Natural gas analytics

Analytics for leak detection forecasting and workforce optimization in natural gas

Spring 2023

E Source

POWERING WHAT'S **NEXT**

Speaker introductions

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E Source Data Science

Data scientists with deep AI expertise ***and*** utility domain knowledge

50+ sophisticated AI models that unlock utility data, savings, and insights

Serving 30+ utilities, each with proven results

Select client base

$5 million–$10 million
… annual asset maintenance savings (10%–20% reduction)

28x
… ROI (client savings over initial investment)

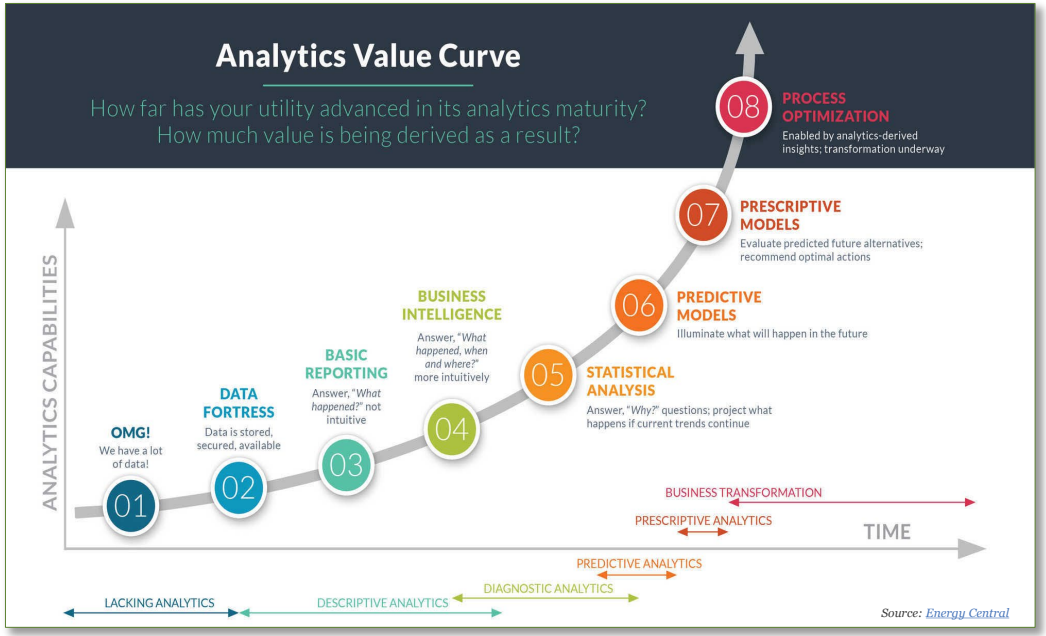
75% +
… reduction in utility protective device expense

84%
… accuracy on structural vulnerabilities

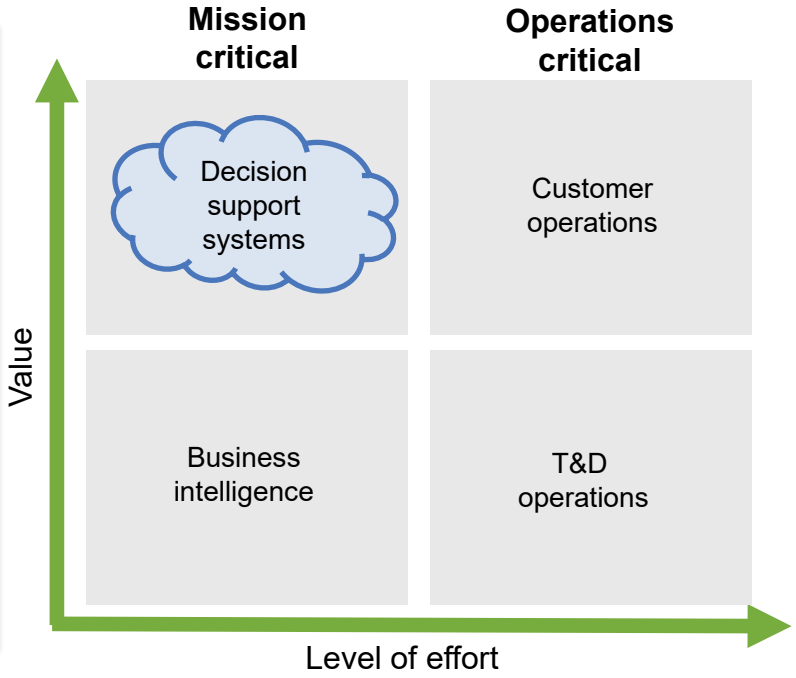
48%
… reduction in deviation of actual-to-scheduled hours

