



REX2024
PRCI Research Exchange

Deep Dive Session: Artificial Intelligence in the Energy Industry

Challenges, Opportunities, and Successes of AI

Moderator: Justin Johns
San Diego, California
February 27, 2024



Pipeline Research Council International



Safety Moment

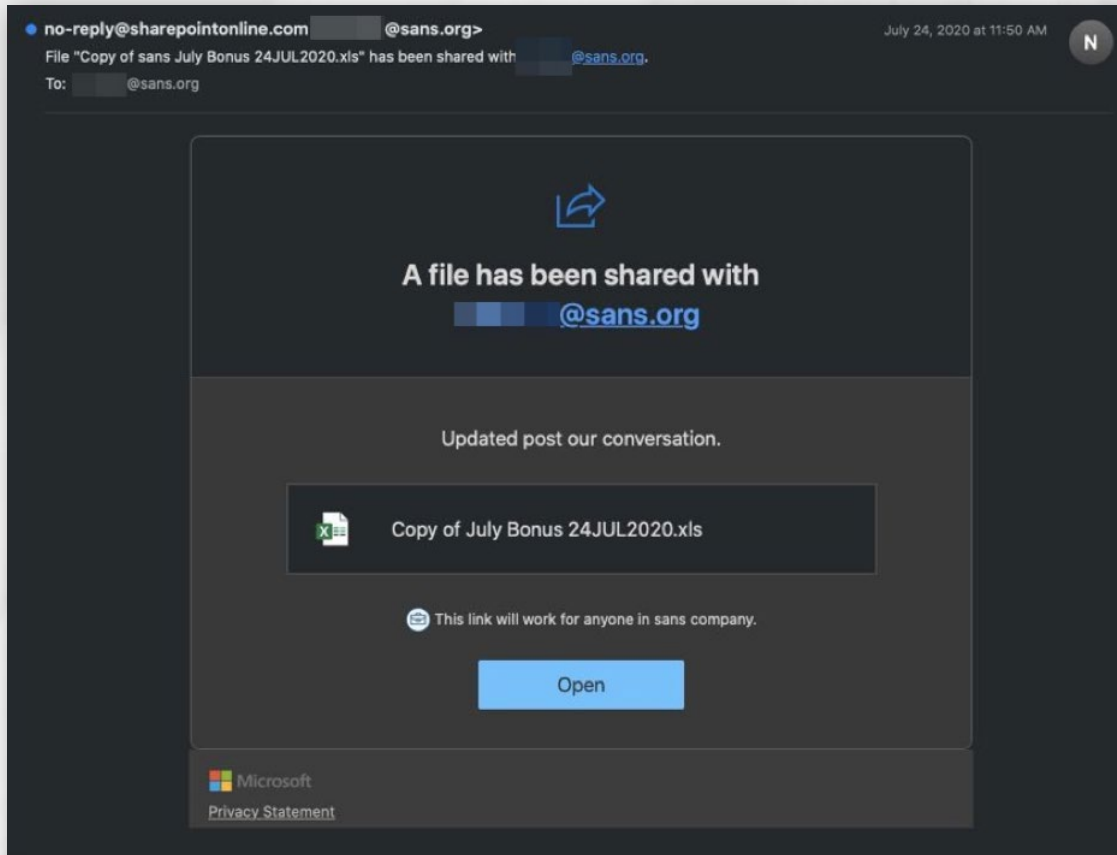
Consent Phishing

Even the Pro's Can Be Phished

On Tuesday, August 11, 2020, SANS, a trusted leader in cybersecurity training, disclosed a security breach within their organization which was the result of a successful Consent Phishing campaign. The phishing email enticed a single employee to install a malicious Office 365 add-in for their account. The O365 add-in caused a forwarding rule to be configured on the victim's account, which resulted in 513 emails, containing 28,000 confidential records being forwarded to an unknown external email address.



The Phish



- The body of the email was designed to look like a Microsoft issued File Share email.
- The recipient was enticed to click the “Open” button, which initiated the installation of a malicious Office 365 app.
- The malicious app set a rule to forward emails containing specific keywords, (finance, payment, transfer, etc.)



user@contoso.com

Permissions requested



Contoso Test App
zawad.co

This app would like to:

- ✓ Read and write your files
- ✓ Read your calendar
- ✓ Sign you in and read your profile

Accepting these permissions means that you allow this app to use your data as specified in their [terms of service](#) and [privacy statement](#). You can change these permissions at <https://myapps.microsoft.com>. [Show details](#)

Cancel

Accept

The OAuth Consent Redirect

- After clicking the deceptive link, the employee was prompted to grant access permissions to the malicious web app that simulated an Office 365 OAuth app.
- Unknowingly the employee complied with the request and granted permissions.
- As a result 513 emails containing 28,000 records of confidential information (PII) were forwarded to a suspicious external email.

3 Things to help you identify a Consent Phishing attempt

#1 Validate

- Is this email something you were expecting?
- Do you recognize the sender's email?
- Is the sender's email from a suspicious domain?

#2 Check Links

- When you hover over any hyperlink, is the link to an address for a different website?
- If using mobile, validate on your desktop.

#3 Say "NO" to Pop-Up apps

- If a window pops up asking for authentication: Validate, check links, and if in doubt report via 'Report Message'.
- Trust your intuition.

If it seems 'phishy', it probably is.

Artificial Intelligence in the Energy Industry - A few use cases

PRCI REX 2024
SERGIO ARMENTA, TC ENERGY

FEBRUARY 27, 2024

AIDEN at TC Energy

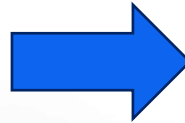
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Who is AIDEN?

