Qii.AI

The Future of Asset Inspections in the Energy Sector

How deep technology makes oil and gas, nuclear, and electric power companies more resilient and competitive
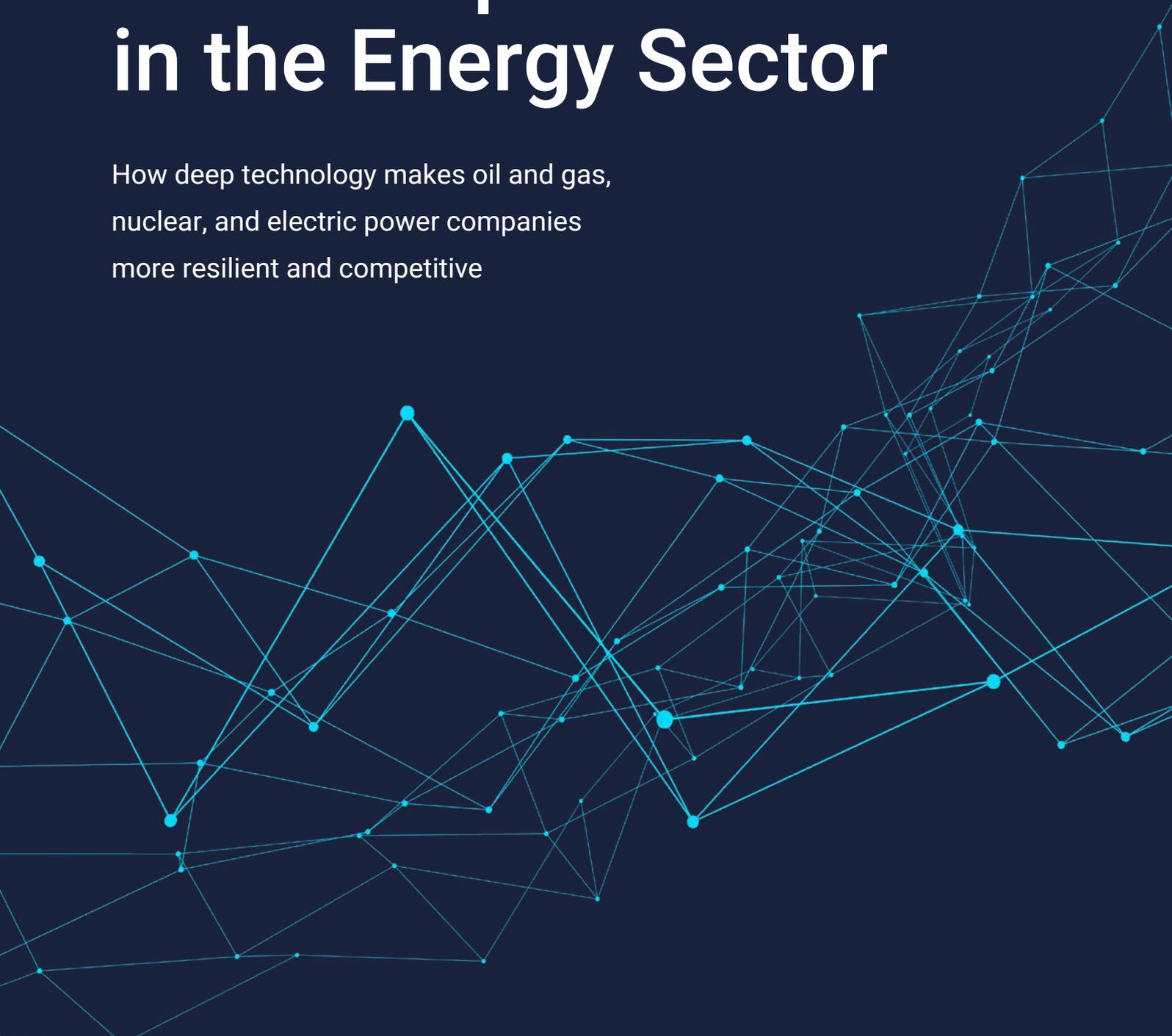
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BACKGROUND

The energy sector is facing unprecedented change.

Drivers such as COVID-19, climate change, and increased competition are pushing the energy sector towards digital transformation.

"Historically, the energy sector has been slow to adopt new technologies," said Jose Soliz, host of the Energy ScaleUps Podcast.

"Since implementing technology is often expensive, time-consuming, and not always successful—especially when not done properly—the industry took an 'if it ain't broke, don't fix it' approach. But COVID-19 and the climate crisis have shown that we need to act now. Transformation is key to staying competitive and reducing emissions."