The data science tech paradigm shift

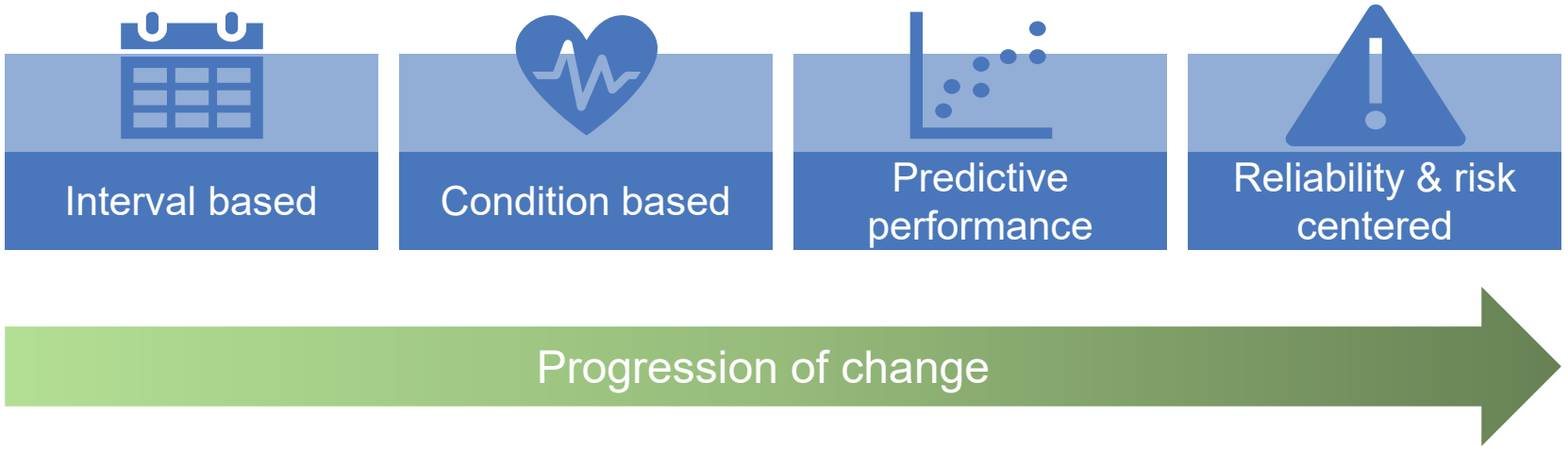
Data-driven decision-making



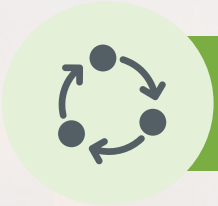
Source: Shelly Cotton, Analytics Value Curve, Energy Central



Evolution of maintenance with technology



Benefits and challenges of predictive analytics



Improve operations and decision-making

Reduce risk and increase efficiencies

Optimize service offerings

Increase profits

Challenges

Unclear goals

Incomplete/inaccurate data

Unpredictability of human behavior

Requires consistent data uploads

Predictive analytics: Focusing on what matters

Predictive analytics provide insight and support in achieving operational goals and strategic initiatives?