Self-named power virtual agent using several internal TC Energy communication parameters

Artificial Intelligence Driven Employee Navigator

It even described himself



AIDEN Model:

GPT 4.0 Turbo (OpenAI's most advanced system!)
Teams+RestAPI+Azure Open AI

I am AIDEN, an AI chatbot designed to assist internal company employees at TC Energy with information and tasks relevant to their work. My architecture is based on a complex series of algorithms and machine learning models that enable me to understand and process natural language, respond to queries, and provide assistance.

AI chatbots like me typically operate on a combination of technologies, including:

- 1.Natural Language Processing (NLP):** This allows me to understand and interpret human language, enabling me to communicate effectively with users.
- 2.Machine Learning (ML):** Over time, I learn from interactions to improve my responses and provide more accurate information.
- 3.Data Retrieval Systems:** These systems help me to access and deliver information that is stored in databases or other knowledge bases.
- 4.Cloud Computing:** Often, AI chatbots are hosted on cloud platforms, allowing for scalable resources and access from anywhere.
- 5.APIs:** Application Programming Interfaces allow me to interact with other software systems and services to perform tasks or retrieve data.

My purpose is to assist and streamline the workflow of TC Energy employees by providing them with quick and accurate information, thereby enhancing productivity and efficiency.

AIDEN vs. ChatGPT

Artificial Intelligence Driven Employee Navigator



AIDEN



ChatGPT



Adherence to TC Standards

Tested by Privacy, Compliance, and Cybersecurity teams

Specific TC Disclaimers



Blocked by Cybersecurity

Lacks standard 3rd party cybersecurity assessments and multi-factor authentication

Capability to Ingest Internal Data

Expanding use cases and value opportunities

Data remains internal, yet, it does have access to the internet



Data Limitations

Only includes publicly available data

Information Accuracy

Technical backend control should remove hallucinations

100% certainty on results



Risk of Hallucinations

False information may be presented as fact



Day to Day Applications

Use Case	Examples of Inputs
Summarizing Information	Can you summarize the following information into simpler terms? + pasted paragraph
Drafting Documentation & Messages	Can you review and correct the email draft below? + pasted email
Creating Templates for Meeting Agendas, Emails, Invites, Safety Moments, etc.	Create an email template for a project status update.
Microsoft Tools & Citizen Development	Create an excel formula that will calculate the number of days in each of the month, for which the dates are given.
Research	What is BYOD? Please give me a brief history of GTN pipeline.
Soft Skill & Leadership Guidance	How can I better give direct and empathetic feedback to struggling employees? What are the most important qualities of a leader?

Future Plans for AIDEN



Connecting to our
Intranet



Accessing 2024 Data



Informing and
Engaging Users



Ingesting SAP Data



Ingesting ServiceNow
Data

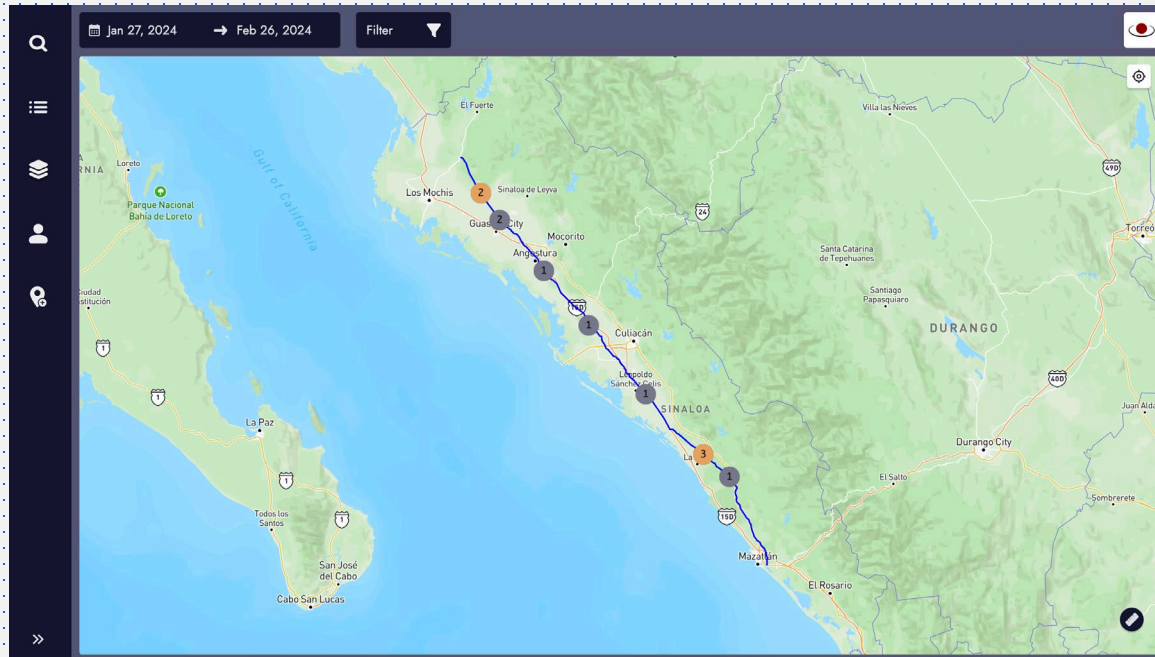
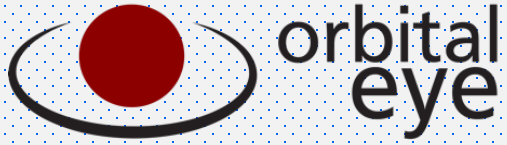