Oil and gas, nuclear, and electric power companies are fast-tracking their transformation efforts by optimizing their asset maintenance strategies. New, deep technology provides real-time insights into equipment and can address the following challenges:

More frequent and severe climate events that can knock out equipment, leading to costly outages and liabilities. Collecting real-time data about assets helps you identify weak spots that may put your operations at risk.
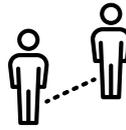
Growing competition from new market players. Making your operations more efficient can help you provide higher levels of service and win market share.

Climate mandates that drive the energy sector to reduce emissions. Optimizing legacy assets can lower your carbon footprint and your operations costs.

COVID-19 physical distancing mandates. You must find a way to inspect assets and make decisions even when employees can't work together in person.

Increased regulatory and security mandates that put pressure on oil and gas, nuclear, and electric power companies to better monitor and report on asset performance.

The great crew change. As skilled employees retire, the energy sector must attract new employees or find a way to inspect assets with fewer people.

Another driver for transforming inspections is aging assets. Most electric power assets are nearing 70 years old and have far surpassed their expected lifespan of 50 years. Meanwhile, the average nuclear and fossil fuel asset is 35-50 years old. As equipment ages, it requires increased maintenance. Old assets are also prone to failures that can negatively impact your operations and the environment.

In addition to managing aging assets, the energy sector is bringing new equipment into the mix. Deloitte found that with the growth of renewables and distributed energy resources, the energy sector is managing 10 times more assets than it managed 20 years ago, and these assets will continue to grow. This mix leads to increased complexity, as equipment may have "electronic components with different life spans, depreciation rates, operating scenarios, and maintenance requirements."

Digital transformation in your inspection department is key to optimizing asset performance and staying competitive in a rapidly changing market.

> New technologies such as real-time sensors and monitoring devices are creating a bottleneck of information that's just sitting there. The challenge is knowing how to use this data to drive business value.

Harold Queen
President & CEO, Queen Consulting Services

[1] Deloitte, Digital utility asset management: Building the backbone of the energy transition, 2021
[2] Deloitte, Digital utility asset management, building the backbone of the energy transition, 2021

Why it's challenging to manage and analyze drone inspection data

Oil and gas, nuclear, and electric power companies face three key challenges when it comes to drawing accurate conclusions from inspection data:

Challenge 1:
Managing data

A single drone inspection can generate thousands of images. It's time-consuming, if not impossible, for small inspection teams to review all these images.

Organizing inspection data for easy sorting and analysis is also a challenge. Many inspection teams upload data to computer hard drives or file-sharing tools. While these systems offer storage, they aren't designed to organize gigabytes of inspection data and make it effective to use.

Challenge 2:
Collaborating around data

Asset inspection teams are dispersed and involve many stakeholders. Different people may use different platforms to share data, such as email and cloud collaboration tools. But the more platforms you use, the harder it is to keep track of everything.

Storing inspection data in disparate platforms makes it hard to collaborate. As one person marks-up images, other inspectors will need to see the latest data. Depending on what tools your team members use, not everyone may have access. You need a central location where your team can find real-time data and perform virtual inspections efficiently.

Challenge 3:
Analyzing data

Inspection teams often lack tools that extract insights from their raw data quickly and accurately. They still rely on manual analysis methods such as annotating and highlighting anomalies by hand. However, these processes are expensive, slow, and cumbersome. Manual analysis can also lead to errors, such as failing to detect an anomaly.

If you perform digital inspections, you may face limitations with your AI models. Labeling and training AI models typically requires massive volumes of data. If you're just getting started and don't have tons of data, you won't see much value from your investment.

Companies in the energy sector have limited resources and can inspect just **10%-12%** of their assets each year.

If you don't address these data challenges, you'll have a hard time knowing where to focus your maintenance efforts and may fail to inspect assets that require critical repairs.

[3] Power, Improving Asset Inspections with Drones and AI, 2020

THE TECHNOLOGIES

Make your inspections faster, safer, and more efficient with deep technology

Drone inspection software that includes deep technology eliminates the headaches of manual inspection processes while providing a real-time view of your assets.

Deep technology also helps solve the challenges of managing, analyzing, and collaborating around drone inspection data by:

✓ Organizing all your inspection images in a central platform that is easy to search.

✓ Streamlining your data analysis by automatically selecting the most relevant inspection images, highlighting anomalies, and creating digital twins that give you a 360° view of your assets.