- Sustainability
- Safety
- Customer experience
- System reliability

Leak pressure: From the IRA to regulators

Difficulty measuring methane slows plan to slash emissions

Last Updated: Tuesday, January 31, 2023

Satellites, drones and airplanes equipped with infrared cameras will likely be the backbone of a new federal policy to fine the nation's largest methane polluters

NEW YORK (AP) — The doors of a metal box slide open, and a drone rises over a gas well in Pennsylvania. Its mission: To find leaks of methane, a potent greenhouse gas, so that energy companies can plug the leaks and reduce the emissions that pollute the air.

The drone is among an array of instruments whose purpose is to detect leaks of methane, which scientists say causes roughly 30% of manmade global warming. Along with satellites, ground sensors and planes armed with infrared cameras, drones are part of the backbone of a new federal policy to compel energy companies to record and slash their methane emissions.

The problem is, no one knows when — or even whether — that will be possible. Technology that might allow for precise methane measurements is still being developed. Under the Biden administration's Inflation Reduction Act, enacted into law last year, companies must start producing precise measurements of their methane emissions next year and face fines if they exceed permissible levels. Yet if no one knows how much methane an energy company has emitted, it's unclear that any fines could be justified.

Lost gas alone is worth an estimated $2 billion each year.

E Source client case study

Southern Company Gas serves approximately 4.2 million natural gas utility customers through its regulated distribution companies in four states and more than 600,000 retail customers through its companies that market natural gas.

- Across the Southern Company Gas service territory, leaks are discovered or encountered every day.
- To proactively repair services, field workers would use a gas detector and manually walk the lines to identify areas of concern.
- This process was very labor-intensive. Staffing and budgeting for the detection and repair of leaks is typically done by manual estimation.
- To meet forecasting, budgeting, and planning requirements, staffing decisions often must be made a year in advance.

Desired outcomes




Improve	Mitigate	Ensure	Provide
plans for internal and external costing for field operations work	risks of unplanned work activities in monthly work plans	resources are being optimized based on expected work activities	confidence that strategies and operational initiatives are feasible and/or are being achieved

Enhanced effectiveness of resource and budget planning

If the team at Southern Company Gas reduced overestimated manpower for leak detection by 5%, annual cost optimization opportunities could be expected to reach $500,000+ per year. Reducing underestimated manpower by 5% could optimize $300,000+ per year.

Survey leak forecasting: Overview

Null hypothesis: Predicting future leak survey results relying on historical leak survey data will produce a "just as good" result as relying on predictive analytics

Phase 1

Forecast incoming leaks from leak survey process

- Determine key variables (pipe age, location, etc.)
- Forecast 18-month view to inform resource planning