Integrating with Joule

Satellite-data & AI for monitoring Third Party Interferences

THREAT DETECTION MEXICO

FEBRUARY 27, 2024



Satellite-based pipeline monitoring

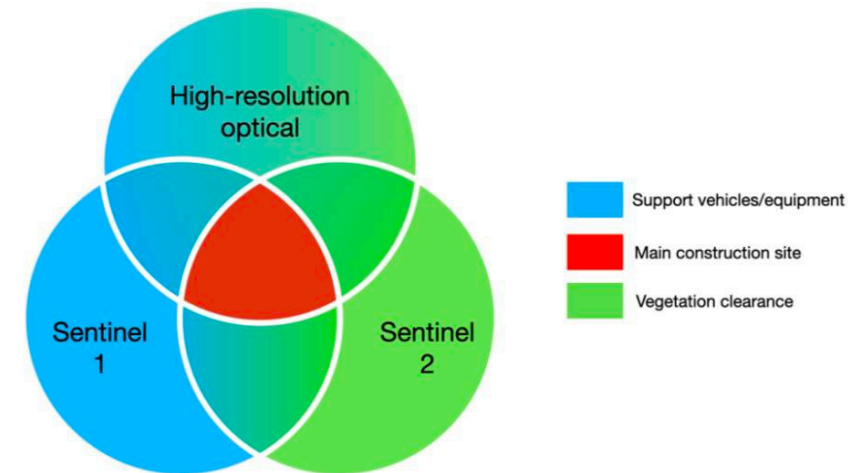
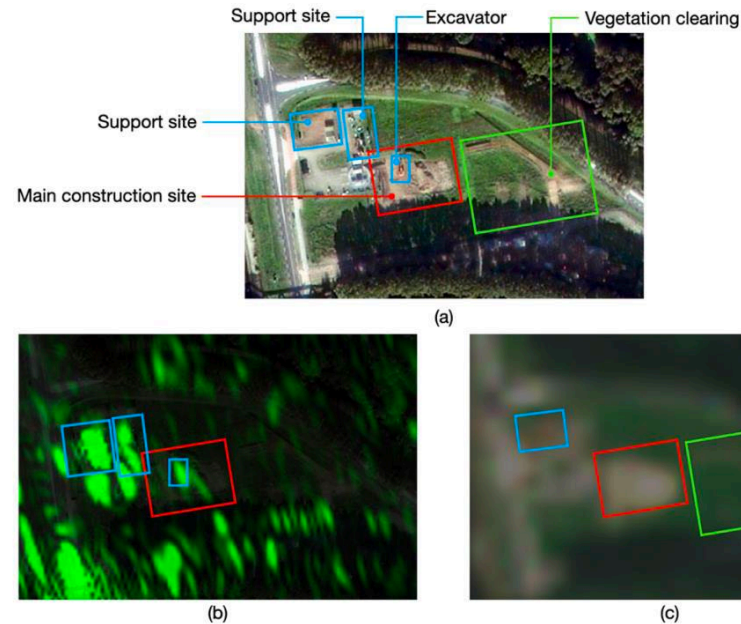
In 2023, TC Energy Mexico started monitoring the Mazatlán pipeline (450km) using satellite-data with COSMIC-EYE, a tool from Orbital Eye.

COSMIC-EYE is a satellite-based monitoring solution to detect Third Party Interferences such as excavations and encroachment on the ROW.

AI & Machine Learning are integrated for:

- Automated detection of activities in the pipeline RoW
- Filtering out of irrelevant activities
- Automated optical tasking

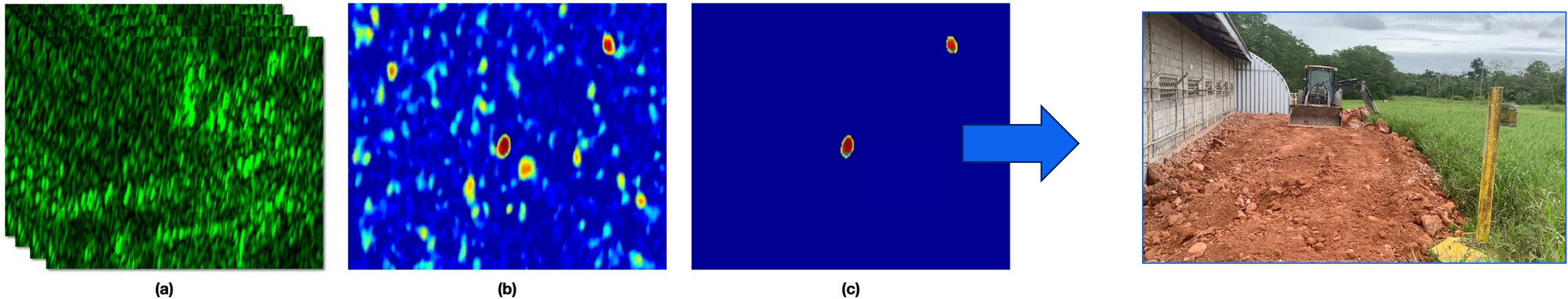
Step 1: Detect activities using satellite data



Activities are automatically detected through the analysis of 3 different types of satellite data

- a) Synthetic Aperture Radar (SAR) satellite data - Sentinel 1
- b) Multispectral satellite data - Sentinel 2
- c) High-resolution optical satellite data – Commercially available array of satellites

