative AI applications and operational value in energy and utilities.

https://www.pwc.com/us/en/tech-effect/ai-analytics/generative-ai-for-energy-and-utilities.html

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