

Leveraging Data and AI in Asset Management

Mitch Simon, Industry Solutions - IBM Energy



Key Challenges across utilities operations

Utilities face a myriad of challenges from traditional operations to emerging challenges associated with policies to reduce carbon emission. The mission has not changed: Utilities must delivery safe, reliable energy to power homes and communities in which they operate. IBM offers digital solutions to support utility transformation with Data and AI.

Asset Operations

Aging asset infrastructure along with a **transitioning workforce** impacts the safety and reliability of the grid

Climate-related **extreme weather** threatens **major disruption** to utility operations and businesses

Energy Systems

Increase the amount of **renewable** energy in the grid

Electrification of Transportation and **Buildings** will increase demand

Customer Operations

Customers are **more engaged**, asking sophisticated questions and seeking **sustainable options**

Deliver **proactive, personalized**, and **intuitive omni channel** interactions

Reduce agent handling time

Enterprise Operations

Pressure to **increase operational efficiencies** and **reduce costs**

Manage **increasing regulation**

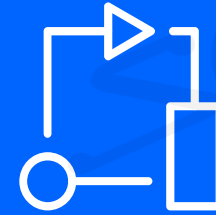
Key digital trends for the energy transition



Digitizing assets

Build infrastructure efficiency, reliability and resilience using IoT and analytics solutions to optimize asset performance

Optimize efficiencies by increasing levels of automation and AI in Asset Operations



Digitizing interactions/workforce

Implement conversational AI with natural language process and automation to improve workforce safety and efficiency, customer interaction, service and support



Digitizing grid operations

Accelerate and orchestrate the integration of distributed energy resources.

Drive scale, speed and complex work by incorporating, artificial intelligence, machine learning, and decision optimization to increasingly automate energy systems

AI-driven Asset Operations for Utilities

AI and Edge enables remote inspection and monitoring of the infrastructure, which helps reduce emissions and the cost of truck rolls while improving worker safety, asset reliability and data collection



AI guides technicians as they conduct field operations, reducing mean time to repair, improving safety and regulatory compliance, while increasing productivity