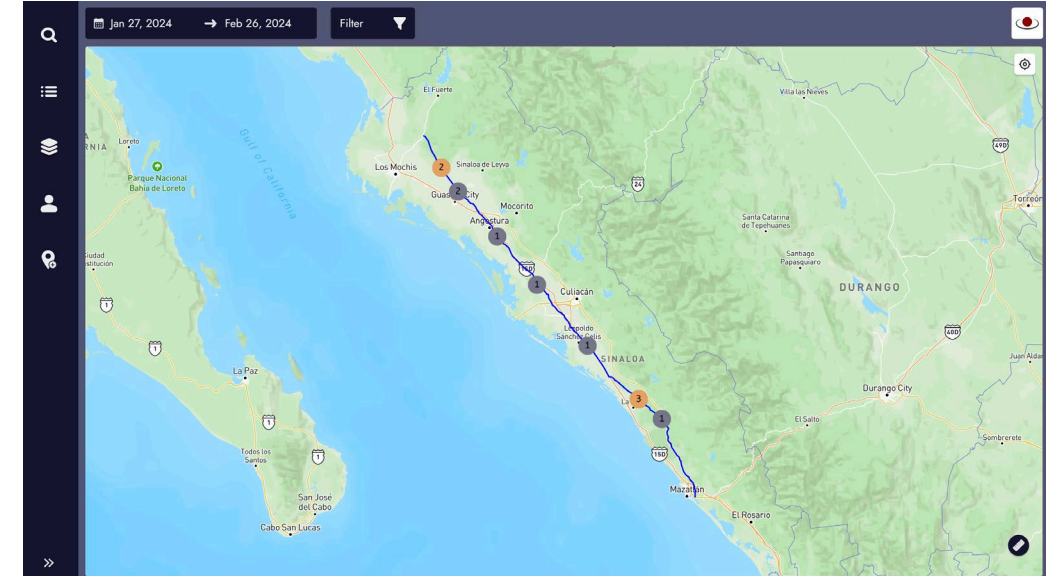
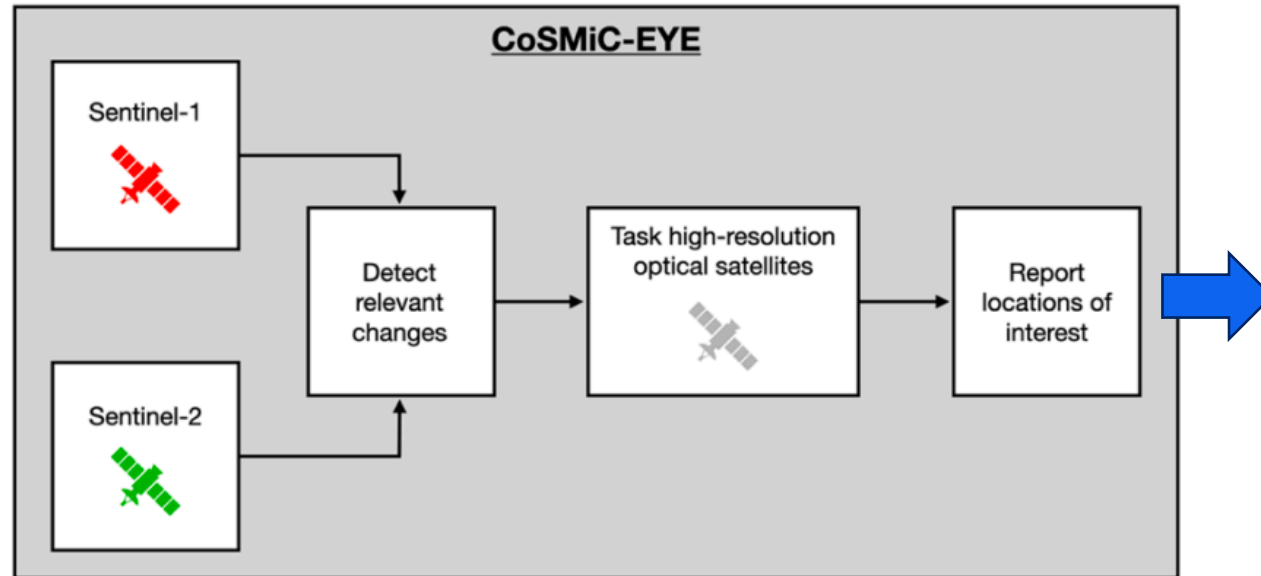
Step 2: Filter out irrelevant activities



3 steps that define the change detection algorithm of the COSMIC-EYE technology:

- a) Stack of radar images
- b) Change detection heat maps
- c) Filtered change maps identifying and eliminating all non-threatening events

Step 3: Automatically task high-resolution optical satellite data



Business Strategy

- Optical data is costly, therefore AI-based algorithms are used to optimize and automate tasking
- Only ordering data for locations where activities take place
- Satellite data image licensing; no added archiving costs



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Operationalizing AI/ML within Utility Organizations

Examples of Utility Focused AI / ML Use Cases

Ben Dwinal, Locana a TRC Company
San Diego, California
February 27, 2024



Pipeline Research Council International

Geospatial AI Defined

Apply spatial machine learning and deep learning techniques to help solve complex problems and derive deeper insights.

Ability to scale complex data processing challenges that have traditionally been cost or time prohibitive for most organizations.

Opportunities Presented by AI/ML

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Unlock the Power of Your Data

Problem:

- Unable to exploit Maximum Value from Existing volumes of Data

Opportunity:

- Reduce time/cost to **maximize value of existing data** to generate new or update existing data.
- Achieve **higher Accuracy / Reliability**

Get Maximum Value out of Your Data at Reduced Cost

Data Enrichment / Completeness

Problem:

- Costly and Time/Resource Intensive to generate data or fix inaccurate data

Opportunity:

- Deep Learning Models can be **scaled to process large volumes of data** at lower cost and faster
- Improving Remote Analysis/Planning Capabilities – **Reducing Truck Rolls**

Improving Data Quality and Completeness

Verbal Prompt Analyses (NLP)

Problem:

- Situational Analytics Dependent on Data Stewards / Technical Skills

Opportunity:

- **Reducing technical skill needed** to access real-time Data and Conditional Analyses

