

OPAI AI Use Case Work Stream – Survey Results

May 2026 Update



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Agenda

1. Discuss Priority Use Cases for Co-Development

1. Asset Image Analytics Vegetation Management

1. Circular Solar descriptive example

2. Domestic Outage Detection and Analytics using Advanced Metering Infrastructure (AMI)

Interactive Session – Please Contribute Verbally – We will Take Notes and Follow Up

Use Cases – 17 Use Cases 38 Expressions of Interest Summary....So Far

Asset	Use Case	Utilities Interested	Technology Providers Interested	Team Member Count	Meets Multiple Utility Multiple Tech Provider?
Distribution	Domestic Outage Detection and Analytics using Advanced Metering Infrastructure (AMI)	OPPD, NRECA	Microsoft, Dviz, UtilityAPI, EPRI	6	Yes
Distribution	Advanced Metering Infrastructure (AMI) Data Historical Backcast and Forecast		UtilityAPI	1	
Distribution	Advanced Metering Infrastructure (AMI) Data Validation		UtilityAPI	1	
Grid	Asset Image Analytics / Vegetation Management	Chubu Electric Power Co, NRECA, NPPD, OPPD	IFS, Dviz, Watchfuly, Circular Solar, SAP, EPRI	9	Yes
Grid	Digital Twin Model Validation	ERCOT	TII	2	
Grid	Electric Vehicle Charging Infrastructure Data Analysis	OPPD	TII	2	
Grid	Transformer Overload Analysis	OPPD, NRECA, Consumers	SAP	4	1 tech provider needed
Grid	Outage Management System Log Retrieval		TII	1	
Grid	Reliability Index Analytics		TII	1	
Grid	Energy market Price Forecasting		TII	1	
Grid	Grid Extreme Weather Event Forecasting		TII	1	
Grid	Grid Constraint Forecasting		TII	1	
Grid	Asset Rating Analytics	NPPD		1	
ICT	Cyber Anomaly Detection for Operational Technology (OT) Systems	OPPD	Leidos	2	
Power Plant	Steam Generators Predictive Monitoring	NRECA	E-signal.ai, SAP	3	1 utility needed
Solar	Solar Photovoltaic (PV) Image Based Defect Detection		TII	1	
All	Engineering Technical Knowledge Retrieval	Avangrid		1	

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

Asset Image Analytics and Vegetation Management

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.

Situation

(Context and background)

- Lots of asset image data, grid assets and generation assets, vegetation
- Many vendor products and applications, demos, much research

Complication

(Main issues with the situation, challenges)

- Is it labelled, is it structured? Is it freely available?
- May be difficult to find **insights from the images**? DX Grid – positional accuracy satellite imagery for trees linking to GIS
- Is it siloed, does it link to other systems or data points? Costs? Compute resources? Is there information available from the solution providers

Question

(The specific problem to be solved)

- DX Grid – positional accuracy - enhanced insights.
- What one specific problem can we agree on that we would try to solve in this co-development effort?

Answers

(What solutions could OPAI technology providers supply, what data can utilities provide)

•

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.

Situation

(Context and background)

- Lots of AMI smart meter data available
- Usually well structured, time series, locational

Complication

(Main issues with the situation, challenges)

- Difficult to gain insights from the data beyond commercial insights and behaviours and patterns Losses
- Not well linked to operational processes such as fault detection or crew dispatch? Linked to planning, asset maintenance, etc? Integration with GIS DMS/EMS
- Data privacy Anonymization or synthesization, availability?

Question

(The specific problem to be solved)

- Insights → Actions (comms) interlinking / interoperability/integration with other systems. Electrical model aligned to meter data – validation of model data, Matching to OMS/ADMS, phase balancing. ID→ fault classification→response (potential for more granular data sharing for fault classification)

Answers

(What solutions could OPAI technology providers supply, what data can utilities provide)

•

Use Cases – Top 2 Use Cases For Initial Kickoff

Asset	Use Case	Utilities Interested	Technology Providers Interested	Description
Distribution	Domestic Outage Detection and Analytics using Advanced Metering Infrastructure (AMI)	OPPD, NRECA	Microsoft, Dviz, UtilityAPI, EPRI	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.
Grid	Asset Image Analytics / Vegetation Management	Chubu Electric Power Co, NRECA, NPPD	IFS, Dviz, Watchfuly, Circular Solar, EPRI	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.

Tentative commitments, any others?

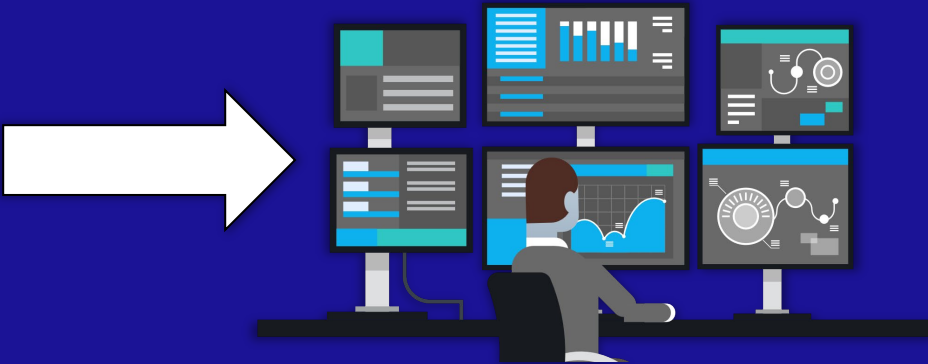
What Does This Look Like for a Typical Use Case?

Use Case Priority 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.