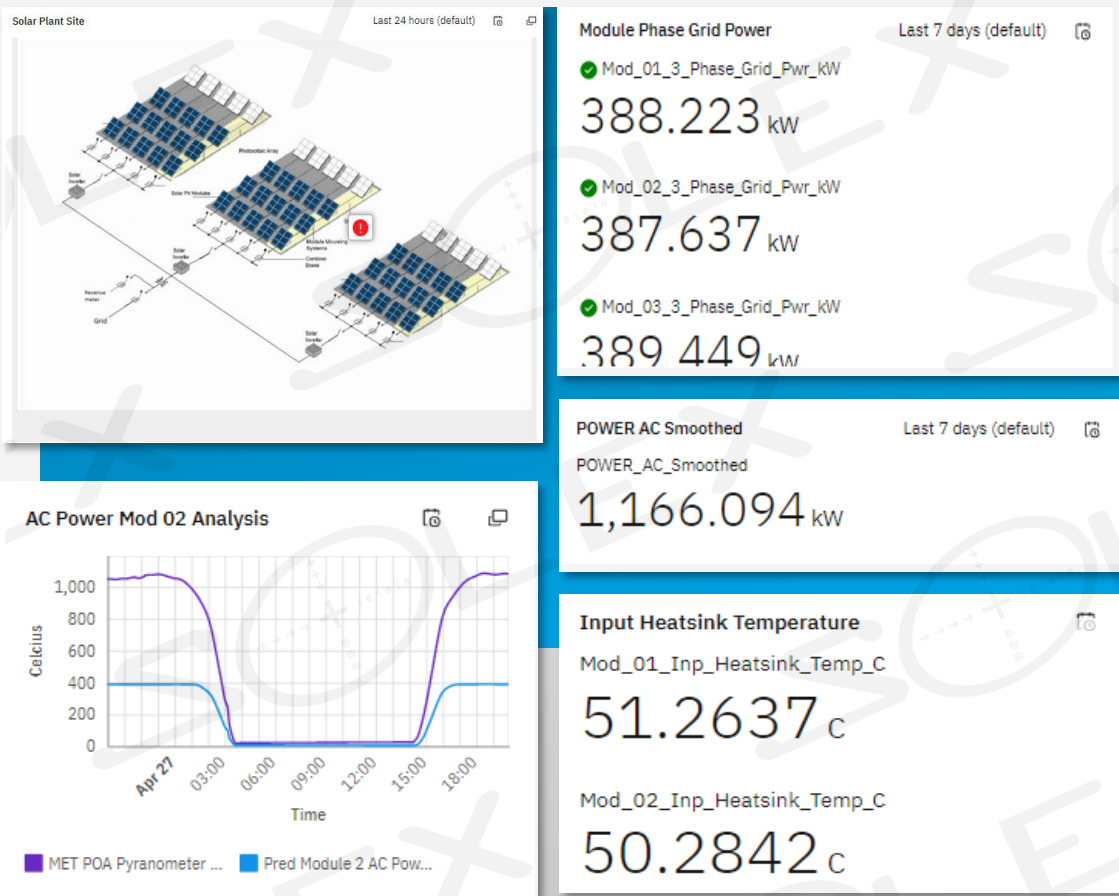


AI and ML, combined with IoT and Weather data helps utilities understand the health and risk of assets, transforming operations and maintenance with prescriptive actions that improve grid performance, increase reliability and extend asset life



Asset Performance Management

Advanced analytics derived from real-time and historical data collected continuously from sensors at the edge, helps utilities manage and maintain assets based on health and risk

