

# OPAI AI Use Case Work Stream – Survey Results

March 2026 Update



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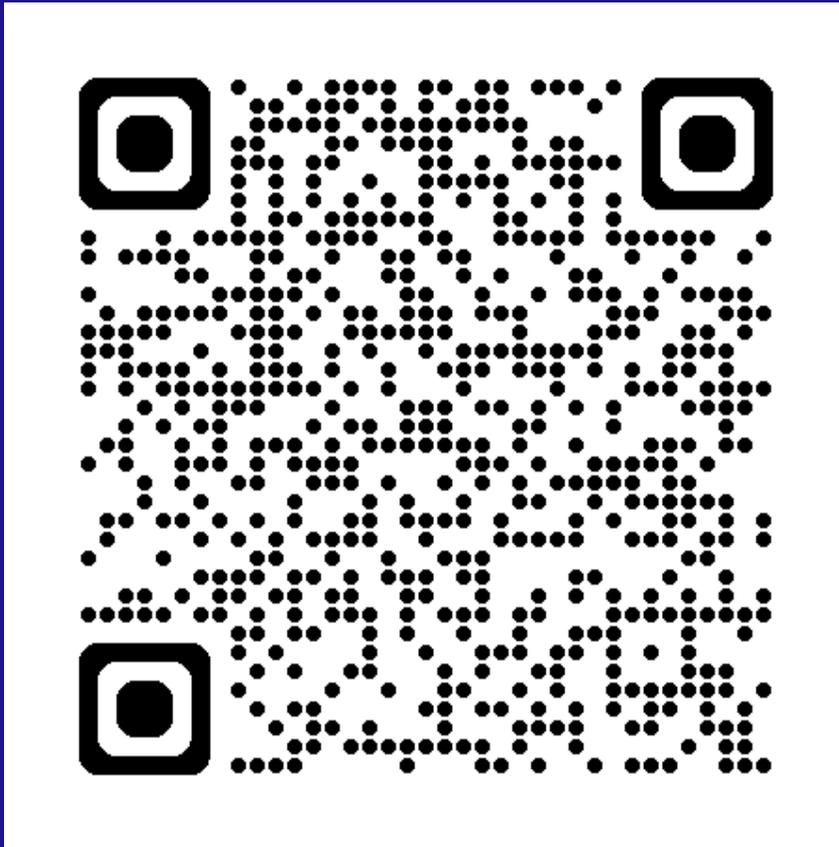
# OPAI Use Case Survey Links – Remains Open Indefinitely



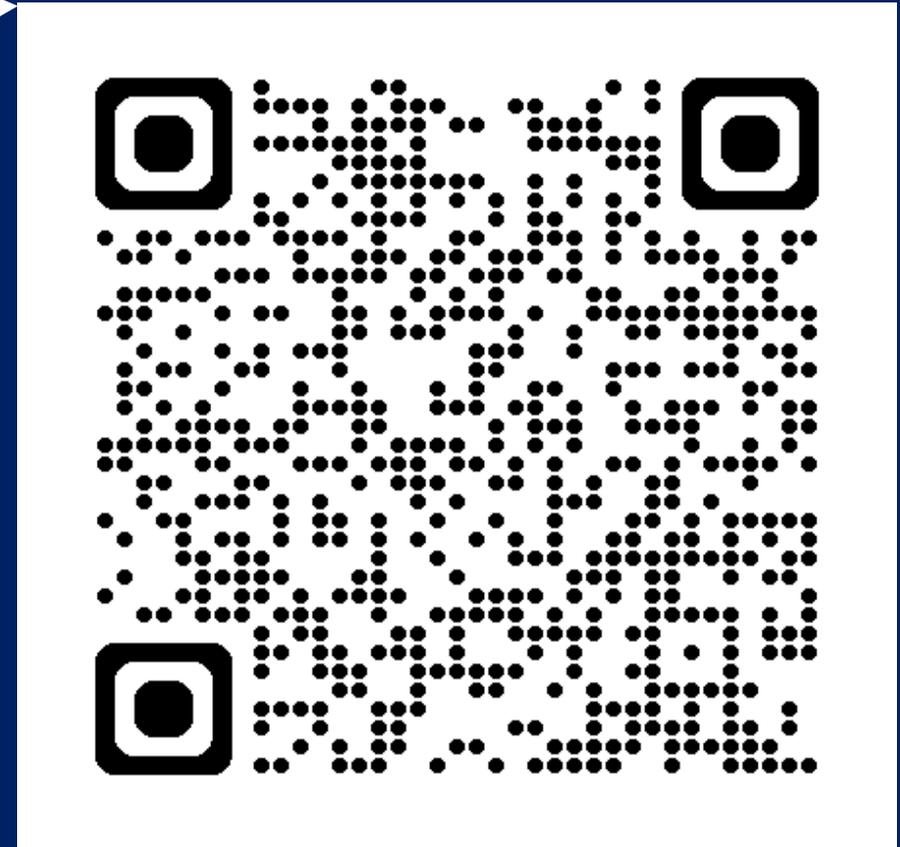
Energy Utility Survey



Technology Provider Survey



Click or Scan



<https://www.surveymonkey.com/r/OPAI-Use-Cases-Utilities>

<https://www.surveymonkey.com/r/OPAI-Use-Cases-Tech-Providers>

# Use Case Survey By the Numbers – So Far!



62

*91 Entities Submitted at  
Least 1 Response*



29

Utilities

11340

*12343 Data Entries (Evaluation,  
Maturity or Comment)*

1003

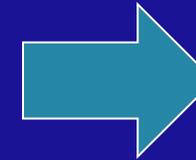
Technology Providers

*Assuming ~20 Seconds Entry – Cumulative Total of ~69 hours of data entry  
Thank You!*

# Transforming Survey Data to OPAI Member Value

Use Case  
Assessment  
Criteria  
Prioritization

- Top 5-10 Reliability and Resilience
- Easiest to implement
- Least risky...etc
- Company confidential benchmarks relative to industry



Utility and  
Industry Demo  
Spotlights

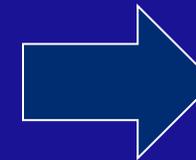
- Reference and spotlight utility or technology use case implementations

Use Case  
Functional  
Prioritisation

- Top 5 10 Asset Management
- Top 5-10 Operations
- Top 5-10 Markets, Nuclear....etc

Use Case to  
Technology  
Matching

- Map high priority use cases to medium to high technology solution maturity



Use Case Co-  
Development

- OPAI will bring forward the highest priority use cases for co-development
- Potential data availability identified in survey, utilities with highest need may provide