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

Use Cases – Top 2 Use Cases For Initial Kickoff

Asset	Use Case	Utilities Interested	Technology Providers Interested	Open Discussion Points – What Should we be thinking about ?
Distribution	Domestic Outage Detection and Analytics using Advanced Metering Infrastructure (AMI)	OPPD, NRECA	Microsoft, Dviz, UtilityAPI, EPRI	
Grid	Asset Image Analytics / Vegetation Management	Chubu Electric Power Co, NRECA, NPPD	IFS, Dviz, Watchfully, Circular Solar, EPRI	

Tentative commitments, any others?

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?

Next Steps

Review Meeting Materials

- Are these top 17 use cases of interest to your utility or technology provider.
- Would you like to contribute to the top 2
- If so...in what way?
- Email 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

- Next Week: Begin process of putting together high-level SOW for the top use cases matching utilities and tech providers.
- Put together teams and resource planning
- Next Call May 8th.

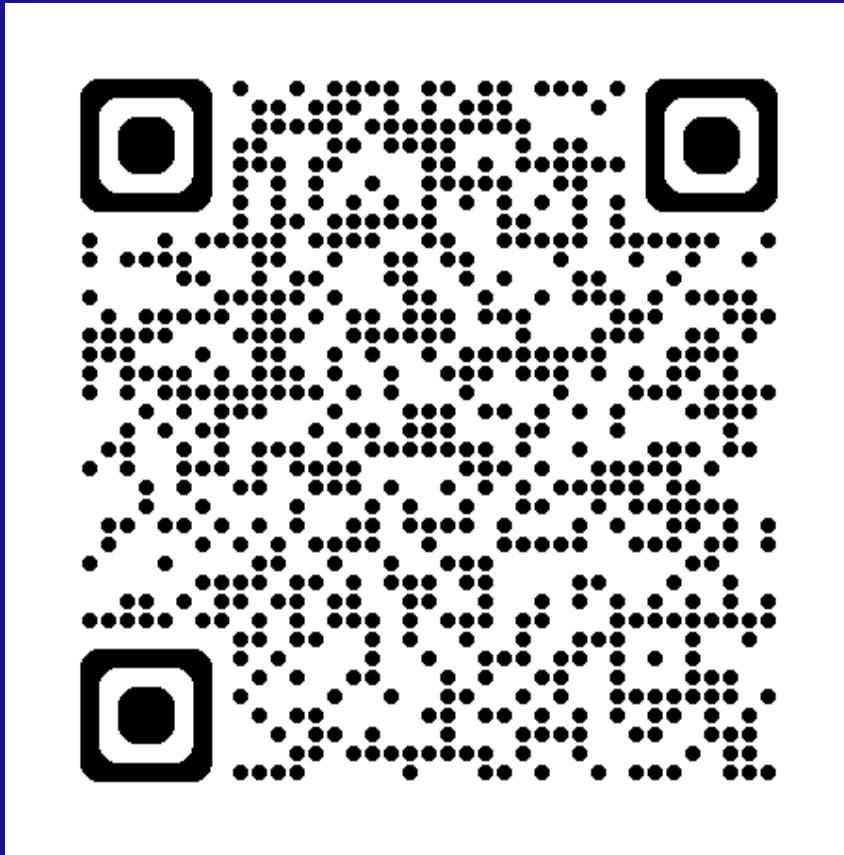
OPAI Use Case Survey Links – Remains Open Indefinitely



Energy Utility Survey



Technology Provider Survey



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



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

Click or Scan

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

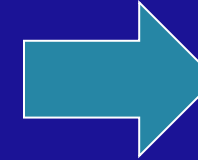
Technology Providers

*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

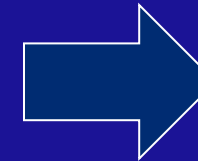
- Top 5 10 Asset Management
- Top 5-10 Operations
- Top 5-10 Markets, Nuclear....etc

Use Case to
Technology
Matching

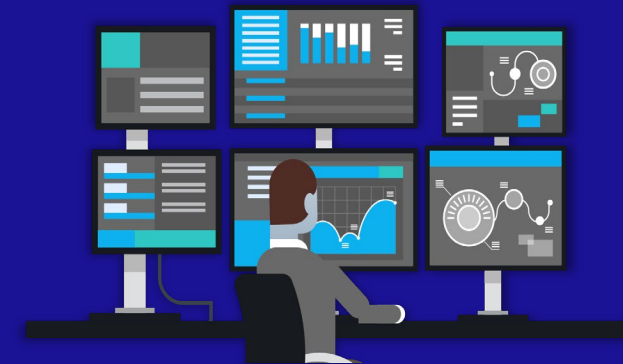
- Map high priority use cases to medium to high technology solution maturity