Phase 2

Productionize the model inside Southern Company's systems

- Continuous updates
- Visualization and interaction tool with PBI dashboard

Key result

In aggregate, reduced error rate by 75%

Expansion to Phase 3 customer call leak analysis

Data inputs

Call center and job order data

CIS data
20 variables

GIS pipe data
10+ variables

Historical leak survey data
64 variables

Weather data
30+ variables

Total: 120+
variables

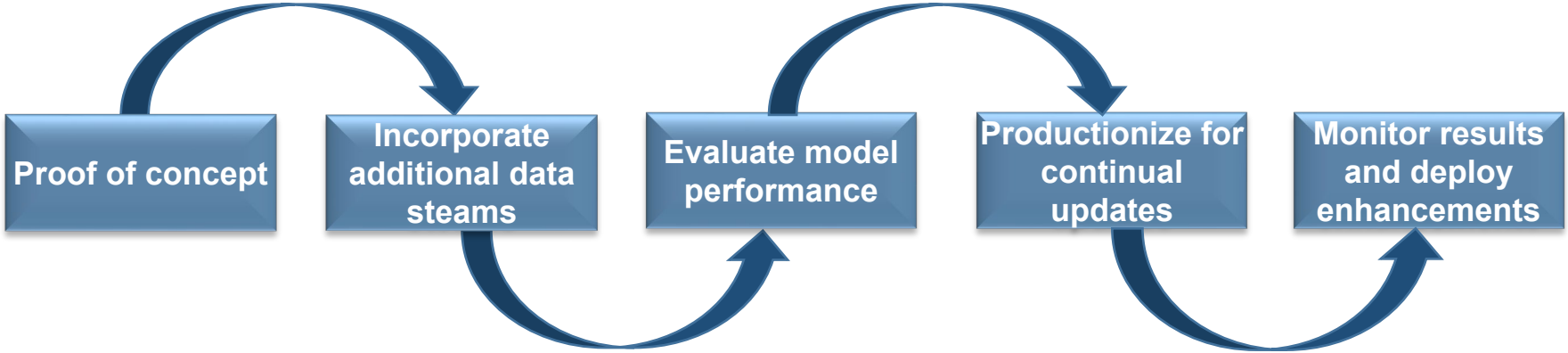
Predictors considered

Data variable		
Region	Survey completion time	Correct grid number
Company	Survey status	Odd riser location
Meter location	Leak grade (1, 2, 3)	Comments
Service center	Leak type (meter, service, main)	Ad-hoc status
Grid #	Leak location code	Map page / grid
Survey interval	Leak details	Customer conversation
Premise address	Riser data (type, size)	Date-time data of survey
Appt #	Curb box	Numeric data*
City	Map correction reason	Grid survey schedule data
State	Correction comments	Compliance data
Survey type	GIS pipe data by service center	

Major predictors utilized

Data variable		
Region	Survey completion time	Correct grid number
Company	Survey status	Odd riser location
Meter location	Leak grade (1, 2, 3) -1 not utilized	Comments
Service center	Leak type (meter, service, main)	Ad-hoc status
Grid #	Leak location code	Map page / grid
Survey interval	Leak details	Customer conversation
Premise address	Riser data (type, size)	Date-time data of survey
Appt #	Curb box	Numeric data*
City	Map correction reason	Grid survey schedule data
State	Correction comments	Compliance data
Survey type	GIS pipe data by service center	**Numeric data corresponds to corrosion type, repair needs, soil subsiding data, bollard data, 30+ numerical leak data points.*

Data science approach



Progressively move toward a more fully automated AI-driven tool that predicts leaks in real time, staffs accordingly, and re-routes a smaller, more efficient group of field workers to most efficiently manage the end-to-end leak management process.

Gas leak survey prediction modeling process

Gas leak predictions: Year-to-date view

Delivered a **self-updating** dashboard to visualize the model outputs for forecasting and communication.