Published soon on  
<https://openpowerai.org/>



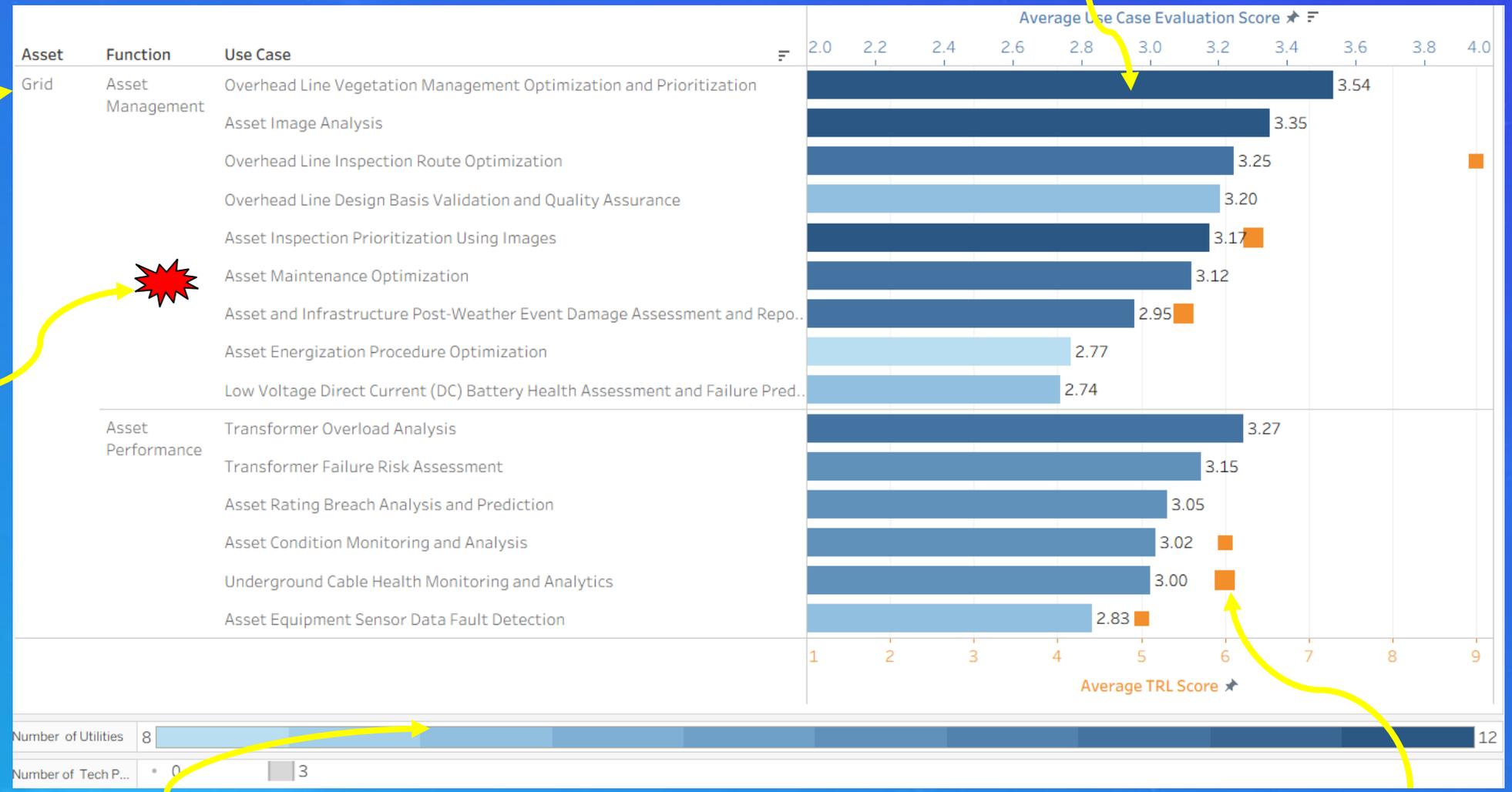
Use Case Co-Development

# How to Read the OPAI Use Case Survey Results Charts

Score is out of 5. 3+ is a good score. Shown on the blue axis. Sorted by highest score to lowest. Top 15 usually shown

Asset, Function and Name of Use Cases

A use case that an OPAI member has expressed interest in co-developing

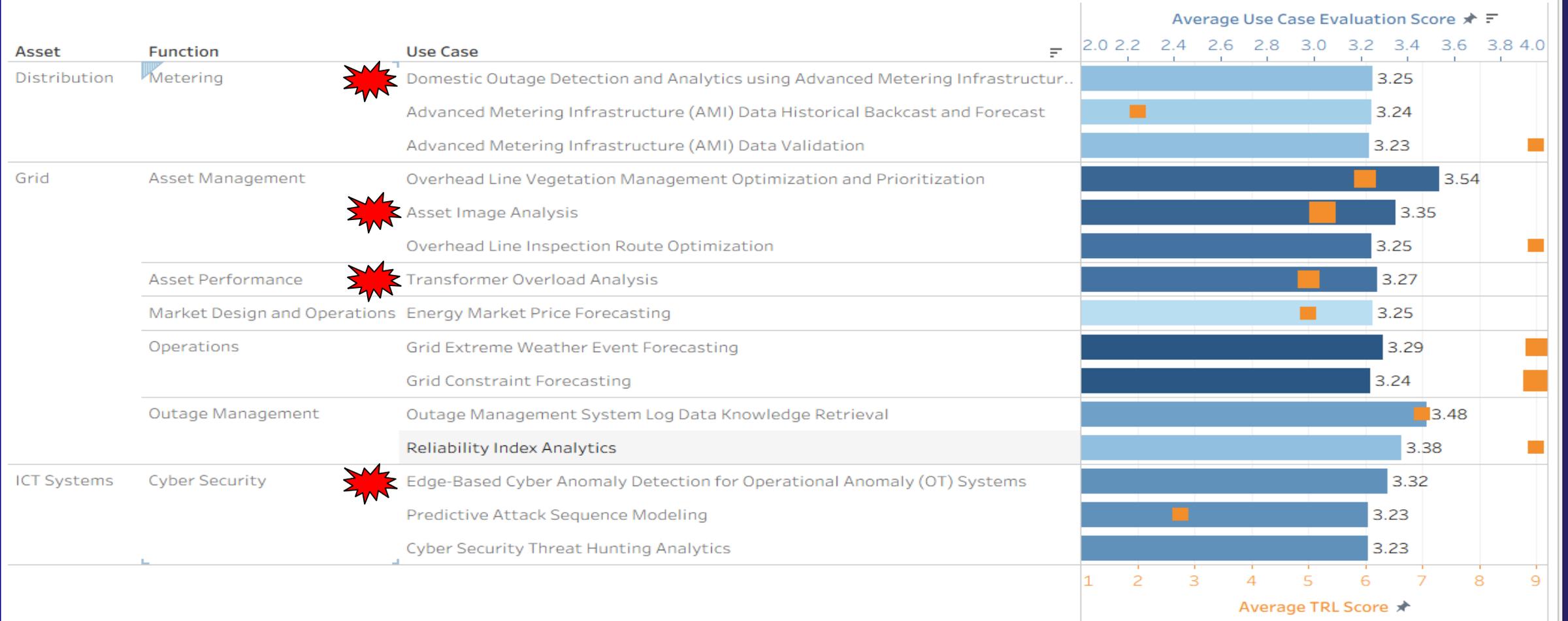


Color of the bars indicate the number of utilities who evaluated the survey. Darker is more utilities. Legend at bottom, usually 5+

Orange square is average TRL score 1-9. The size of the square indicates number of Tech provider respondents