✓ Providing your global team members with a single platform where they can collaborate on inspections.

Here is a deeper look at technologies that can help you manage, analyze, and collaborate around inspection data:

> AI makes data useful instead of a burden.
>
> Anne-Sophie Riopel-Bouvier
> **Co-Founder, EXO Tactik Air Support**

01. ARTIFICIAL INTELLIGENCE

Drones collect thousands of photos and massive amounts of data during inspections. Humans can't review and analyze all this information. If you want to make profitable decisions, you need a way to process inspection data quickly and accurately.

AI "pre-reviews" your inspection data and performs intelligent analysis on it. The technology can save your team countless hours by reviewing each drone image and identifying the ones that contain anomalies.

AI can also pull actionable insights from complex data sets and deliver recommendations to your inspection teams. For example, it can estimate an asset's current state based on prevailing environmental and usage conditions, without requiring your team to perform a physical inspection.

Think of AI like a doctor in an emergency room. When patients arrive, a doctor will perform a quick assessment to determine if they need treatment in the ICU or if they can get medicine and go home. AI quickly assesses your equipment so you can decide if something needs further review or critical maintenance.

[4] EPRI Journal, <u>Can Artificial Intelligence Transform the Power System</u>, 2019
[5] Solar Energy Industries Association, <u>Solar Industry Growing at a Record Pace</u>, 2021
[6] Qii.AI, <u>Inspections using digital twin models and AI for bridges</u>, 2021

Here are just a few of the ways that AI is helping nuclear, electric power, and oil and gas companies drive more value from their inspection data:

Identify malfunctioning transmission and distribution equipment.
The Electric Power Research Institute (EPRI) collected 7,000 inspection images and developed AI algorithms to distinguish between functioning and non-functioning assets. EPRI believes that AI can improve asset reliability by identifying risks and providing the information needed to fix equipment before it fails.

Forecast problems before they occur in solar panels.
In the past decade, the solar market has grown at a rate of 42 percent annually. Not only is the number of solar farms increasing, but they are also getting larger. It is no longer practical or cost-effective for individuals to inspect farms manually. Autonomous drones can inspect large areas and document anomalies in a single flight. Then, AI algorithms can manipulate the data to provide inspectors with insights into each asset's condition. For example, AI algorithms can determine when areas deviate from the norms and flag pixels that show problems with solar panels, such as hotspots, cracks, and discoloration. AI provides insights that allow solar companies to replace panels before issues become costly.

Improve the speed, quality, and safety of bridge inspections.
As bridge structures become more complex, they are harder to inspect using traditional methods. Digital twins allow inspection teams to simulate "what-if" scenarios using virtual 2D and 3D models.

Meanwhile, AI can perform intelligent analysis on the data and give engineers deeper insights into a bridge's condition—including the precise size and location of corrosion or cracks. The insights help inspection teams determine whether a bridge needs maintenance   without performing a costly, time-consuming, and dangerous physical inspection.

The future of asset inspections

Harold Queen, President & CEO, Queen Consulting Services

We'll see more automated asset inspections using technologies such as AI in the future.

The energy sector pushed back on automation until recently, when experienced workers started to retire en masse. These workers often aren't replaced. At the same time, the number of industrial assets and the data they produce is growing exponentially. Energy companies are seeking ways to inspect all these assets with less staff.

Technologies such as drones, AI, and automation can perform inspections that aren't safe for humans—while filling the gap caused by the skilled worker shortage.

Meanwhile, continuous monitoring will reduce the need for inspections. Attaching IoT sensors to assets allows energy companies to detect faults automatically without sending inspectors to remote or dangerous locations.

New digital technologies aggregate data from IoT sensors and inspections into a central platform. Reviewers can access this information at any time and from anywhere. Predictive analytics show what's happening with assets in real time—allowing energy companies to optimize their maintenance programs and keep equipment running.

02. MACHINE LEARNING

Automated machine learning models can reveal hidden patterns and relationships in datasets.

Analysis and smart discovery generate comprehensive data stories and visualizations that highlight insights, trends, outliers, and interactive "what-if" simulations that give you a deeper understanding of your assets.

Machine learning also continually trains and optimizes your AI model. The more you use an AI and machine learning inspection platform, the more the quality of your data will improve over time. Here are three ways to use machine learning to improve the quality of your inspection data:

Make more accurate predictions.
Machine learning is like having a team of experts working around the clock to analyze your datasets and pull the most valuable insights from them. The larger your datasets, the more accurate your predictions, as machine learning won't be biased towards one sample. For example, DeepMind used machine learning algorithms to make predictions based on neural networks trained on weather forecasts and historical wind turbine data. With this data, they can predict power output 36 hours ahead of generation.