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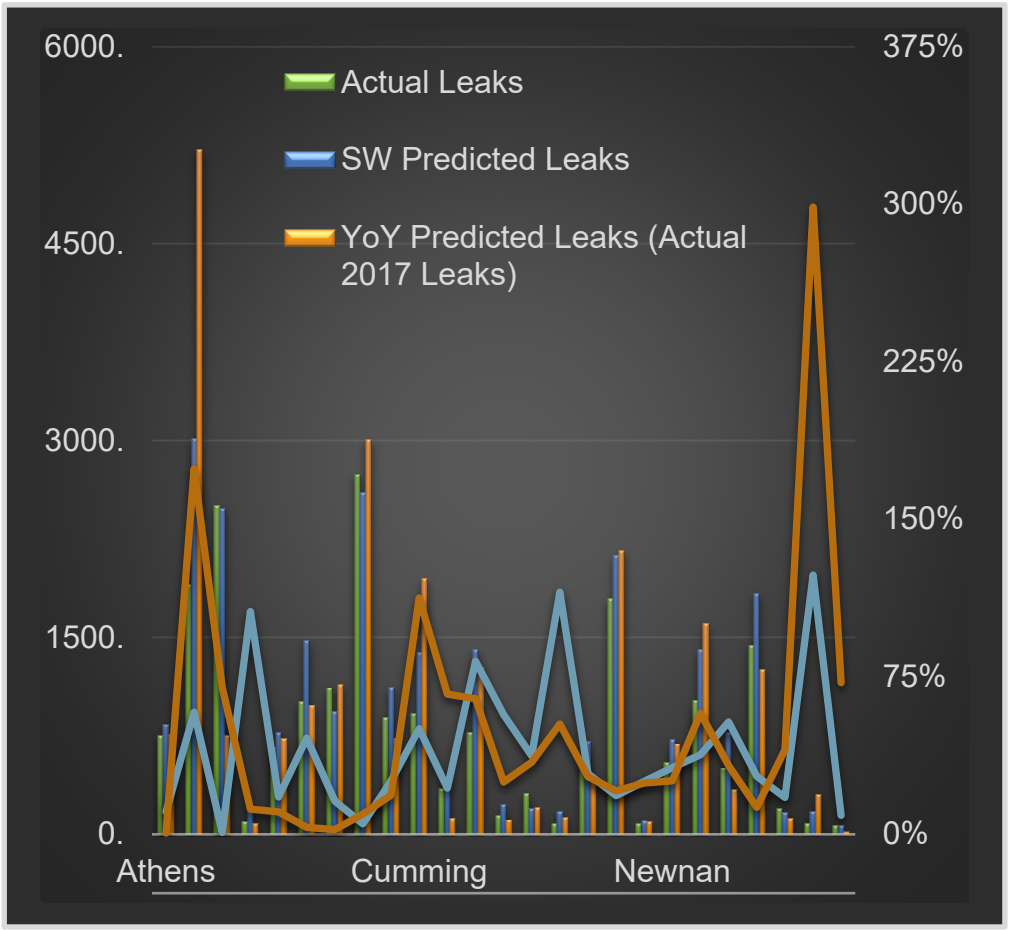
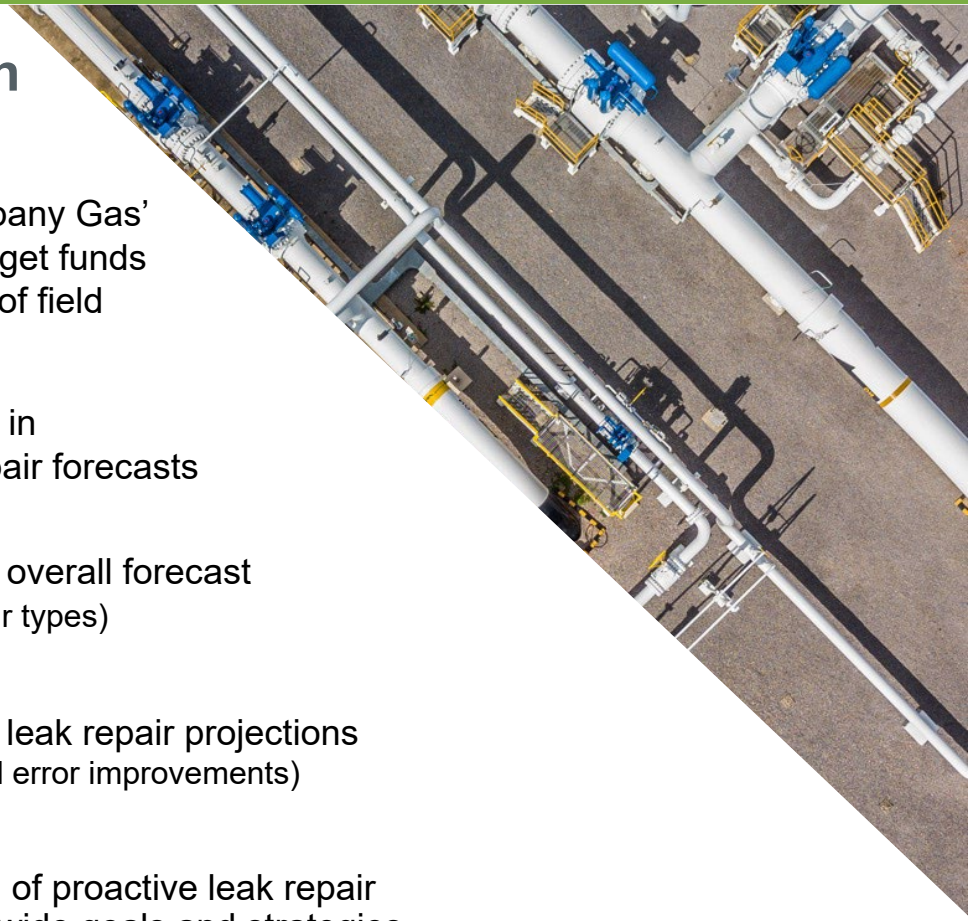
Gas leak predictions: Historical view