# Top 15 of All Use Cases

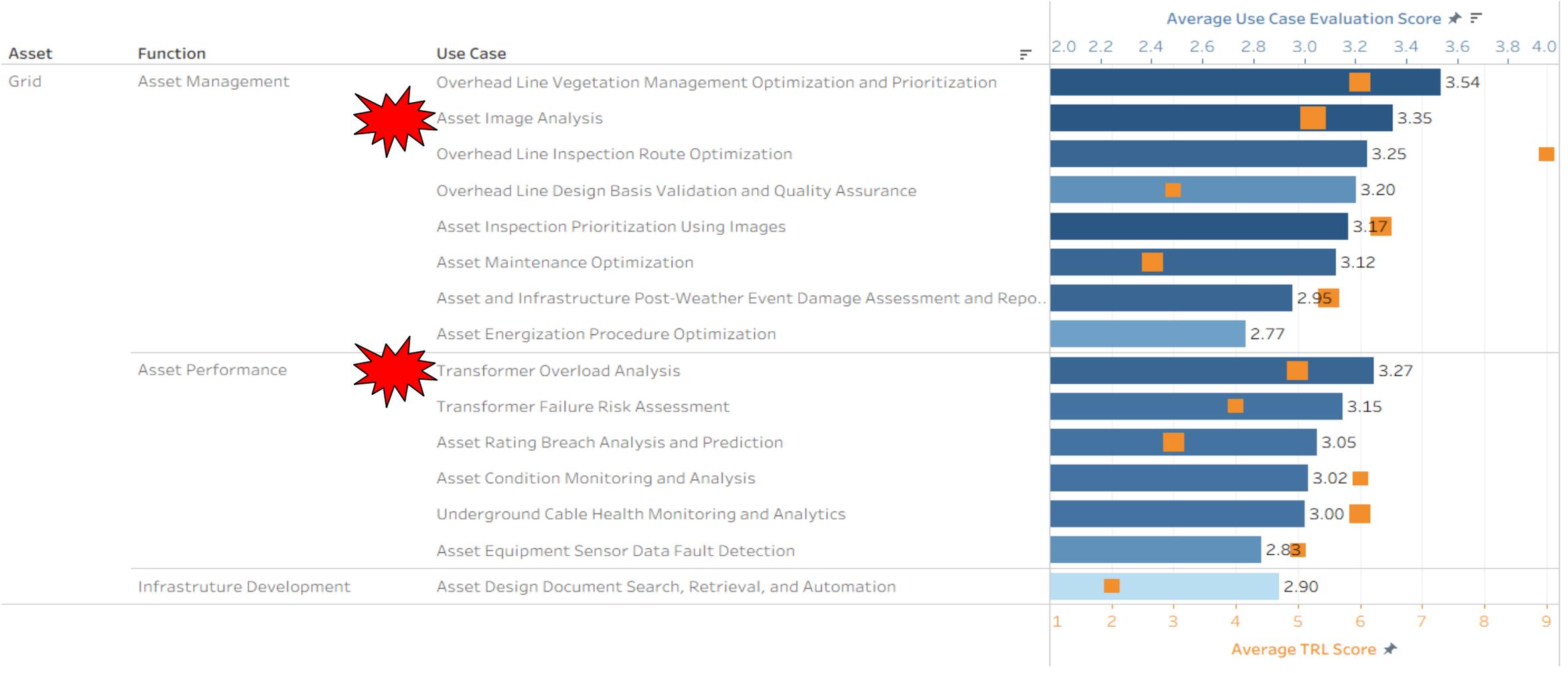
## Top 15 Use Cases Base - All



Number of Utilities	6	13
Number of Tech P...	0	3

# Grid Asset Management and Performance

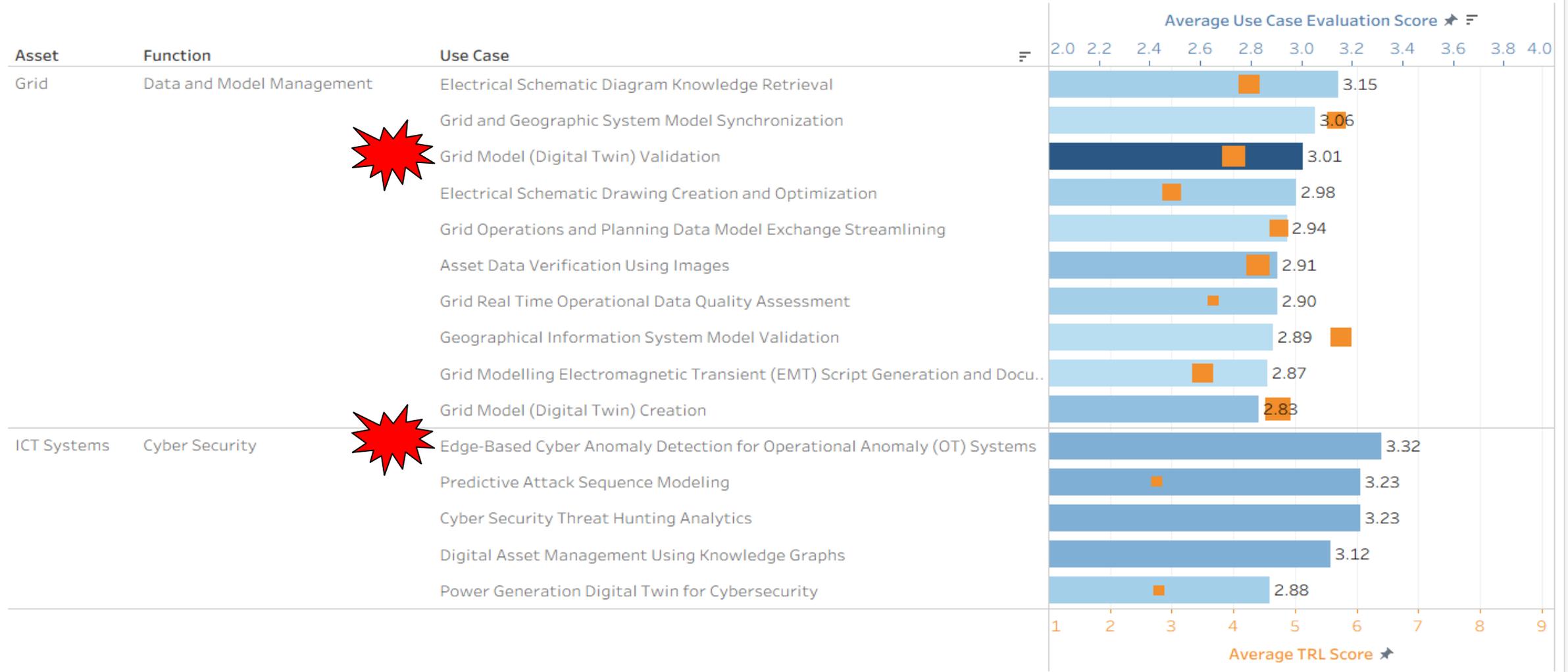
Top 15 Use Cases Base - Grid Asset and Infrastructure