Improve the quality of your drone inspection data.
Machine learning can review thousands of drone inspection images and automatically select the best ones for your AI model, such as ones with consistent focal lengths and good lighting. Then, it will derive conclusions based on patterns in the data. For example, it can review photos of power lines and identify problems that need your immediate attention. Since you don't need to sift through thousands of images, you can spot the most pressing issues and quickly take action to prevent failures.

Give your assets longer and cleaner lifespans.
Technologies such as remote sensing, machine learning, and digital twins give you deeper insights into each asset's condition. Armed with this information, you can optimize your maintenance strategy to increase your assets' lifespan and minimize the need for replacement parts or equipment. When your equipment operates in top condition, it is also less likely to leak oil, gas, and other materials that can harm the environment.
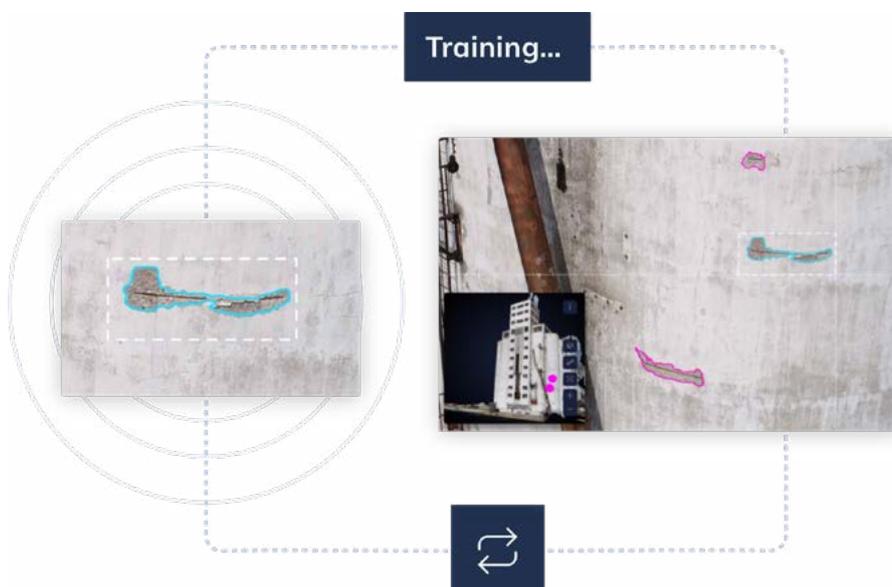
[7] Qii.AI, How and Why You Should Use AI and Machine Learning to Enhance Business Intelligence, 2021
[8] International Finance Corporation, Artificial intelligence in the power sector, 2020

03. COMPUTER VISION

Humans may not see everything when they perform manual inspections.

For example, rain and fog can hinder their vision and make it hard to spot defects. Computer vision mimics human cognitive capabilities to process the visual data collected by cameras, sensors, radars, and other equipment. An AI and computer vision inspection platform can process thousands of data points per minute and detect anomalies that are imperceptible to the human eye. Here are three ways computer vision provides higher quality inspection data:

Identify road defects quickly and accurately.
Traditionally, municipalities use ground-based methods to detect road defects. Lifting the perspective to a bird's-eye view, drones allow municipalities in Quebec to quickly scan streets and take thousands of pictures. Then, an AI and computer vision platform automatically processes these images and creates reports for the inspection teams. Municipal inspectors can review the reports and immediately spot potholes, cracks, and other defects that need attention. These technologies enable new inspection methods that can be adapted to the reality of each municipality's workflow and are even more cost-effective when combined with other territorial survey applications.

Dramatically reduce the time it takes to survey a cooling tower's concrete shell.
Traditional cooling tower inspection methods are dangerous and time-intensive. Operators put themselves at risk when they climb towers with cameras and take photos. Drones make surveys much faster by eliminating the need for humans to inspect dangerous assets manually.