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/>



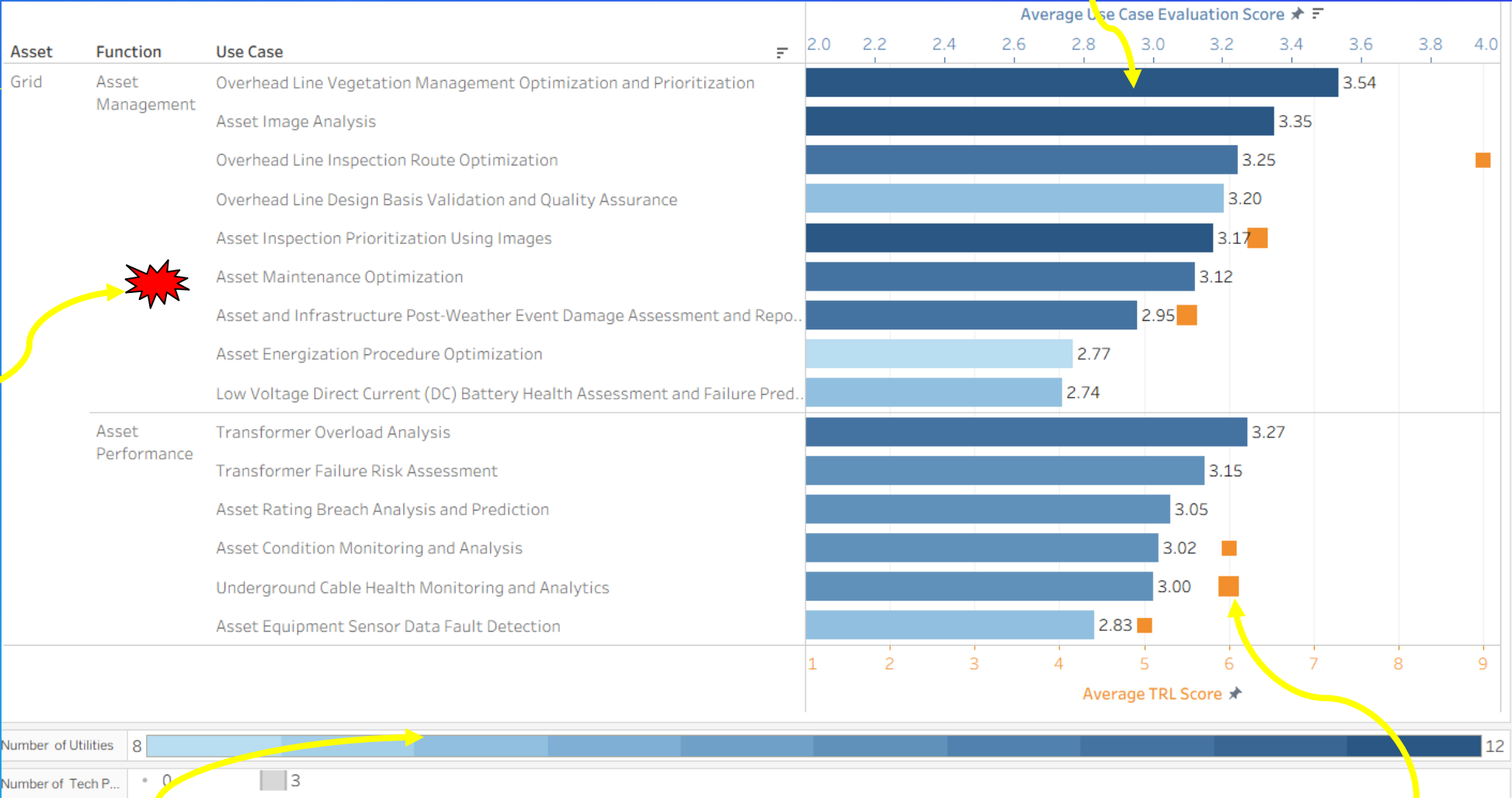
Use Case Co-Development

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

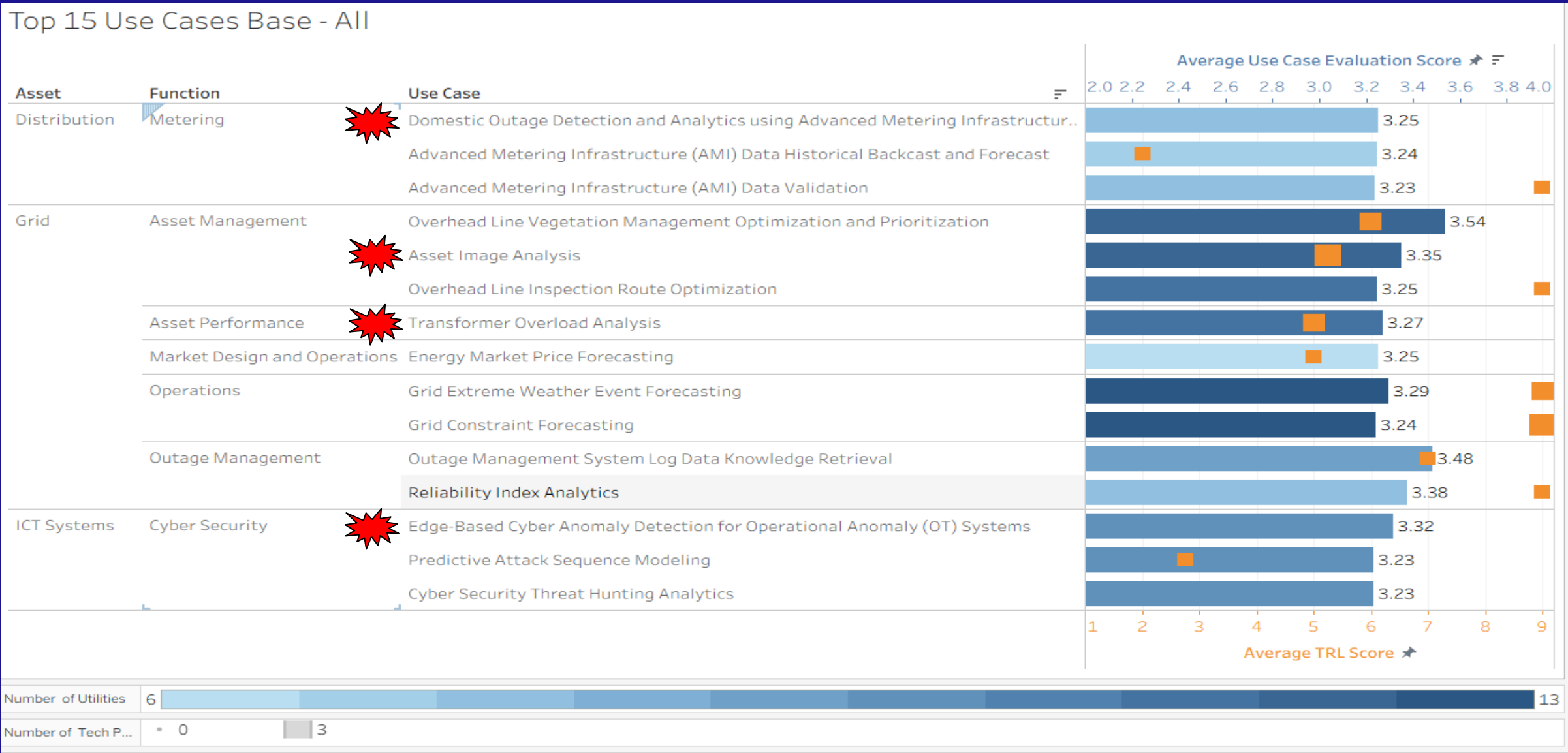
A use case that an OPAI member has expressed interest in co-developing