Number of Utilities	5	12
Number of Tech P...	0	3

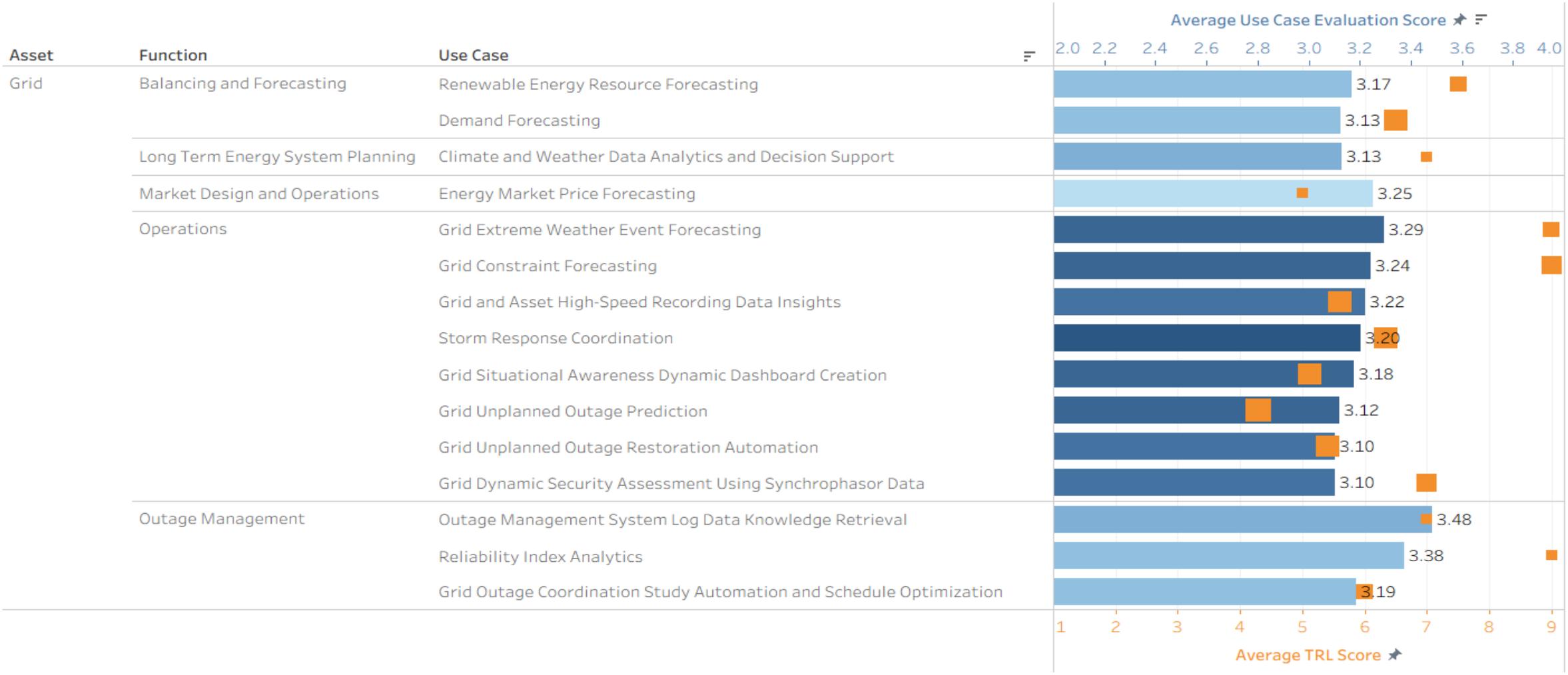
# Grid ICT and Data Management

## Top 15 Use Cases Base - Grid Data and ICT



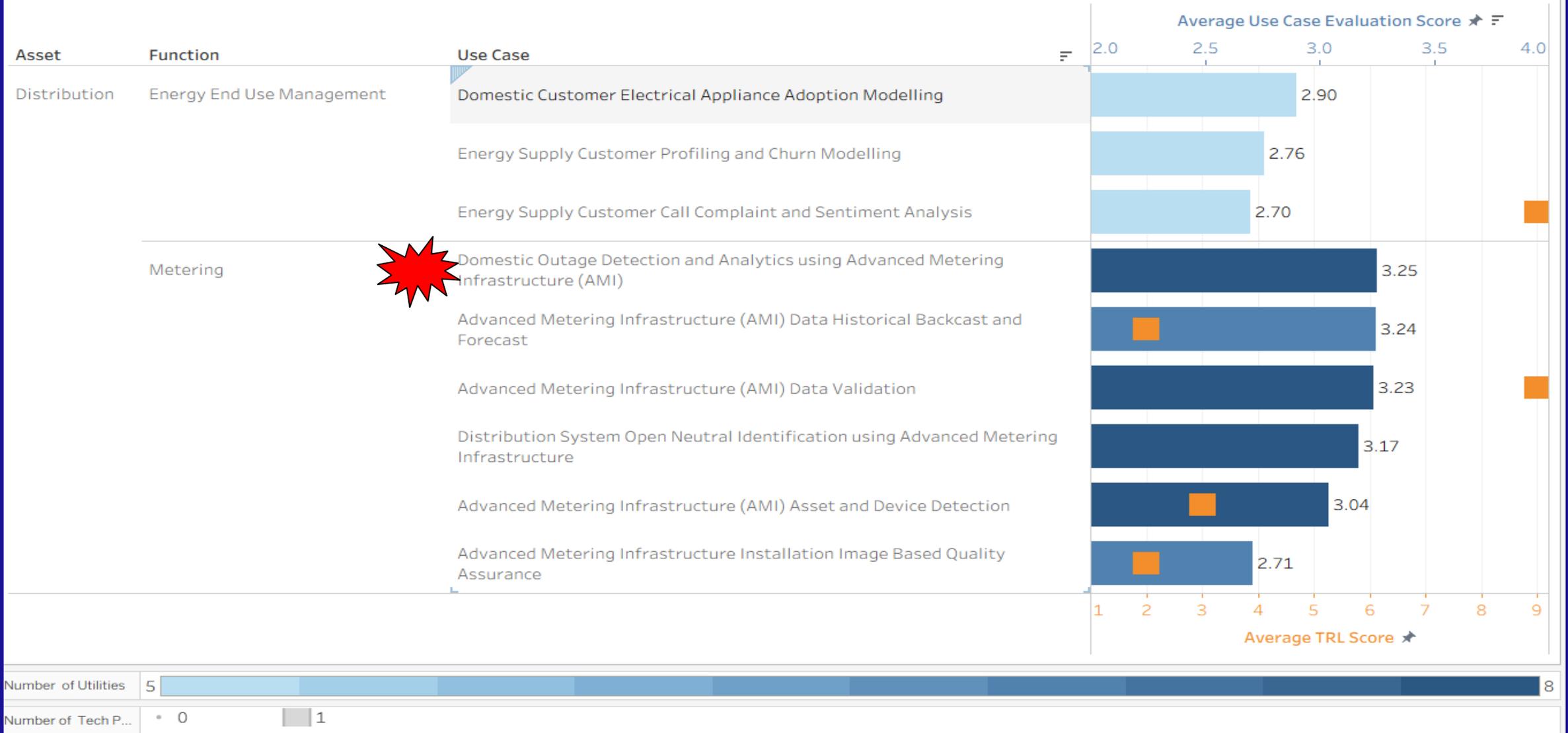
# Grid IGES T and D Operations and Planning