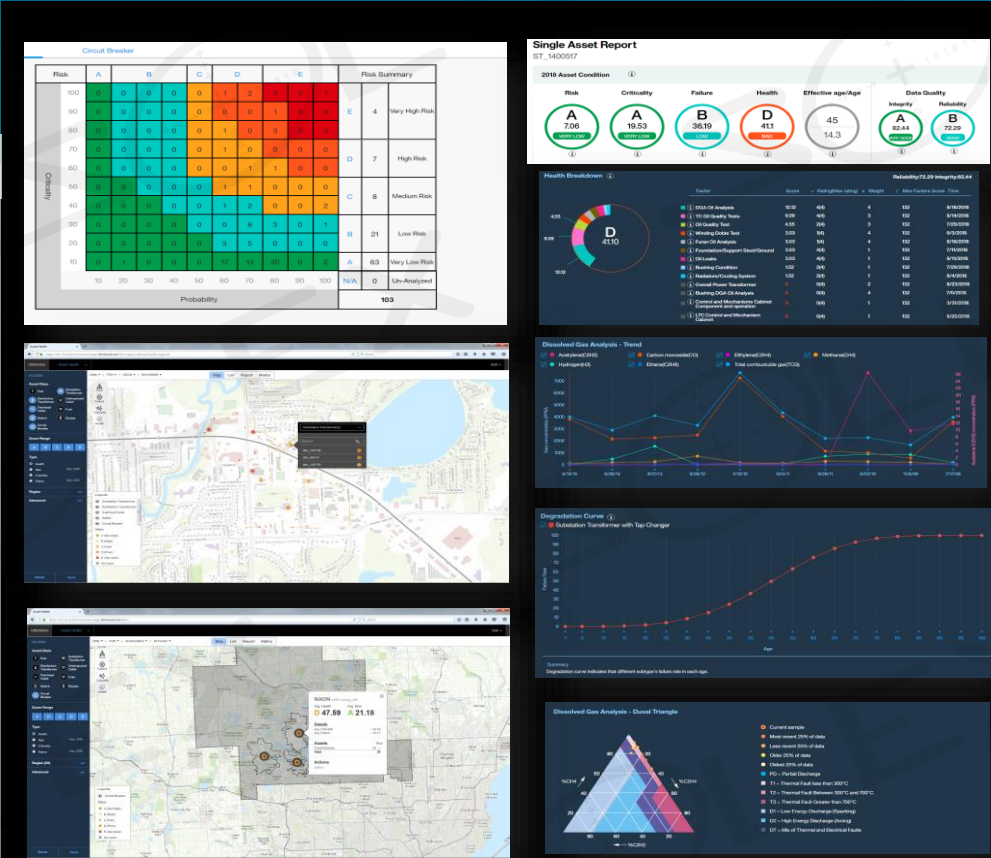


Active Monitoring for Distributed and Remote Infrastructure

- Machine Learning for Predictive Maintenance
- Statistical Analysis framework for Condition based Maintenance
- AI Anomaly Detection helps with root cause analysis
- Secure IoT Connection Service
- Edge Computing

Asset Health and Risk for Transmission and Distribution

- Support for Common Information Model IEC 61970, 61968
- Out of the Box Models for Transformers, Circuit breakers, Poles, Underground cables, Overhead conductors, Switch Gears, Batteries
- Algorithms include Health, Criticality, Probability of Failure, Risk, Effective Age, Data Reliability, Data Integrity
- Drives maintenance prioritization and replacement planning



Asset Operations

Utilities use AI to optimize asset lifecycle operations with data driven recommendations on monitoring, operating, maintaining, and replacing assets

**European
Energy
Provider**

Predictive Maintenance for Turbo Pumps

Early detection of faults to reduce unplanned shutdowns or performance degradations that impacted generation contract commitments

Solution included

- Equipment Health Score
- Failure probability/Days to failure
- Total Anomaly count
- Prescriptive Maintenance recommendations

**RED
ELÉCTRICA
DE ESPAÑA**

Intelligent Maintenance for Substations

Analyze and infuse AI outcomes

- Evolve to condition based, reliability centered and risk-based maintenance
- 10-30% reduction in Maintenance and Replacement costs
- 15-40% labor hour savings across all Asset Management processes
- Prescriptive maintenance actions drive efficiencies and productivity

**Melbourne
Water**

Remote Inspection of Stormwater Grates

Remote inspection of more than 4000 stormwater grates in a 14000km service territory

- Apply deep learning Visual Inspection with remote fixed cameras on a 3G Network
- Reduced in person inspection and truck rolls to remote locations
- Reduce worker safety incidents by only dispatching workers to blocked grates