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

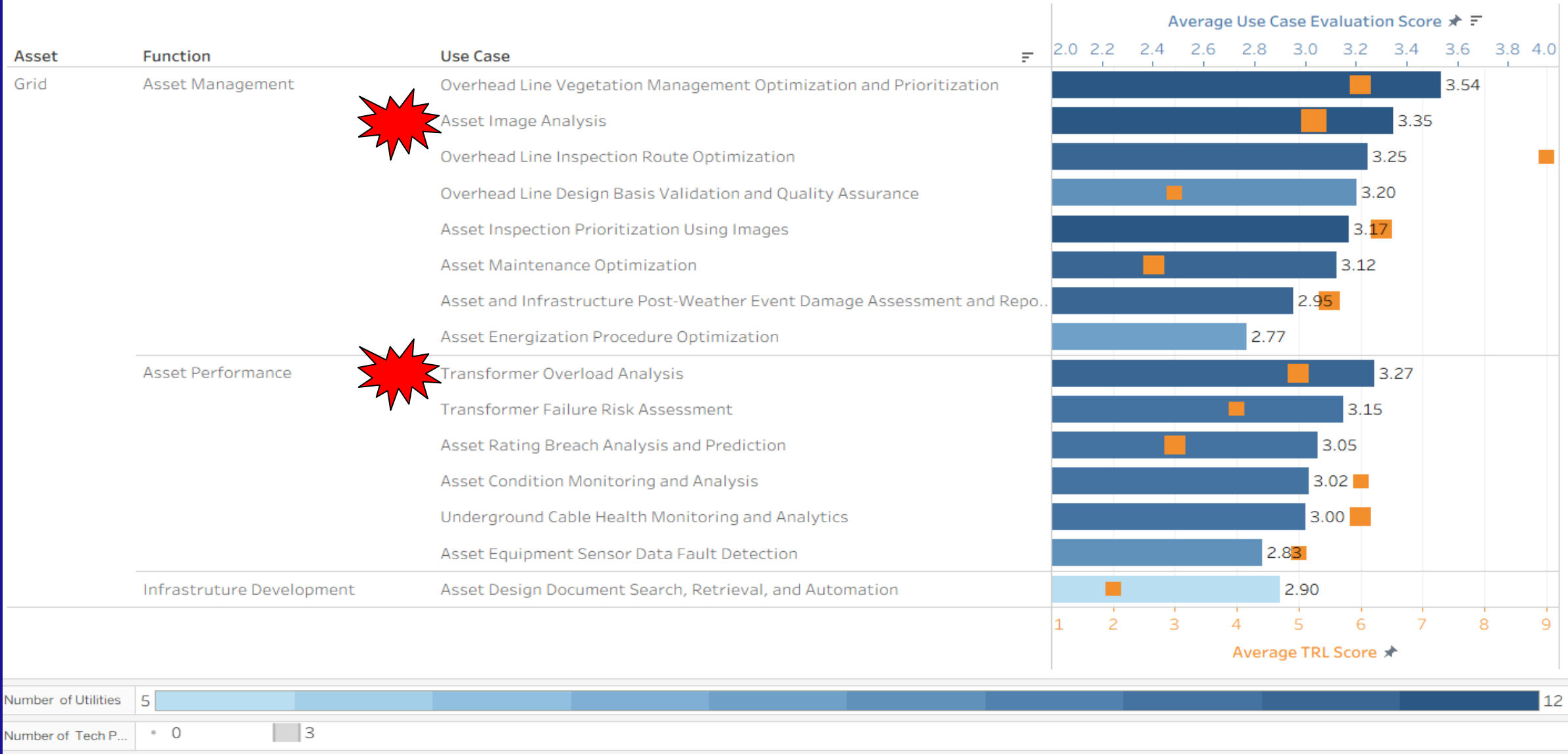
Orange square is average TRL score 1-9. The size of the square indicates number of Tech provider respondents