Close the Gap between Decision Makers and Data



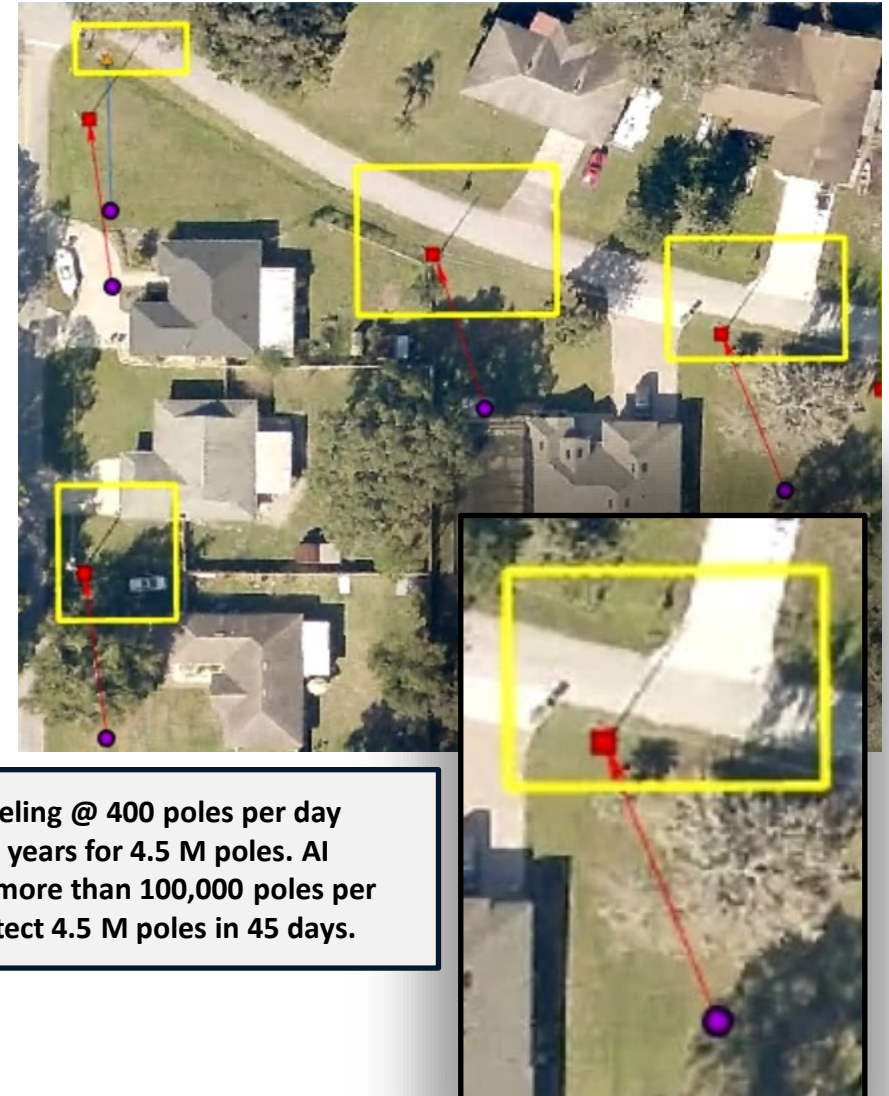
Automated Conflation

*Improve efficiency, safety,
and work accuracy with ML-driven
data improvements.*

Automated Data Conflation Using Computer Vision

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- Use Computer Vision to train a ML model for detection of pole locations in aerial or terrestrial imagery
- Leverages AI to improve locations via imagery & "shift vectors" (how far to move in which direction)
- Improves safety and accuracy of work, as sometimes features are so far off, they appear on a different street
- Scalable - AI approach resulted in **6X faster** workflow (5 days, reduced from 30)



Manual labeling @ 400 poles per day will take 30 years for 4.5 M poles. AI can detect more than 100,000 poles per day and detect 4.5 M poles in 45 days.

ML Driven Automated Conflation

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Today's challenge: Asset locations often don't meet the industry standard for accurate data, causing safety risks & inefficiencies for back-office and field teams. Traditional correction methods are lengthy and costly. Utilities need a faster, less manual way to improve the locational accuracy for all service regions.

High-Quality Data is Foundational

Back-office workers and field crews need high quality data to drive efficient and safe work. Regulatory bodies demand accuracy for compliance requirements.

Business leaders need reliable data for decision-making.

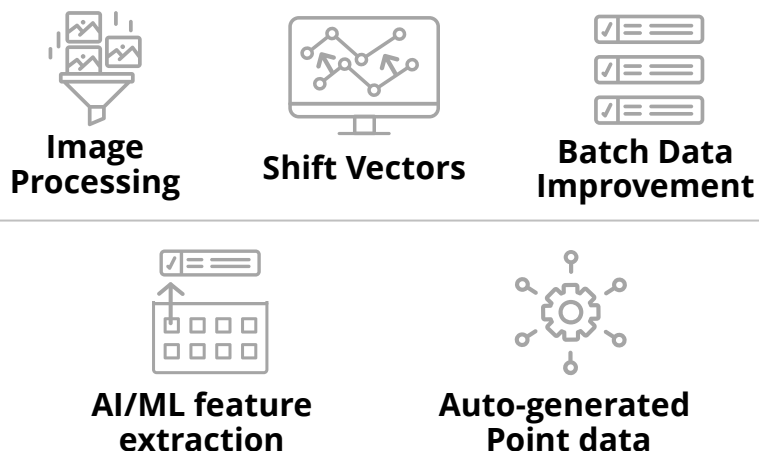
Utilities have invested in supplemental data like high-resolution imagery, but to date, traditional conflation processes have been too expensive or labor-intensive to scale effectively.

Using **ML-driven conflation techniques**, it's now possible to achieve high-quality, conflated data.

At scale.



Solution Components



How It Works

After an accuracy assessment, the source data options are reviewed to determine how to extract the best quality attributes. **E.g., High-quality imagery has proven effective for pole location.**

Automated steps then execute to perform AI/ML feature identification, new point locations, and how to update.