Top 15 Use Cases Base - Grid Operations and Planning



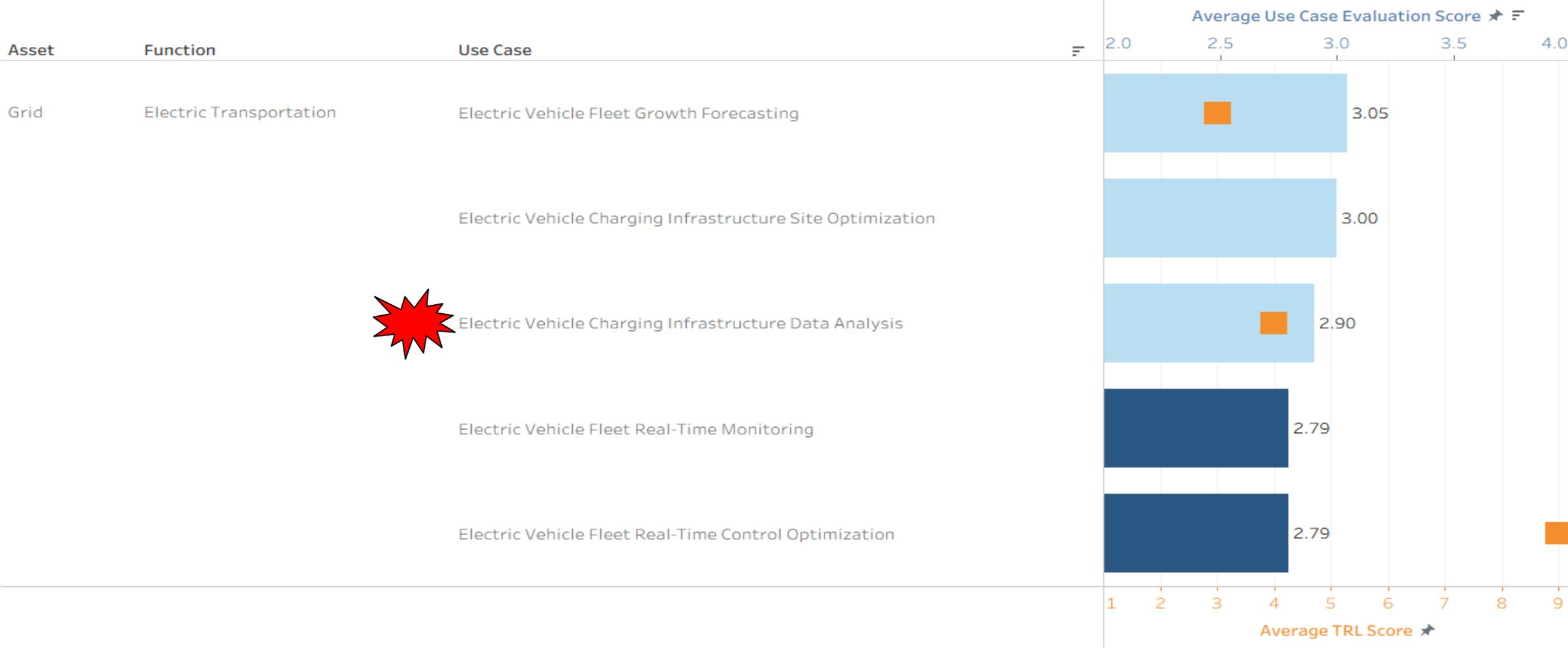
# Grid IGES Distribution

## Top 15 Use Cases Base - Distribution



# Grid IGES Distribution

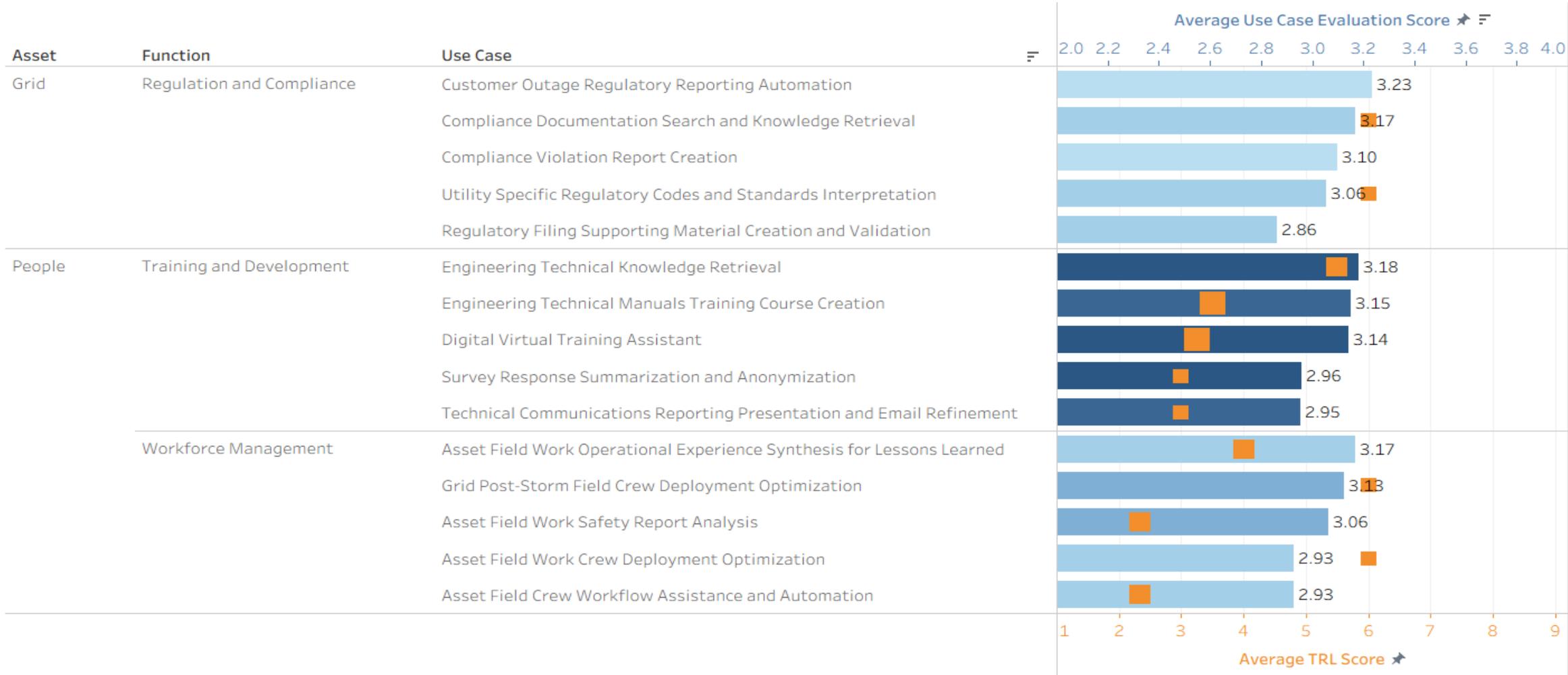
## Top 15 Use Cases Base - Transportation