Top 15 of All Use Cases



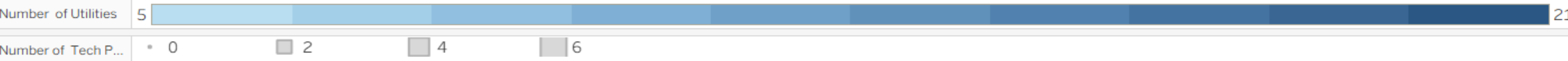
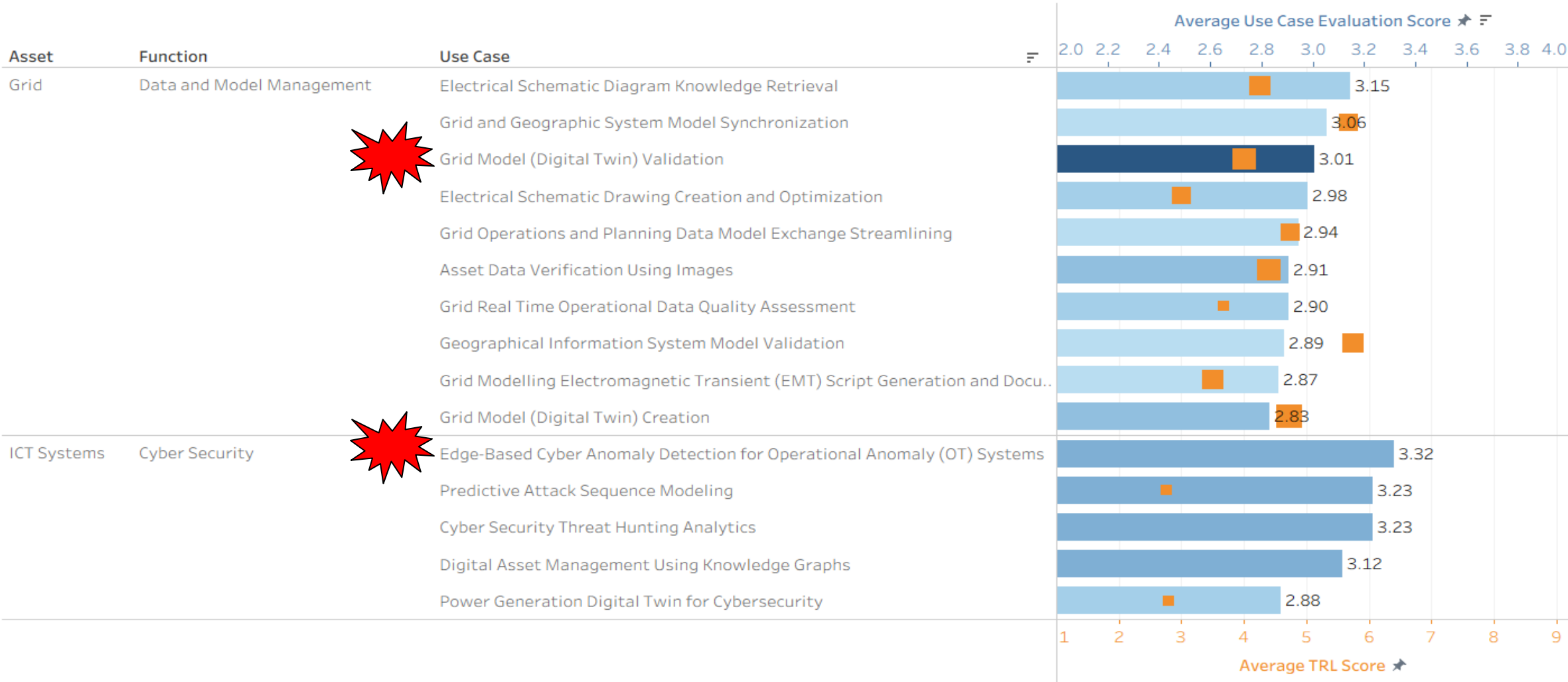
Grid Asset Management and Performance