Results

Output includes:

- AI/ML derived location data extracted from imagery
- **Automated** feature-level shift vectors (*offset distance & angle*)
- Conflated data

Findings (*large utility pilot*):

- Updating locations with AI was **6X faster than manual** [5 days instead of 30]
- More areas processed bring **higher ROI**
- AI/ML based conflation process was **effective in areas with high-quality aerial imagery**

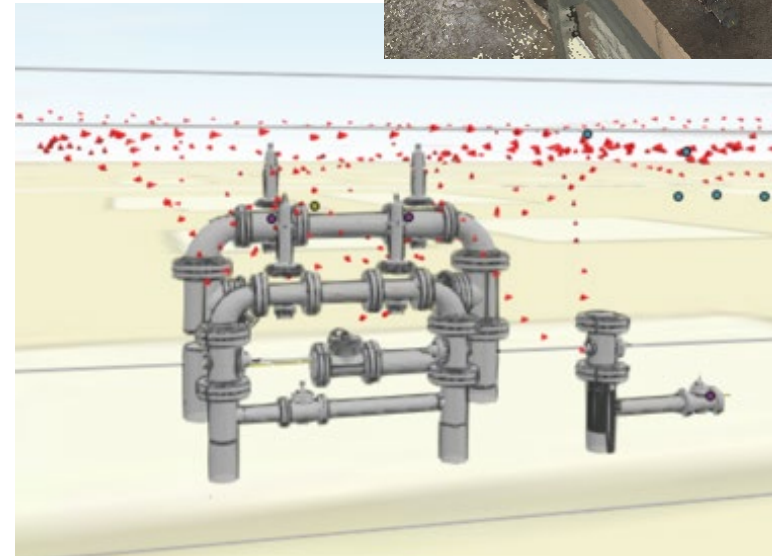
3D Station Modeling

Precise Station Mapping in days, enabling a VR Digital Twin and Achieving Higher Data Accuracy and Completeness

3D Station Modeling Defined

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- Onsite visit to facilities with 3D cameras to gather imagery of site and equipment
- Leveraging imagery for VR purposes, such as remote facility analyses/design/measurements
- **Computer Vision** - Object Detection of Utility Assets (Regulators, Valves, Control Monitors)
- AI/ML extraction generating missing assets / GIS features
- Data Completeness for Improved Analysis and Modelling Functionality
- Accurately Map Inside Facility Equipment



Data Enrichment and Completeness

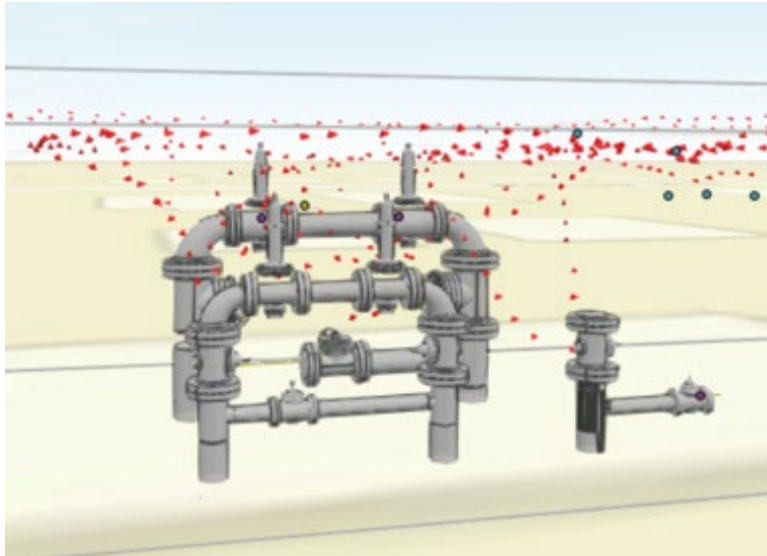
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Station Modeling is Foundational

You can connect transmission & distribution within the same digital network.

Optimally, with high-fidelity station data.

Affordable 3D and reality capture techniques turn station modeling exercises into a 1-hour capture event with a few weeks time to process the data.



Solution Components



Scanning & Collection



Image Processing



3D Modeling



Feature Extraction



Feature Classification



Condition Assessment

Specialized 360-view cameras are used to capture imagery and 3D point cloud data representing assets and their location. ML is then used to derive details like asset type, manufacturer, lot #, and extract serial # from equipment tags.

Enhanced digital network data sets with complete facility inventory and accurate spatial data, **reduced site visits**, and enabling **remote asset inspections** are a few of the benefits realized.

Results


Output includes:

- 3D Mesh / Scene
- 3D SaaS Viewer Access
- Lidar Point Cloud
- 3D CAD Model
- Extracted Network Features

Project results, 2 large utilities:

- Significant cost & time savings
- Increased crew safety with reduced site visits
- Improved Remote Analyses
- Capitalizable expense