Number of Utilities	7	8
Number of Tech P...	0	1

# Grid Regulation and Compliance and Workforce Management

## Top 15 Use Cases Base - Grid and People

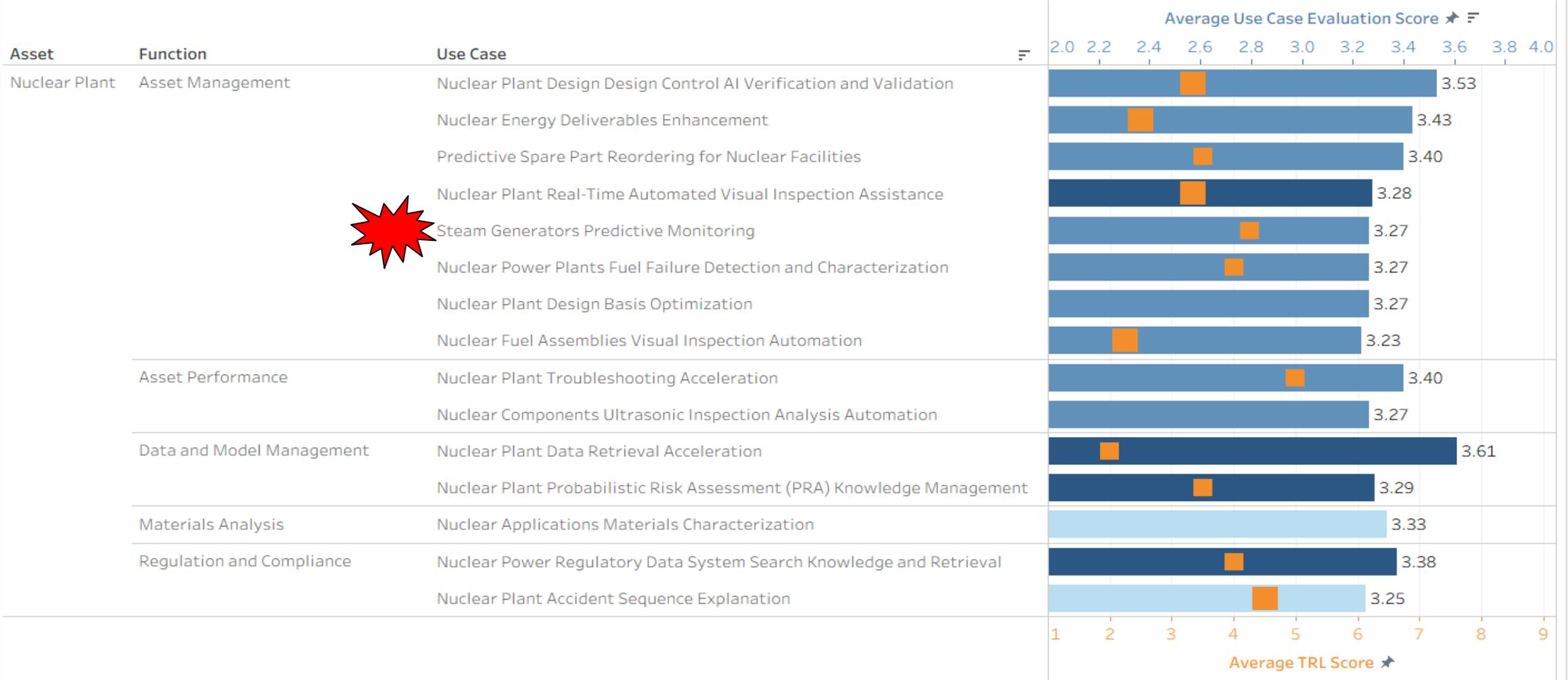


Number of Utilities: 5

Number of Tech P...: 0

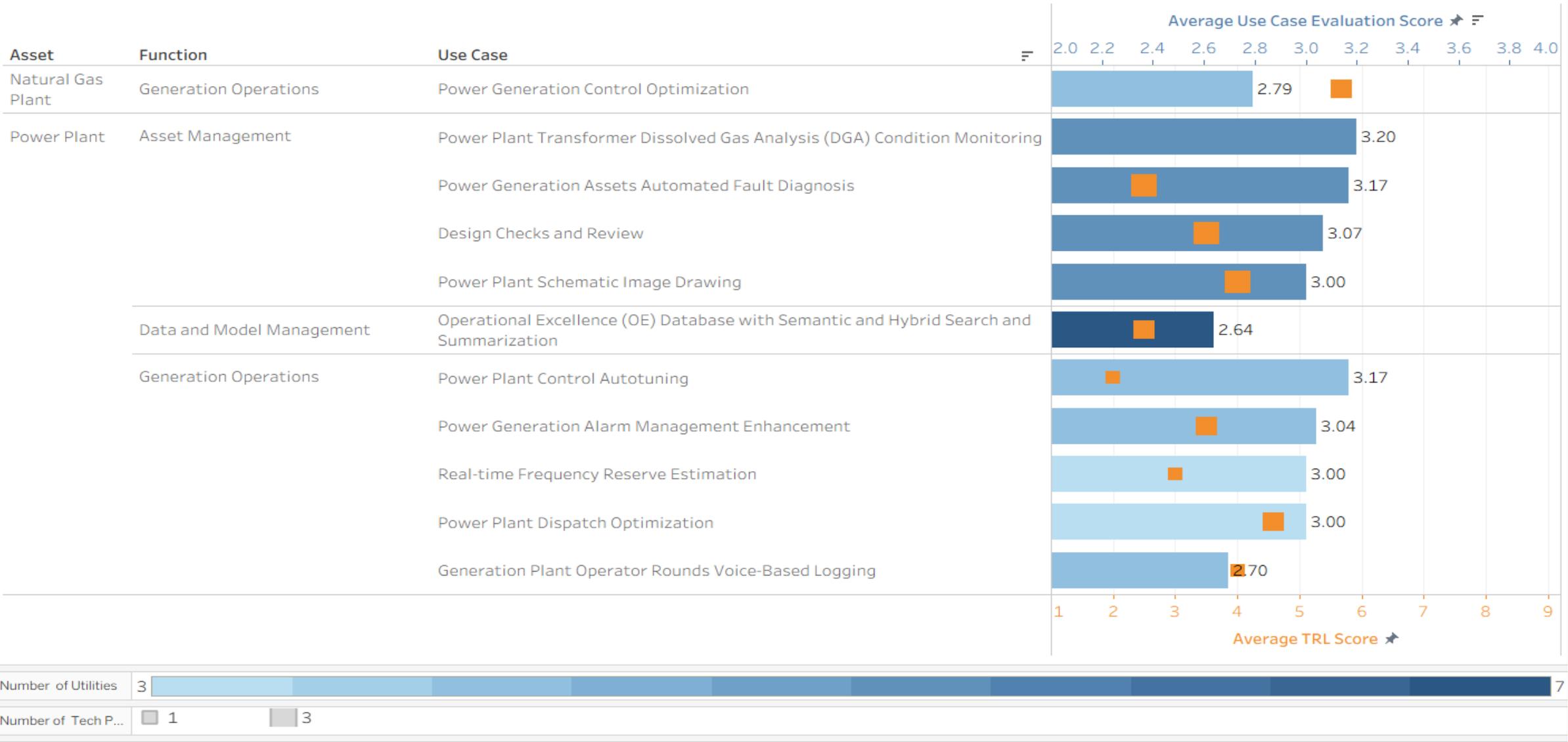
# Nuclear Power Plant

## Top 15 Use Cases Base - Nuclear



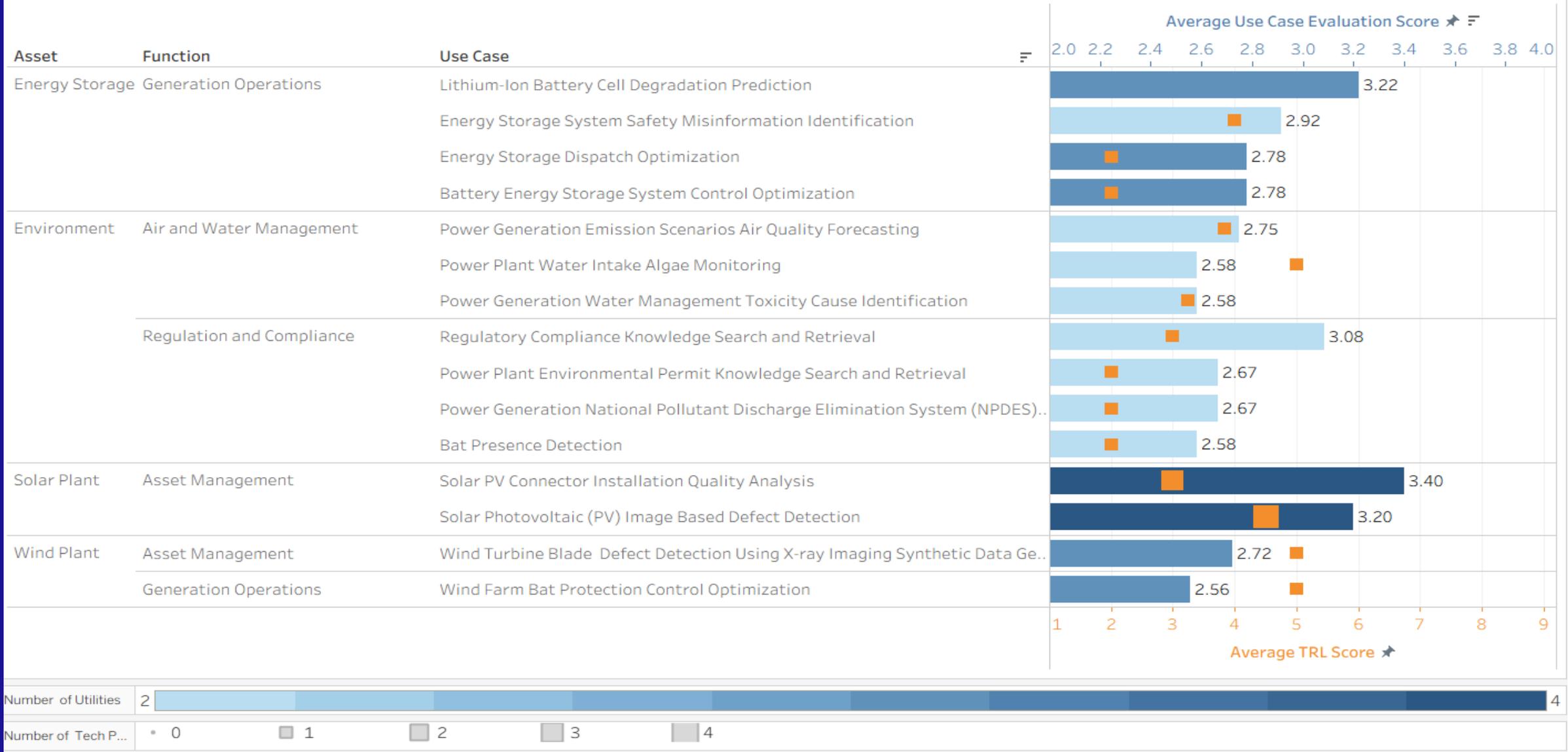
# Conventional Thermal Power Plant

## Top 15 Use Cases Base - Thermal Power Plant

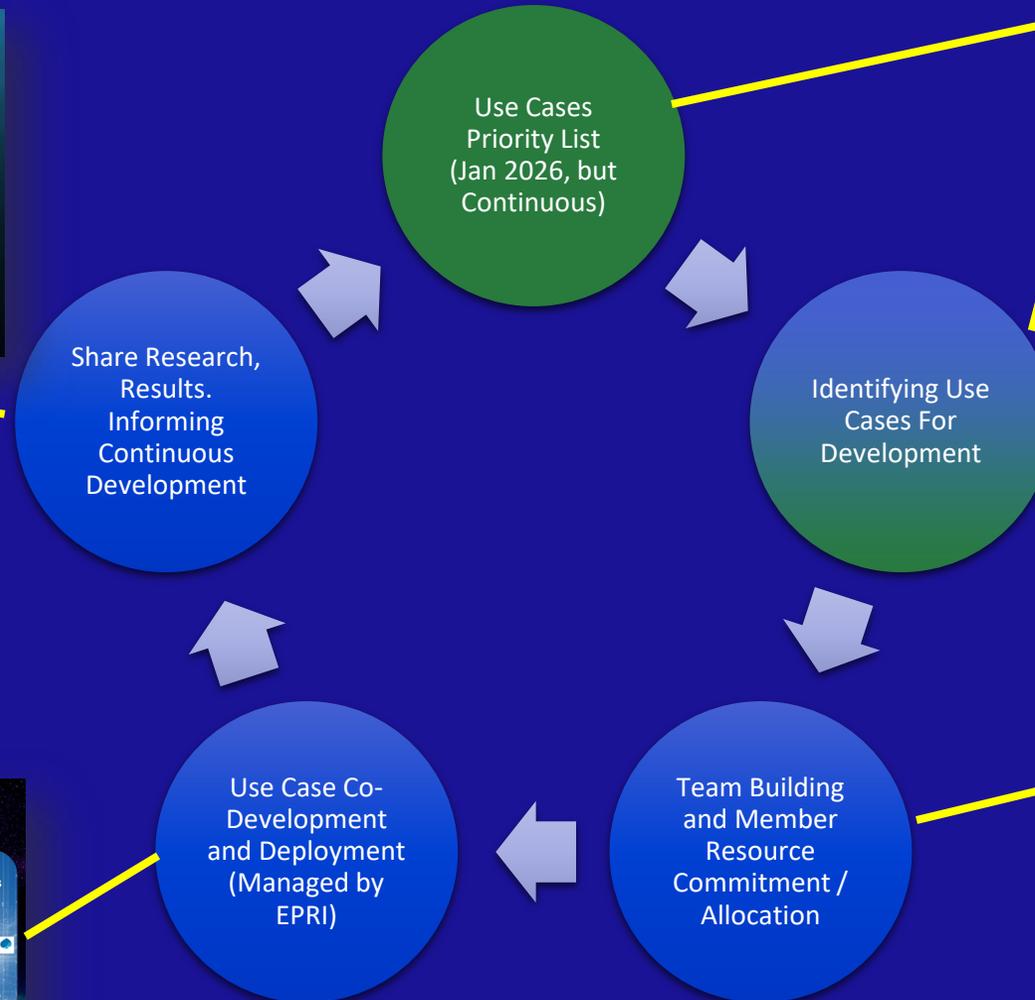
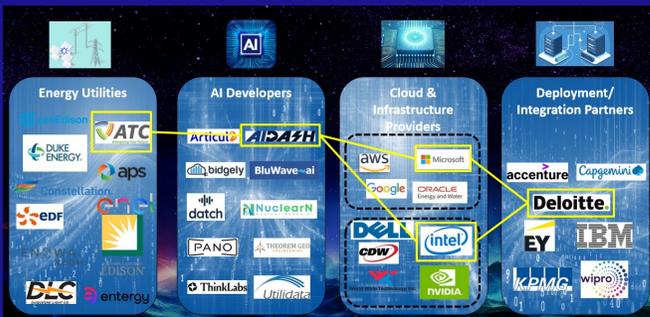