Top 15 Use Cases Base - Grid Asset and Infrastructure



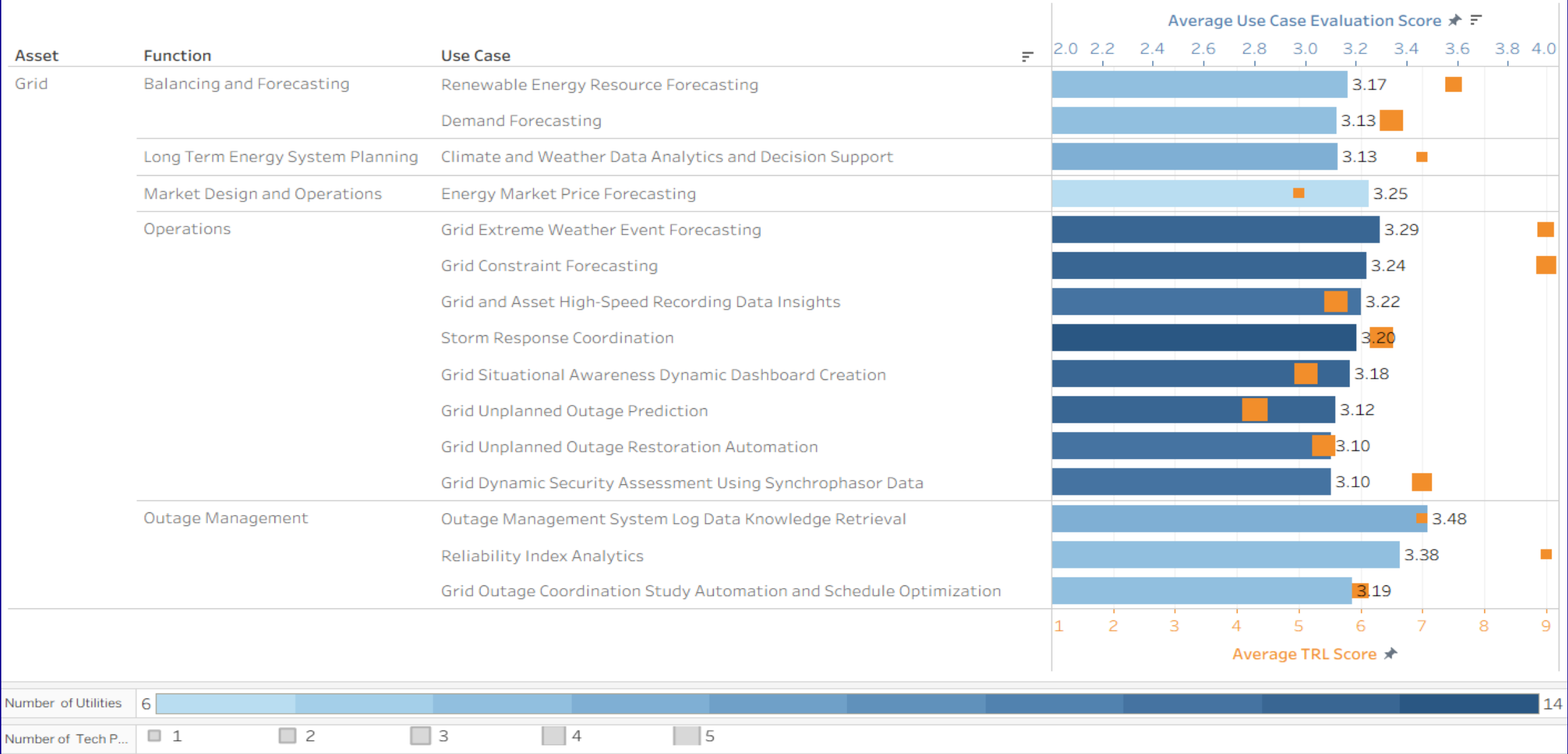
Grid ICT and Data Management

Top 15 Use Cases Base - Grid Data and ICT



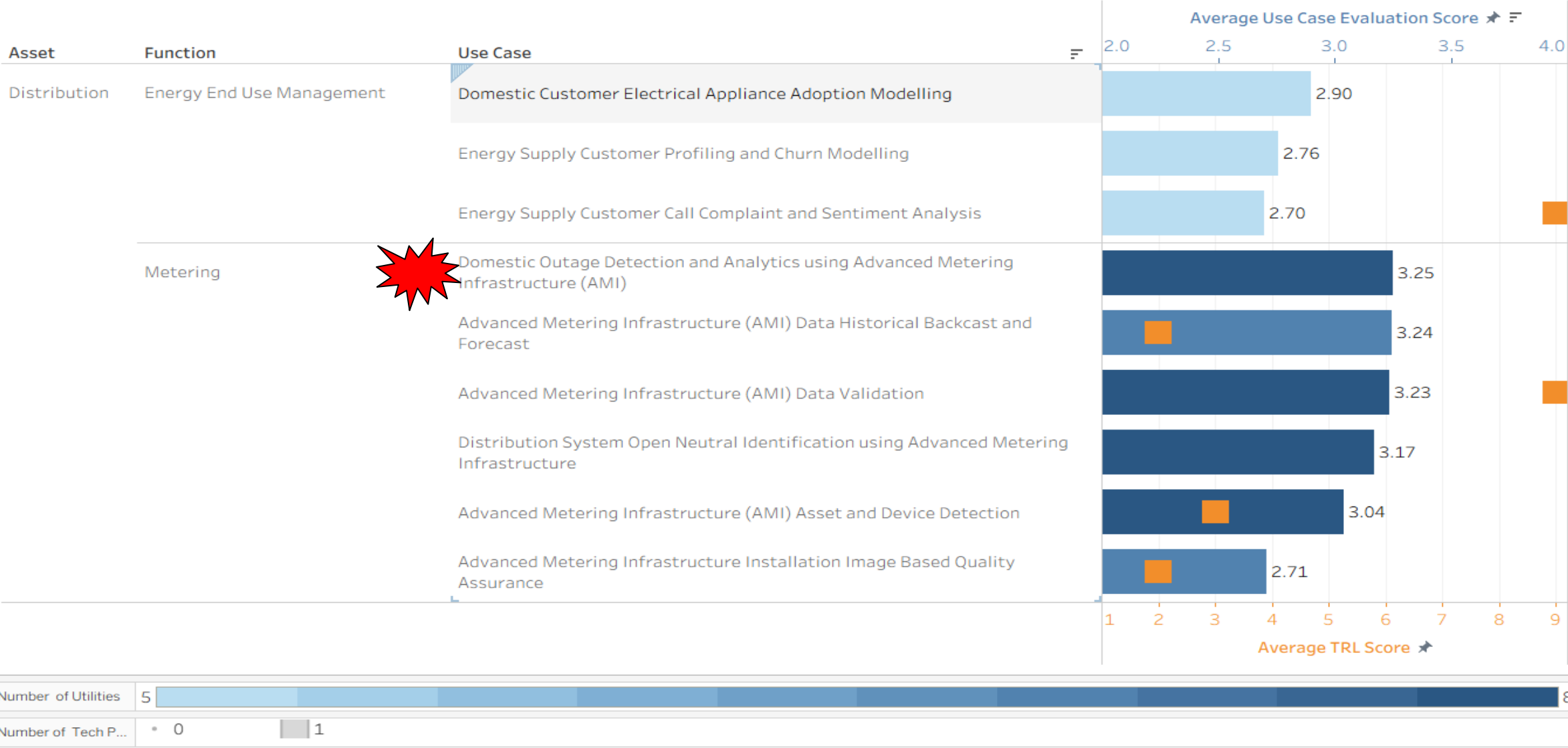
Grid IGES T and D Operations and Planning