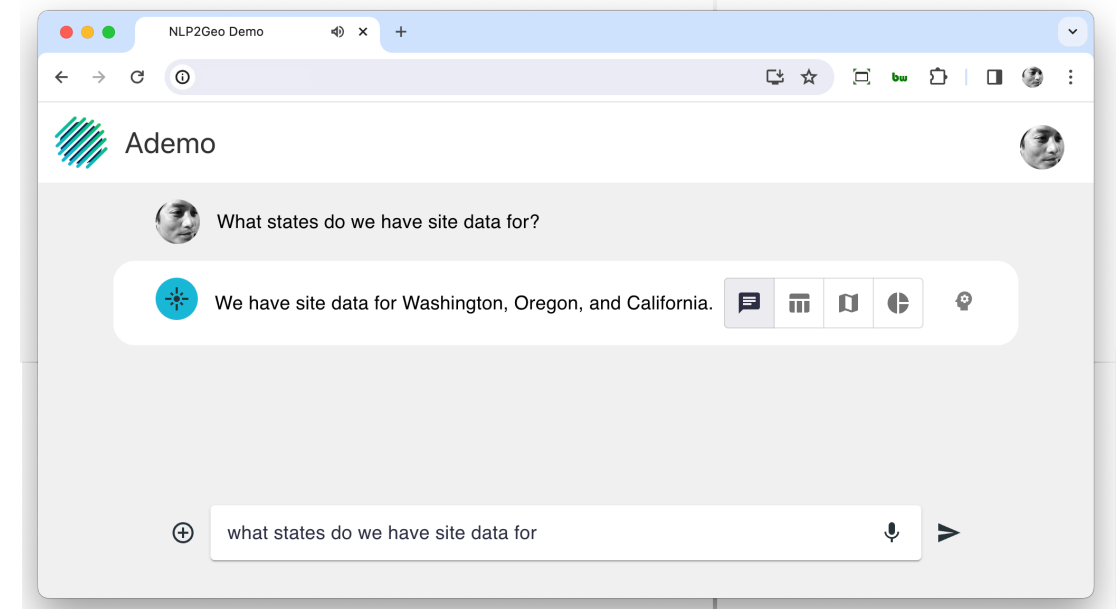


Generative AI - NLP

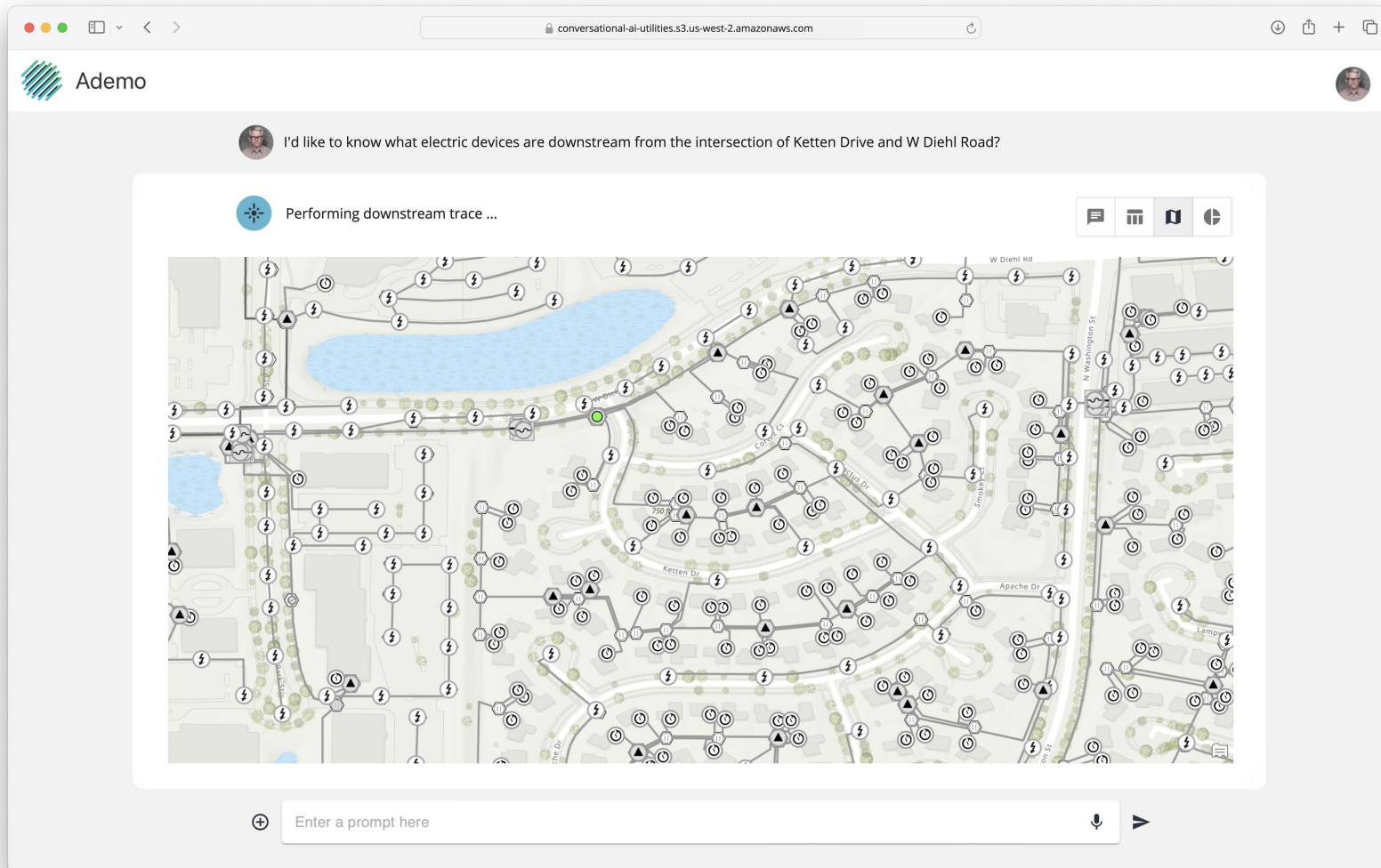
*Unlock the power and intelligence
of your data with natural language
prompts*

Natural Language Prompts – Spatial Analyses

- **Closing the gap between Decision Makers and High Value Data Analyses**
- Have a conversation about data in your own words through a chat interface.
- Natural language processing converts your questions into SQL or spatial queries and returns answers in kind.
- Makes volumes of real-time data more accessible, without needing specialized technical skills.
- Brings a new level of insight to business intelligence, that is easy to consume.