# Renewable Power Plant

## Top 15 Use Cases Base - Renewable Power Plant



# Proposed Use Case Solution Development Process



Top 15 Use Cases Base - Renewable Power Plant

Asset	Function	Use Case	Average Use Case Evaluation Score
Energy Storage	Generation Operations	Lithium-ion Battery Cell Degradation Prediction	3.22
		Energy Storage System Safety Misinformation Identification	2.92
		Energy Storage Dispatch Optimization	2.78
Environment	Air and Water Management	Power Generation Emission Scenarios Air Quality Forecasting	2.75
		Power Plant Water Intake Algae Monitoring	2.58
		Power Generation Water Management Toxicity Cause Identification	2.58
		Regulatory Compliance Knowledge Search and Retrieval	3.08
Regulation and Compliance		Power Plant Environmental Permit Knowledge Search and Retrieval	2.67
		Power Generation National Pollutant Discharge Elimination System (NPDES)	2.67
		Bat Presence Detection	2.58
Solar Plant	Asset Management	Solar PV Connector Installation Quality Analysis	3.40
		Solar Photovoltaic (PV) Image Based Defect Detection	3.20
Wind Plant	Asset Management	Wind Turbine Blade Defect Detection Using X-ray Imaging Synthetic Data Ge	2.72
		Generation Operations	Wind Farm Bat Protection Control Optimization

Number of Utilities: 2 | Number of Tech P: 0

#### 4. Grid and Asset High-Speed Recording Data Insights

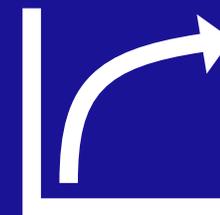
High-frequency data from Digital Fault Recorders (DFRs) and transient recorders is analyzed using deep learning to detect sub-cycle events and transient disturbances as well as power quality. AI models can automatically classify fault types, identify affected components, and reconstruct event timelines. Pattern recognition and clustering models identify recurring issues and affected network areas. Insights support root cause analysis and corrective actions. This helps utilities maintain compliance with power quality standards and improve customer satisfaction. These insights support root cause analysis and post-event reporting. Integration with asset condition monitoring enhances predictive maintenance strategies.

	Energy Utility	Technology Provider
Use Case Scoping Support (e.g. Persona Development)	<input type="checkbox"/>	<input type="checkbox"/>
Engineering Oversight and Guidance	<input type="checkbox"/>	<input type="checkbox"/>
Engineering Development Resources (software development, data collation)	<input type="checkbox"/>	<input type="checkbox"/>
Data Visualization User Interaction Design and Guidance	<input type="checkbox"/>	<input type="checkbox"/>
Data - Structured - Models or Streaming Data (Could be Real or Capable of Being Synthesized)	<input type="checkbox"/>	<input type="checkbox"/>
Data - Unstructured - Images, Documents, Videos, Sound	<input type="checkbox"/>	<input type="checkbox"/>
Hardware or Physical	<input type="checkbox"/>	<input type="checkbox"/>

# Use Cases – 17 Expressions of Interest Summary....So Far

Asset	Use Case	Utilities Interested	Technology Providers Interested
Grid	Asset Image Analytics	Chubu Electric Power Co, NRECA	IFS, Dviz, Watchfully
Grid	Digital Twin Model Validation	ERCOT	
Grid	Electric Vehicle Charging Infrastructure Data Analysis	OPPD	
Grid	Transformer Overload Analysis	OPPD, NRECA	
Distribution	Domestic Outage Detection and Analytics using Advanced Metering Infrastructure (AMI)	OPPD, NRECA	Microsoft, Dviz
ICT	Cyber Anomaly Detection for Operational Technology (OT) Systems	OPPD	Leidos
Power Plant	Steam Generators Predictive Monitoring	NRECA	E-signal.ai

**Expression of Interest Means a Willingness to Participate in OPAI Co-Development: Provide Data, Provide Human Resources or System Access/Licenses, Design Expertise**



**Threshold:  
Multiple Utilities +  
Multiple Tech Providers**

# Next Steps

## Review Meeting Materials

- Are these top 7 use cases of interest to your utility or technology provider.
- If so...in what way.
- Email [akelly@epri.com](mailto:akelly@epri.com)

## Review Company Specific Reports

- Are there other use cases you would like to self-nominate for based on your company specific results?

## Take Forward

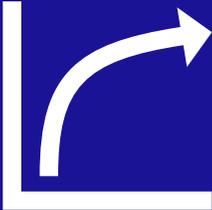
- End of March start to put together high level SOW for the top use cases with matched utilities and tech providers.
- Put together teams and resource planning

# Expressions of Interest in Use Cases

Asset	Use Case	Description	Utility Interest	Technology Provider
Gird	Asset Image Analytics	AI-powered computer vision systems analyze images from various sources including drone inspections, thermal cameras, and ground-based photography to assess equipment condition and identify maintenance needs. Machine learning models detect visual anomalies such as corrosion, mechanical damage, vegetation encroachment, and thermal hotspots across diverse asset types including transmission lines, substations, and generation equipment. The system uses deep learning techniques to classify defect types, assess severity levels, and track condition changes over time through comparative image analysis. Advanced image processing algorithms extract quantitative measurements from visual data including conductor sag, insulator contamination levels, and structural deformation to support engineering assessments and maintenance planning.	Chubu Electric Power Co, NRECA	IFS, Dviz, Watchfully

**Other Expressions of Interest:**

- \*
- \*



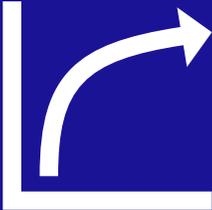
**Threshold:  
Multiple Utilities,  
Multiple Tech Providers**

# Expressions of Interest in Use Cases

Asset	Use Case	Description	Utility Interest	Technology Provider
Grid	Digital Twin Model Validation	AI validates digital twins of the electrical grid by integrating real-time sensor data, historical performance records, and engineering models. Machine learning algorithms calibrate the digital twin to accurately reflect current grid conditions and predict future states. Automated validation routines compare simulated outcomes with actual system behavior, identifying discrepancies. This enables precise scenario analysis, predictive maintenance, and grid optimization.	ERCOT	

### Other Expressions of Interest:

- \*
- \*



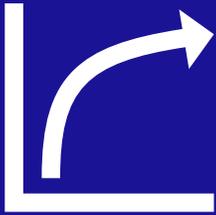
**Threshold:  
Multiple Utilities,  
Multiple Tech Providers**

# Expressions of Interest in Use Cases

Asset	Use Case	Description	Utility Interest	Technology Provider
Grid	Electric Vehicle Charging Infrastructure Data Analysis	AI analyzes charging patterns, site usage, and operational performance of autonomous vehicle charging hubs. Insights include charger utilization, wait times, and failure diagnostics. Predictive analytics optimize maintenance and future site development. Integration with AV navigation and dispatch systems enhances coordination.	OPPD	

**Other Expressions of Interest:**

- \*
- \*



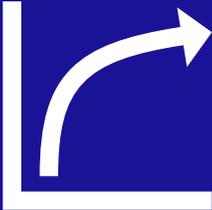
**Threshold:  
Multiple Utilities,  
Multiple Tech Providers**

# Expressions of Interest in Use Cases

Asset	Use Case	Description	Utility Interest	Technology Provider
Grid	Transformer Overload Analysis	AI algorithms continuously monitor transformer loading conditions using real-time measurements, ambient temperature data, and thermal models to assess overload risks and remaining capacity margins. Machine learning models predict transformer thermal behavior under various loading scenarios considering factors such as cooling system performance, ambient conditions, and historical thermal cycling effects. The system provides early warning alerts for potential overload conditions and recommends load transfer strategies or operational adjustments to prevent equipment damage. Advanced analytics integrate transformer aging models with loading analysis to assess the impact of overload events on insulation life and long-term reliability performance.	OPPD, NRECA	