The drones will collect images during a short flight and upload them to a cloud platform that uses AI, machine learning, and computer vision. Together, these tools can automatically identify defects in the concrete, such as scaling and cracks.
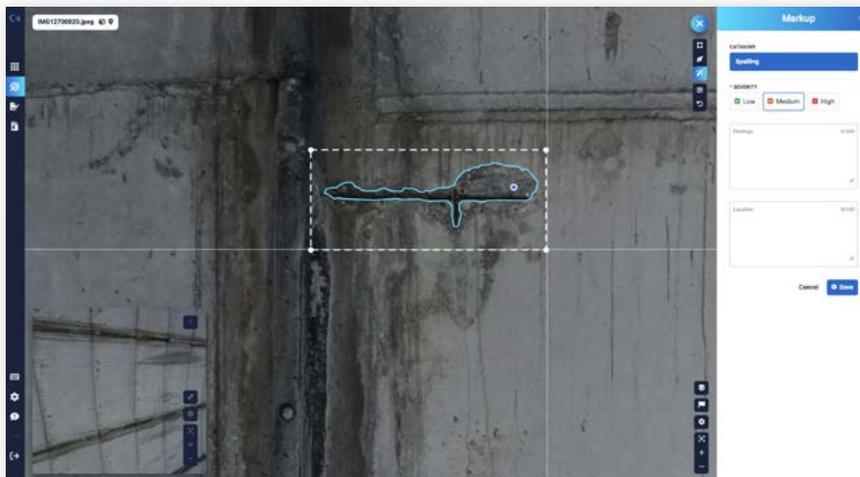
Better detect cracks, corrosion, and other anomalies (even if you have a small data set).
Collecting and annotating samples is a laborious task. An AI and computer vision inspection platform streamlines these processes so you can drive value from your data faster. Simply select the region you want to inspect with a bounding box.

Then, the AI system will automatically segment all the anomalies in the highlighted area. It can segment everything from large patches of corrosion to hairline cracks in a dam's cement façade. You can review the AI predictions by clicking the segmented region and adding or removing pixels. The more you interact with the predictions, the more accurate they will become.

9 Qii.AI, Fast, Safe, and Accurate Nuclear Asset Inspections, 2021

04. EDGE COMPUTING

Edge computing has the potential to transform asset management. It processes data at or near where it is created, including close to the IoT sensors on your equipment.

Since information doesn't need to travel to a data center for analysis, edge computing dramatically reduces your latency. With edge computing, you can respond to critical events quickly and base your decisions on real-time data. Here are three ways to harness the power of edge computing:

Reduce emissions from legacy assets.
Edge computing tells you about problems before or as they happen. If an asset is prone to a gas leak, your maintenance team will receive an alert. That way, they can address the issue before it impacts the environment.

Spot changes in an asset's condition with digital twins.
The next generation of drone inspection software will process structure from motion (SfM), allowing you to create 3D models using your smartphone or tablet. With SfM technology, you can build digital twins while you inspect assets in the field. You'll have on-demand visuals showing how assets have changed over time, so you know where to focus your maintenance efforts.

Get real-time data about your assets.
Edge computing allows you to monitor mission-critical sensors, including those for pressure, temperature, vibration, and humidity. The technology can detect anomalies in real time and alert you of potential hazards. These alerts are invaluable if you have equipment in remote areas and can't perform frequent inspections.
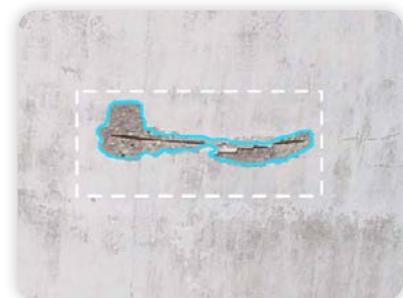
[10] Qii.AI, Making Visual Inspections Smarter with AI, 2021

OUR SOLUTION

Improve how you manage, analyze, and collaborate around drone inspection data with Qii.AI

Qii.AI—a drone inspection platform containing artificial intelligence, machine learning, computer vision, and edge computing—allows you to process large amounts of data quickly, identify patterns, learn about trends, and generate actionable reports.

Qii.AI supports a holistic digital inspection process, including data management and digital collaboration. Our human-centric approach to software design and AI creation assists inspectors and engineers throughout every step of their natural workflow—rather than aiming to replace human involvement.

With Qii.AI, you can improve how you manage, analyze, and collaborate around drone inspection data.

Here's how:

Save countless hours on digital inspections.
You don't need to review thousands of images one by one to identify defects. Qii.AI will automatically select the best drone inspection images for your models, such as photos with consistent focal lengths. Then, Qii.AI will annotate and highlight anomalies so you can immediately spot areas that need your attention.