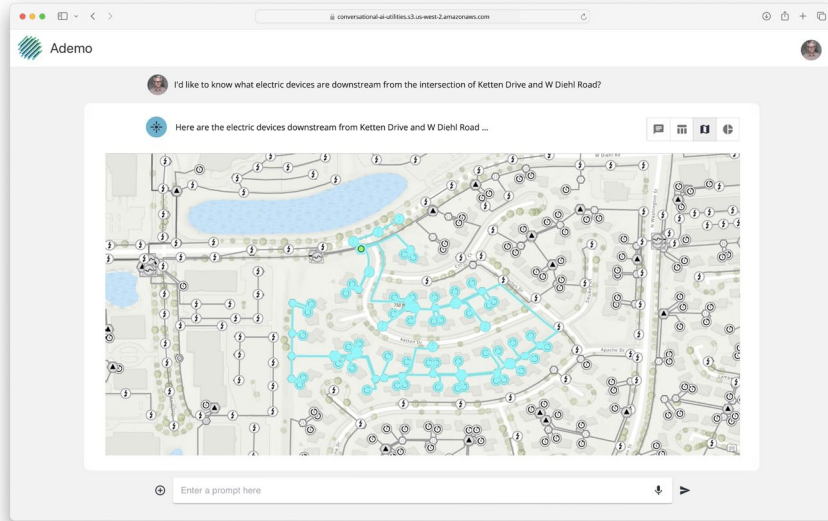


Utility Specific Prompts

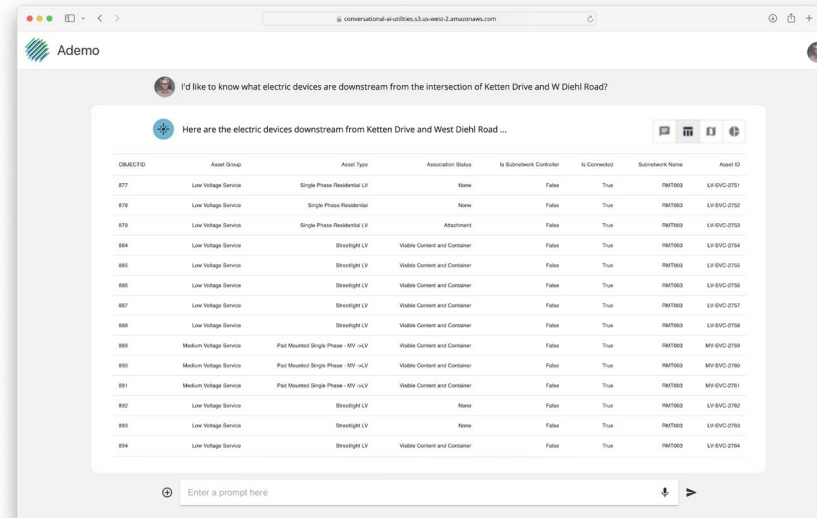


- **Utility Network – Natural Language Prompt**
- **Spoken :** “I’d like to know what electric devices are downstream from the intersection of Ketten Drive and West Deihl Road?”

Visual Response and Verbal Response



- **Response Includes a Map and List of Devices**
- **Text to Voice:** "Here are the electric devices downstream from Ketten Drive and W Diehl Road."



Considerations When Adopting AI/ML Capabilities

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Prepare

- Understand the Fundamentals and Value
- Address Legal and Ethical Considerations
- Evaluate Skillsets / Re-skill , upskill, Hire
- Define Organizational Strategy
- Systems / Technology

Define Your Business Cases

- Organizational or Technical Challenges
- Time or Cost Prohibitive Issues
- Data / Labor Intensive Use Cases
- Reducing Costs / Operational Overhead
- Improving Data Quality or Completeness

Data Governance and Fitting

- Evaluating Data For Use
- Where does it get stored?
- Understand Quality
- No forget features – Ignore Unfit Data
- Availability
- Volume

Model Design and Architecture

- Open Source or Proprietary
- Pipeline – custom or platform
- High Memory / High Compute



AI in the Energy Industry

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What have we learned from our 3,000+ client conversations and 700+ Gen AI projects so far

The 'first age' of Gen AI is coming to an end, characterized by explosive experimentation

Every industry is experimenting



have made significant investments in 2023

Every boardroom has discussed it



agree that their 3–5-year strategies will be impacted



Yet very few have been able to reap its value at scale



are achieving scaled value from AI, even less Gen AI

Fundamentals to drive AI-powered reinvention

01 Prioritize Investments

- *Balance of strategic bets vs. table stakes*
- *Ecosystem platform partners to provide base case technology*

02 Integration and Interoperability

- *Cross entity decision-making*
- *Assessment of technology re-usability*

03 Power of the 'Frozen Middle'

- *Ongoing top-down commitment*
- *Support to the execution layers*

The value in Energy – key AI (and Gen AI) plays

Assess and Develop

- Dynamic portfolio and capital management
- Subsurface prospecting
- Field development optimization
- **Capital projects**
 - Generative design
 - Resource and scheduling generative scenarios
 - Document management

Produce/Operate

- **Augmented asset integrity and management**
- **Field worker companion**
- **3rd party spend optimization**
- Production system optimization
- Safety advisory

Sustainability

- ESG compliance and reporting
- Carbon credits management
- N-tier supply chain decarbonization (scopes 2 and 3)

Trade (incl. VCO)

- Value chain decision impact simulation
- Augmented trading
 - Commodity price forecasting
 - Integrated risk optimization
 - Automated settlements

Sell/Serve

- Sales lead assistant
- Dynamic pricing recommendation
- Retail offer hyper-personalization







The AI Journey – moving from POCs to agile scaling



Plant the seeds

01

Responsible AI framework

AI inventory, risks, guardrails, organizational frame

02

ExCo awareness and education

Gen AI fundamentals, potential value, implications on digital core, talent, and Resp. AI



Build the foundations

03

Gen AI strategy + COE setup

Play identification and prioritization, readiness assessment, implementation plan, COE design and setup

04

Extended education

Gen AI fundamentals, socialization of strategy, how to get your teams on the journey

05

Start value delivery engine

Setup secure sandbox and start implementing the first Gen AI value case



Scale value

06

Agile scaling

Play implementation: data preparation, model training / tuning, application development, process transformation, change management, value realization

Thank you

Sergio Armenta

Manager Digital Enablement, TC Energy

Ben Dwinal

VP Solution Architecture, Locana a TRC Company



Jose Borges

Principal Director Global Strategy, Accenture

Justin Johns

Senior Manager Pipeline Integrity, TC Energy