**Other Expressions of Interest:**

- \*
- \*



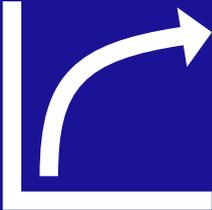
**Threshold:  
Multiple Utilities,  
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# Expressions of Interest in Use Cases

Asset	Use Case	Description	Utility Interest	Technology Provider
Distribution	Domestic Outage Detection and Analytics using Advanced Metering Infrastructure (AMI)	AI detects and analyzes customer-level outages using real-time AMI ping data, consumption drops, and voltage anomalies. The system automatically clusters affected meters and identifies likely fault zones. Insights support faster fault localization and crew dispatch. Historical data is used to identify patterns in domestic outage behavior.	OPPD, NRECA	Microsoft, Dviz

**Other Expressions of Interest:**

- \*
- \*



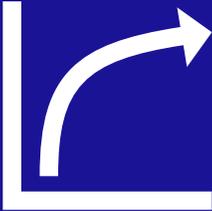
**Threshold:  
Multiple Utilities,  
Multiple Tech Providers**

# Expressions of Interest in Use Cases

Asset	Use Case	Description	Utility Interest	Technology Provider
ICT	Edge-Based Cyber Anomaly Detection for Operational Anomaly (OT) Systems	A solution that leverages edge computing hardware and AI analytics to monitor operational technology networks for anomalous activities, reducing false positives and providing rapid detection of cyber threats.	OPPD	Leidos

**Other Expressions of Interest:**

- \*
- \*



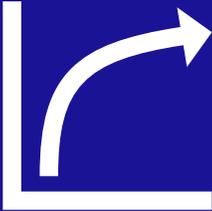
**Threshold:  
Multiple Utilities,  
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# Expressions of Interest in Use Cases

Asset	Use Case	Description	Utility Interest	Technology Provider
Nuclear / Thermal Power Plant	Steam Generators Predictive Monitoring	A digital twin platform that continuously tracks each steam generator's performance, provides trending analytics, and delivers predictive insights to support operation and maintenance.	NRECA	E-signal.ai

**Other Expressions of Interest:**

- \*
- \*



**Threshold:  
Multiple Utilities,  
Multiple Tech Providers**

# What is the Ask of OPAI Members

## Energy Utilities

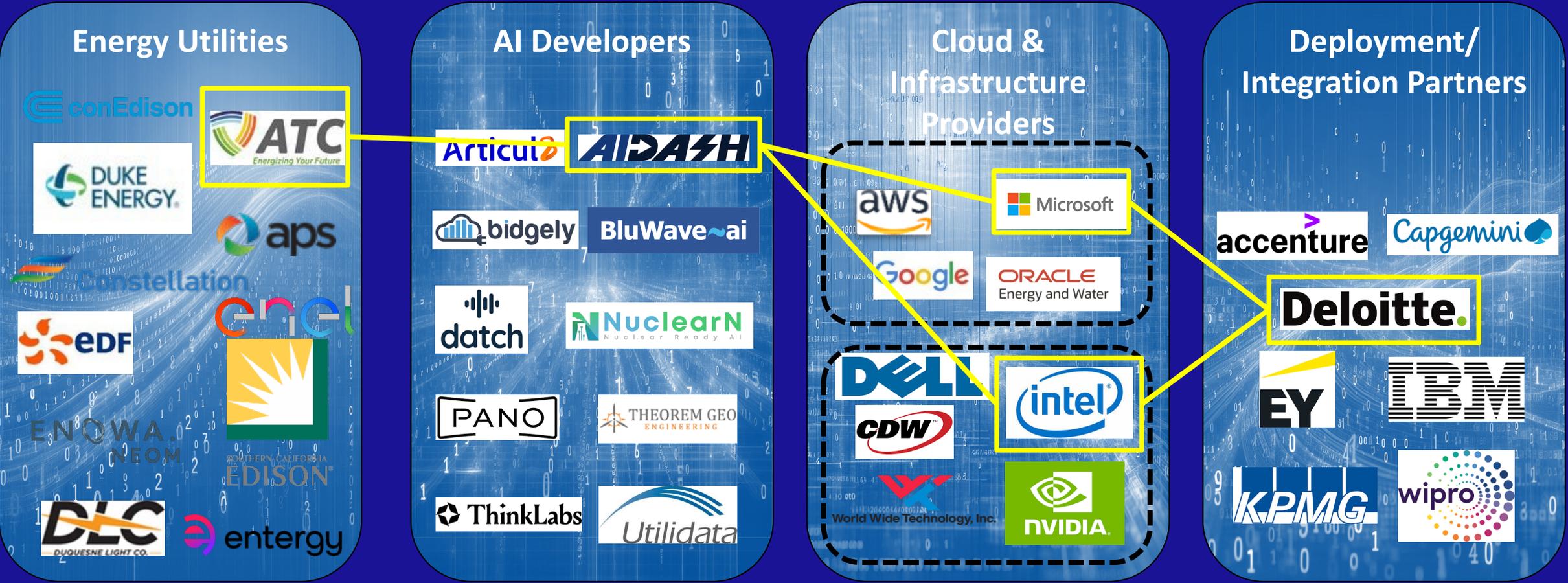
- Review the top use case lists based on your asset and functional responsibilities
- Cross reference with your company specific results.
- Huddle internally to determine which use cases you would be interested in contributing to.
- Is there data available that can be brought to OPAI either real or synthetic to co-develop.

## Technology Providers

- Review the high priority use cases with reference to your technology.
- How mature is the technology ? Can it be used as part of a co-development effort.
- What resources can you bring to the co-development effort?

# Co-Developing and Deploying AI Solutions with Partners

Priority Use Case #1: Interested OPAI Members commit to developing, piloting, and (potentially) deploying solutions (hypothetical example for Use Case #1)



# What Does This Look Like for a Typical Use Case?

## Use Case Priority #2 Grid and Asset High-Speed Recording Data Insights

High-frequency data from Digital Fault Recorders (DFRs) and transient recorders is analyzed using deep learning to detect sub-cycle events and transient disturbances as well as power quality. AI models can automatically classify fault types, identify affected components, and reconstruct event timelines. Pattern recognition and clustering models identify recurring issues and affected network areas. Insights support root cause analysis and corrective actions. This helps utilities maintain compliance with power quality standards and improve customer satisfaction. These insights support root cause analysis and post-event reporting. Integration with asset condition monitoring enhances predictive maintenance strategies.



Development Phase	 Energy Utility Contributions	 Technology Provider Contribution
Requirements Discovery & Prototyping	Define the problem, scope, personas, define data, define end state.	Defining architecture, app requirements, building blocks available.
Environment Setup & Data Engineering	Data provision, synthesization, quality checking	Compute resource design and allocation
Core Development & Model Integration	Oversight on product direction, features	App and AI model development, CI/CD pipelines
QA, Security, and UAT	User testing and feedback, integration oversight and design (IT/OT teams)	Test harness development, cyber security, AI model validation
Deployment & Operational Monitoring	Demo of application, sandboxing, feedback on prototype	Deploy and troubleshoot prototype application

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## Review Company Specific Reports

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## Moving Forward

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- Put together teams and resource planning



**TOGETHER...SHAPING THE FUTURE OF ENERGY®**

# Example Survey Format

## 3. Grid and Asset High-Speed Recording Data Insights

High-frequency data from Digital Fault Recorders (DFRs) and transient recorders is analyzed using deep learning to detect sub-cycle events and transient disturbances as well as power quality. AI models can automatically classify fault types, identify affected components, and reconstruct event timelines. Pattern recognition and clustering models identify recurring issues and affected network areas. Insights support root cause analysis and corrective actions. This helps utilities maintain compliance with power quality standards and improve customer satisfaction. These insights support root cause analysis and post-event reporting. Integration with asset condition monitoring enhances predictive maintenance strategies.

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Engineering Development Resources (software development, data collation)	<input type="checkbox"/>	<input type="checkbox"/>
Data Visualization User Interaction Design and Guidance	<input type="checkbox"/>	<input type="checkbox"/>
Data - Structured - Models or Streaming Data (Could be Real or Capable of Being Synthesized)	<input type="checkbox"/>	<input type="checkbox"/>
Data - Unstructured - Images, Documents, Videos, Sound	<input type="checkbox"/>	<input type="checkbox"/>
Hardware or Physical Energy System Assets (In a lab or in service)	<input type="checkbox"/>	<input type="checkbox"/>