Top 15 Use Cases Base - Grid Operations and Planning



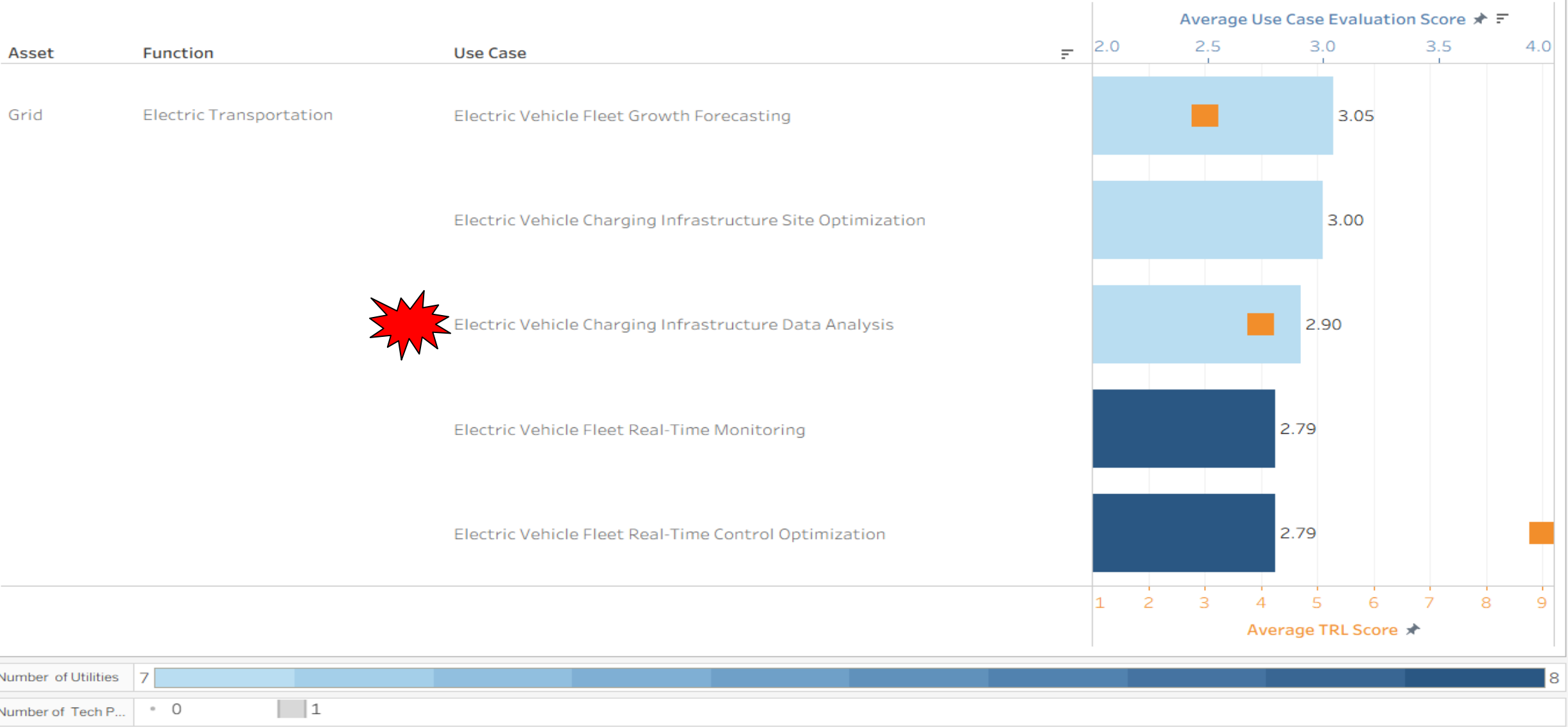
Grid IGES Distribution

Top 15 Use Cases Base - Distribution



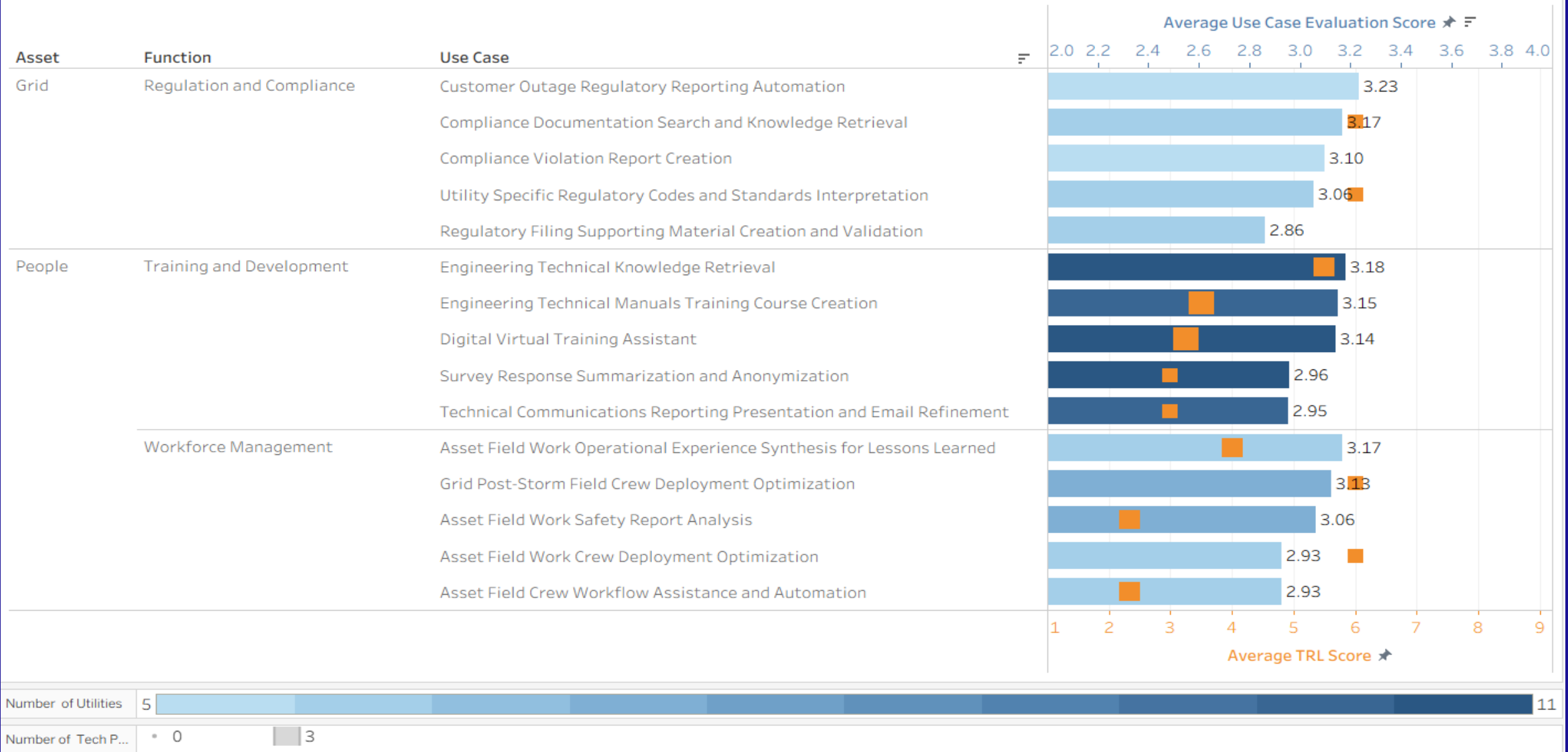