Enable AI Guided Remote Inspections with Visual Inspection

Apply deep learning algorithms to images to uncover defects in grid operations

Image capture



Drone/UAV/Helicopter

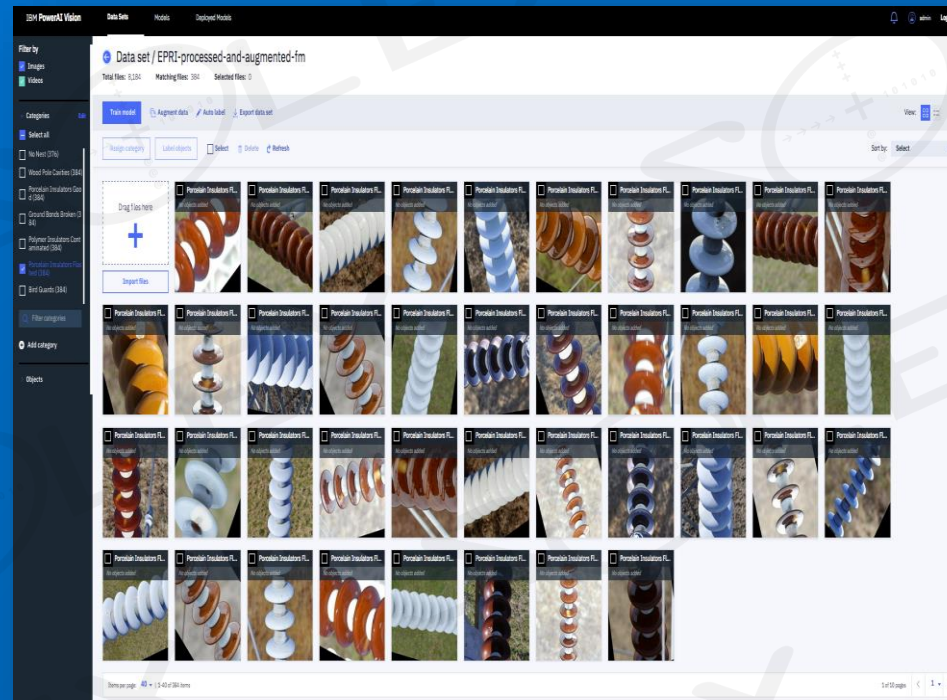


Field Inspection



Fixed Camera

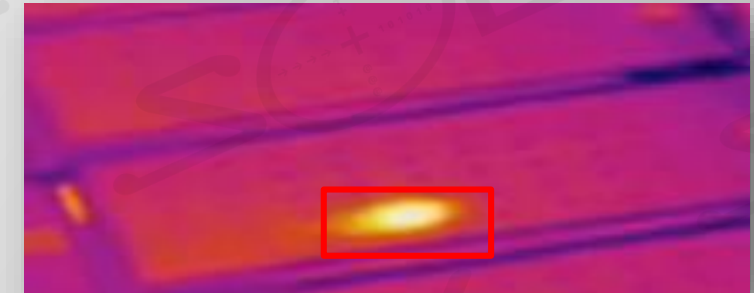
Point and Click labeling and model training



AI object detection and classification

Use cases outcomes

- Remote inspections reduce truck rolls and carbon footprint
- Improve field inspection productivity with AI inference at the Edge
- Integrate with Work and Asset management processes for operational efficiency
- Increase worker safety



Solar panel hot spot



Broken Porcelain



Damaged Conductor



Hot wire

Utility Visual Inspection Use Cases

Generation

Solar Farms:

- Photovoltaic cell outages
- Flashed connections
- Conductor and bus condition

Wind Towers:

- Tower structure integrity
- Blade integrity (4 sides)
- Gear Box integrity
- Post constructure/Pre-acceptance
- Warranty/Insurance claims
- NERC/CIP Compliance

Stack /Dam Inspections:

- Cracks in concrete
- Structural integrity

Coal Ash Pond:

- Dam integrity
- Liner integrity
- Leaks

Transmission

Transmission Tower:

- Broken insulator
- Broken pin
- Hot/Corona connections (infrared)
- Grounding concerns
- Rust/Corrosion
- Environmental Hazards (ie bird nests)

Transmission Line:

- Vegetation encroachment
- Danger trees
- Manmade encroachments
- Conductor condition
- Line sag

Distribution

Substation Inspections:

- Damaged equipment
- Flashed connections
- Conductor and bus condition

Other Substation Use Cases:

- Confirmation of remote-controlled operations such as switch opening/closing
- Detection of animals around lines, switches, transformers
- Worker Safety – remote monitoring of crews

Visual Inspection Accelerators

IBM Digital Twin Exchange marketplace

- Detect PPE for worker safety
- Analyze sedimentation tanks for cleanliness
- Classify assets on Transmission Tower

BirdGuards

ConductorDamaged

ConductorGood

ConnectorsCorroded

CotterPinMissingLoose

DampersDamaged

GlassInsulatorsBroken

GlassInsulatorsContaminated

GlassInsulatorsGood

GroundBondsBroken

MarkerBalls

MisalignedAmorGrips

MisalignedHardware

MisalignedInsulators

Nests

NoNest

PolymerInsulatorsContaminated

PolymerInsulatorsFlashed

PorcelainInsulatorsBroken

PorcelainInsulatorsContaminated

PorcelainInsulatorsFlashed

PorcelainInsulatorsGood

ProperlyAlignedInsulators

WoodPoleCapProblems

WoodPoleCavities

[IBM Digital Twin Exchange](#)

APM with Robotics - Remote Operations

Sam is a maintenance crew chief. He utilizes robotics to avoid dangerous work environments



nationalgrid



“Spot, at 7am every morning walk around the substation”



Training Spot

Sam trains Spot to do a daily walk-through inspection of the high voltage electrical substation



Spot will execute inspection by himself due to the four-legged capabilities.