Results: Prediction accuracy

- ✓ Predictive analytics were within 5.8% of the total number of leaks detected in 2018
- ✓ The model did better than year-over-year predictions for annual leaks detected
- ✓ At an individual service center level, the model cut predicted error in half

Predictive analytics' effectiveness in achieving desired outcomes



- Improved directional accuracy of Southern Company Gas' forecast enables more effective allocation of budget funds across the enterprise due to enhanced planning of field overtime and/or sourcing activities
- The predictive algorithm was used as a key input in generating 2021 and subsequent annual leak repair forecasts
- Testing identified marginal error improvements in overall forecast for leak repairs of 15% to 20% (based on leak repair types)
- Estimated budget allocation benefits of improved leak repair projections could be more than $0.2 million (based on marginal error improvements)
- Allowed for effective determination and validation of proactive leak repair strategies, while supporting other key enterprise-wide goals and strategies

Exploring the possibilities with predictive analytics

Exploring the possibilities

Capital deployment

Shut off for nonpayment

Other above-ground work volume

Below-ground work volume demand

Customer satisfaction

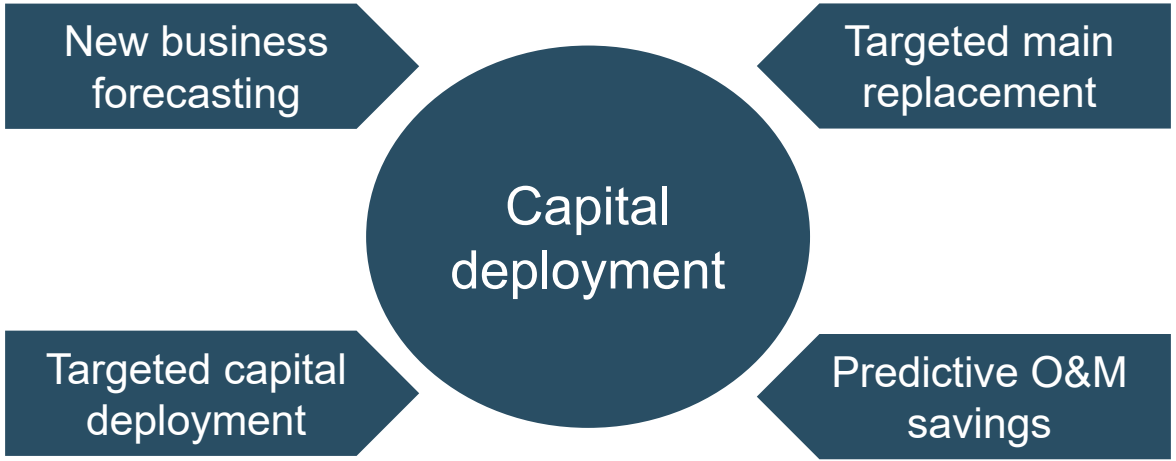
Resource supply

Emergency leak volume demand

Contact center optimization

Other opportunities

Exploring the possibilities



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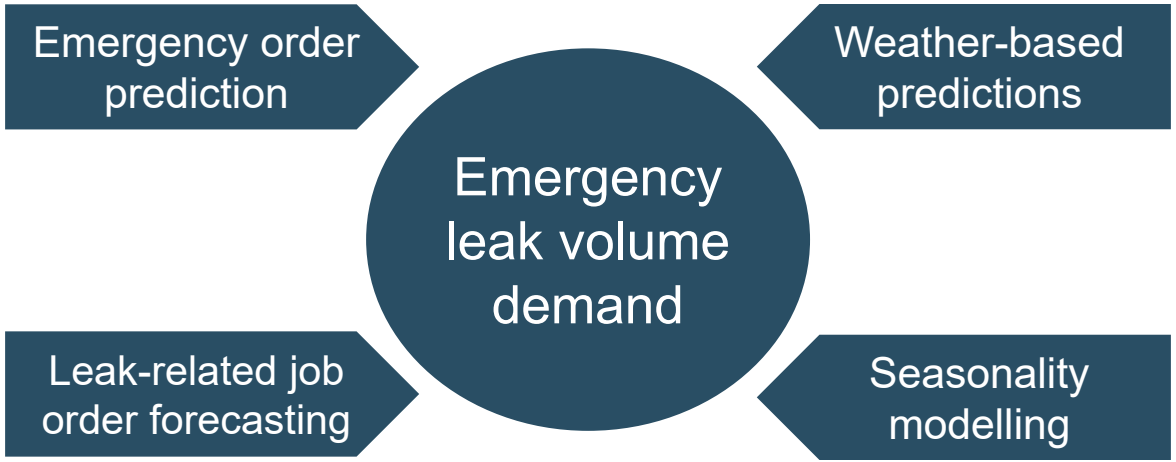

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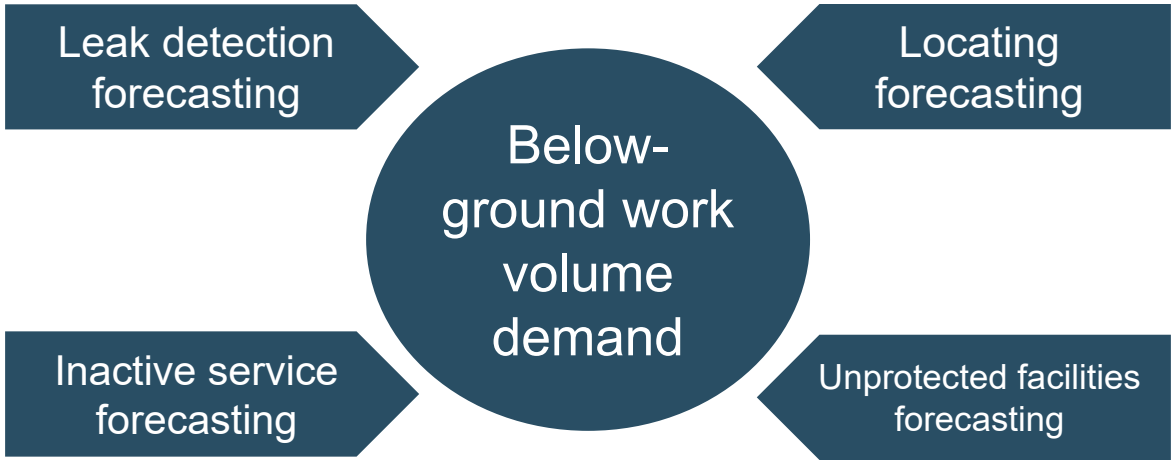

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