Gain a 360° view of your assets.
Qii.AI's photogrammetry technology will take your 2D photos and perform a structure from motion and create 3D digital twins. These models give you immediate insights into how your assets have changed over time so that you can spot and fix defects faster.

**Drive value from just a small amount of data.**

With Qii.AI, you can jumpstart your AI program with limited samples. Few-shot learning will build accurate machine learning models based on the data you have on hand. As your inspection team collaborates in Qii.AI, continuous learning will improve your AI models to make your drone inspections more accurate.

Customize your AI models.

Qii.AI gives you complete control over your segmentation and labeling so that you can ensure the accuracy of your AI models.

Keep your data organized and your team on track.

Qii.AI organizes your inspection images in a user-friendly cloud platform. Search images by asset, site, or inspection date. You can also filter data by type, severity, or status to gain critical insights into your asset health. And, since Qii.AI is cloud-based, it can store massive volumes of data and scale as you add new assets.
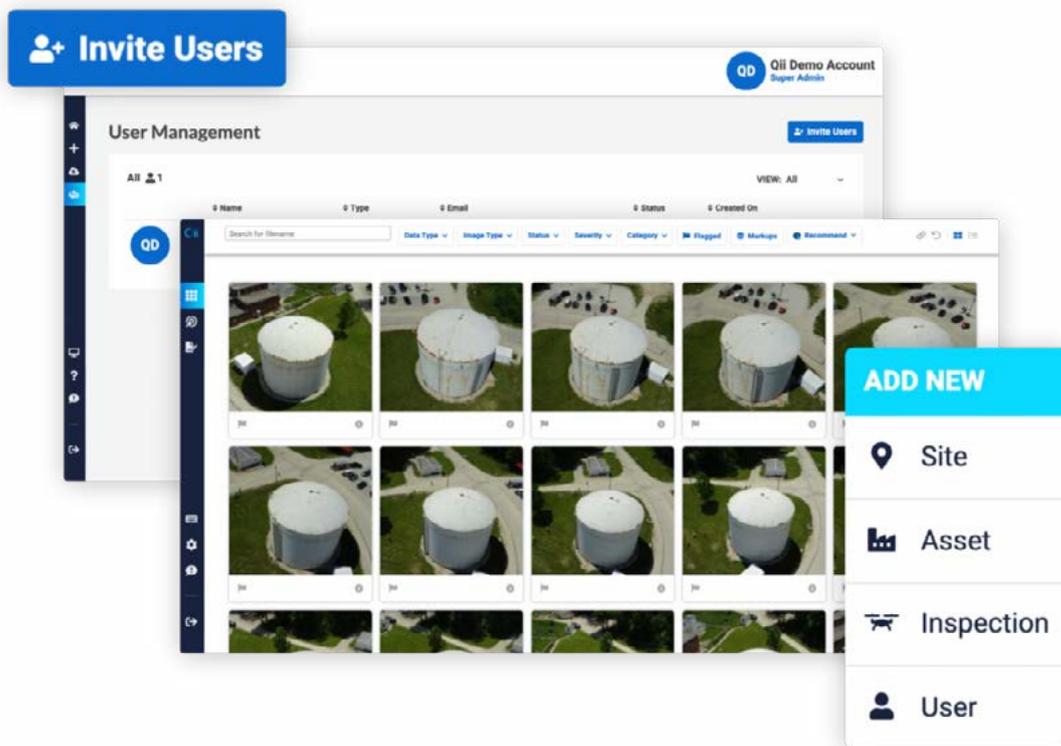
Give your team the access they need while maintaining tight control over your data security.

Manage all your users from a central platform where you can specify different access levels for inspectors, clients, vendors, and other partners. Give team members, such as third-party drone pilots, temporary access so that they can upload data without putting your security at risk. You also have the option of running Qii.AI in the cloud or on premises, depending on your business and IT needs.

Next steps

Traditional asset inspection methods are slow, error-prone, and costly. They also don't give you real-time data you need to keep pace with changing market demands.

When you harness new technologies, you can inspect equipment quickly and accurately. You will also get a "live view" of each asset's condition. Armed with these insights, you can focus your maintenance activities on the areas that will reduce your costs and risks the most.

While technologies such as AI and edge computing offer benefits on their own, you'll get better results when you combine them in a single inspection platform. Qii.AI—a platform that includes drone inspection software, AI, machine learning, and computer vision is 30x more effective at finding defects than manual inspection methods.

Are you ready to transform your drone inspections and gain critical insights into your assets? Book a demo of Qii.AI now or learn more at www.qii.ai.

Book a demo of Qii.AI now