Inspection Automation

Spot's four legged capabilities allows for him to do the inspection without a worker to accompany him.



Rather than Sam inspecting and reading the electrical gauges, Spot will utilize Visual Insights to read them throughout the substation.



Visual Insights

Spot will read the analog gauges and inspect for potential equipment issues and thermal anomalies.



Spot has been able to create a safe work environment for the employees and is able prevent outages at the substation with the routine inspections.



Work Anywhere

While Spot is doing the inspection, Sam will be notified of any abnormalities that Spot may find.

AI Worker Assistance

AI helps utility field workers perform their job more effectively, accurately and safely



Aggregates Structured & Unstructured Data

- Engineering and Equipment Manuals
- Historical Work Order Information
- Regulatory Standards
- Standard Operating & Maintenance Procedures
- Safety Procedures
- Sensor data, fault codes, SCADA alerts

AI Worker Assistance

- AI Guided Equipment Diagnosis and Repair
- AI Technical Search
- Integrates with current mobile investments

Address challenges with

- Aging and retiring workforce
- Reliance on siloed and tribal knowledge
- Disseminating latest standard procedures and safety guidelines efficiently
- Low first time fix rates/multiple truck roles



Improve
technician
productivity



Boost first
time fix rates



Reduce
troubleshooting
time



Reduce
Training costs



Reduce
Repair Costs

75% reduction in technical search time

Field Operations

AI increases worker productivity, accuracy and safety for field operations

**Service
Provider
for Nuclear
Power Plants**

Nuclear Plant Outage Maintenance Assistance

Challenge: Repair procedures and technical documentation lack of availability extended mean time to repair for complex refuel machine

Solution included

- A conversational AI assistant to provide information such as troubleshooting tips, repair recommendations and step by step instructions

Data Sources

- Equipment specification and repair manuals.
- Maintenance policies and procedures

**Italian Energy
Company**

Cognitive Turbine Assistant

Challenge: Lack of know-how on how to operate or perform maintenance on a steam turbine

Solution included

- A virtual AI-driven assistant that provides answers to questions regarding operating and performing maintenance

Data Sources

- Turbine Fault Codes
- Engineering and technical reports, system drawings, equipment specifications
- Site logs, maintenance stds



Preserving Institutional Wisdom

Leveraged Natural Language Processing to increase Field productivity

- Ingest and Analyze 600K pages of documentation
- 75% reduction in time spent researching historical work, current regulations, and safety protocols
- US\$10 million in labor savings

Maximo Application Suite

Best of class capabilities to provide complete view of your assets

Manage

Intelligent
Asset
Management



Monitor

Monitor and
Detect
Anomalies



Health

360 View of
Assets



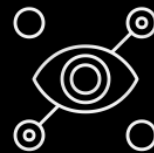
Predict

Predictive
Failures



Visual Inspection

AI-Powered
Insights



Schedule

Schedule
Work and
Resources



Mobile

Technician
Work
Execution



Assist

Prescriptive
Assistance



Safety

Actionable
Insights for
Worker Safety



IBM Cloud Pak for Data | IBM Watson Studio | IBM Watson ML



Infrastructure Independent
Common Operating Environment



The Business Value of IBM Maximo

43%

Less downtime

28%

Increase in end-user productivity

8.6mil

Total equipment cost avoidance



[Source: IDC The Business Value of IBM Maximo](#)



Mitch Simon
Industry Solutions – IBM Energy