Grid IGES Distribution

Top 15 Use Cases Base - Transportation



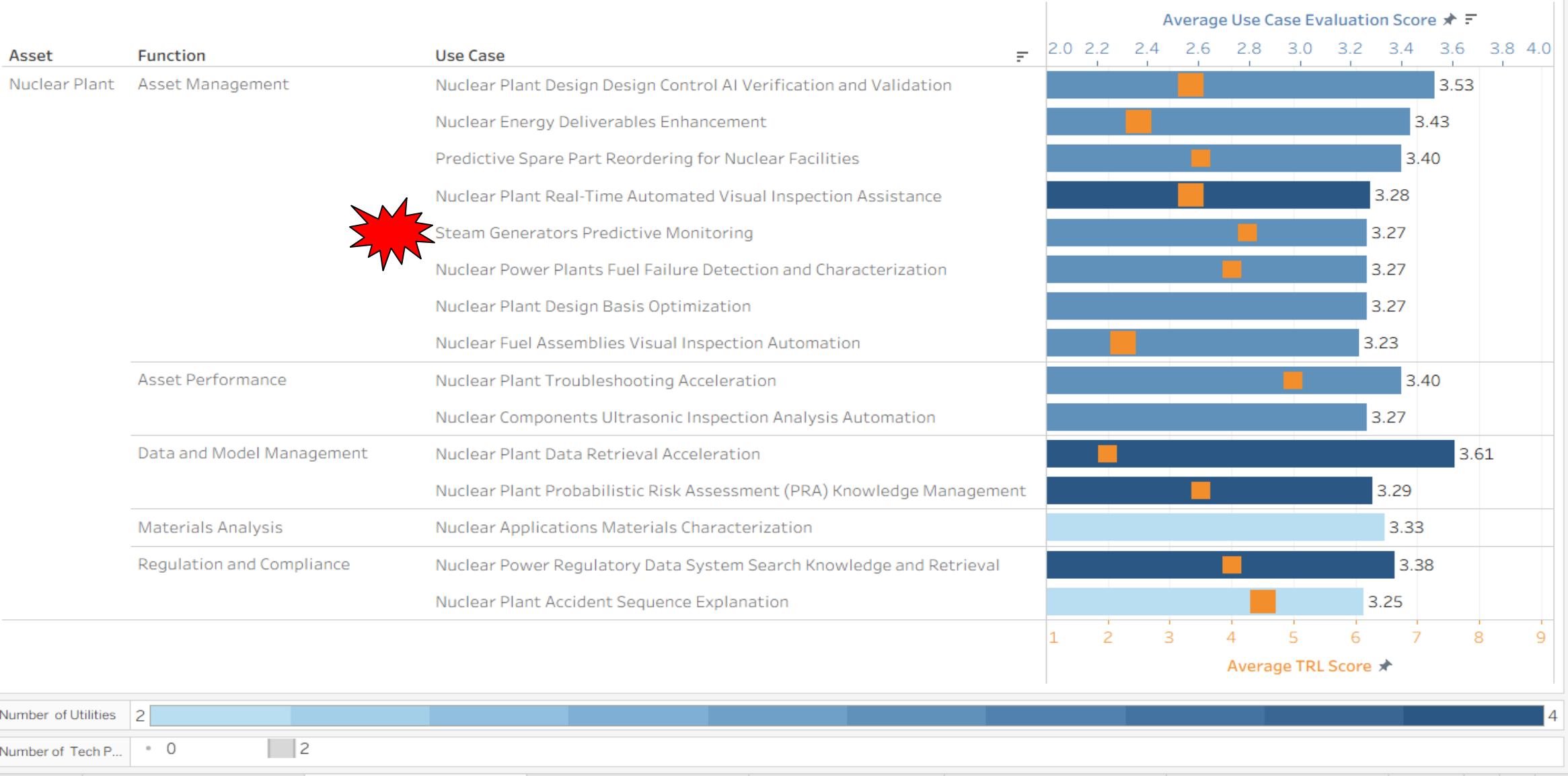
Grid Regulation and Compliance and Workforce Management

Top 15 Use Cases Base - Grid and People



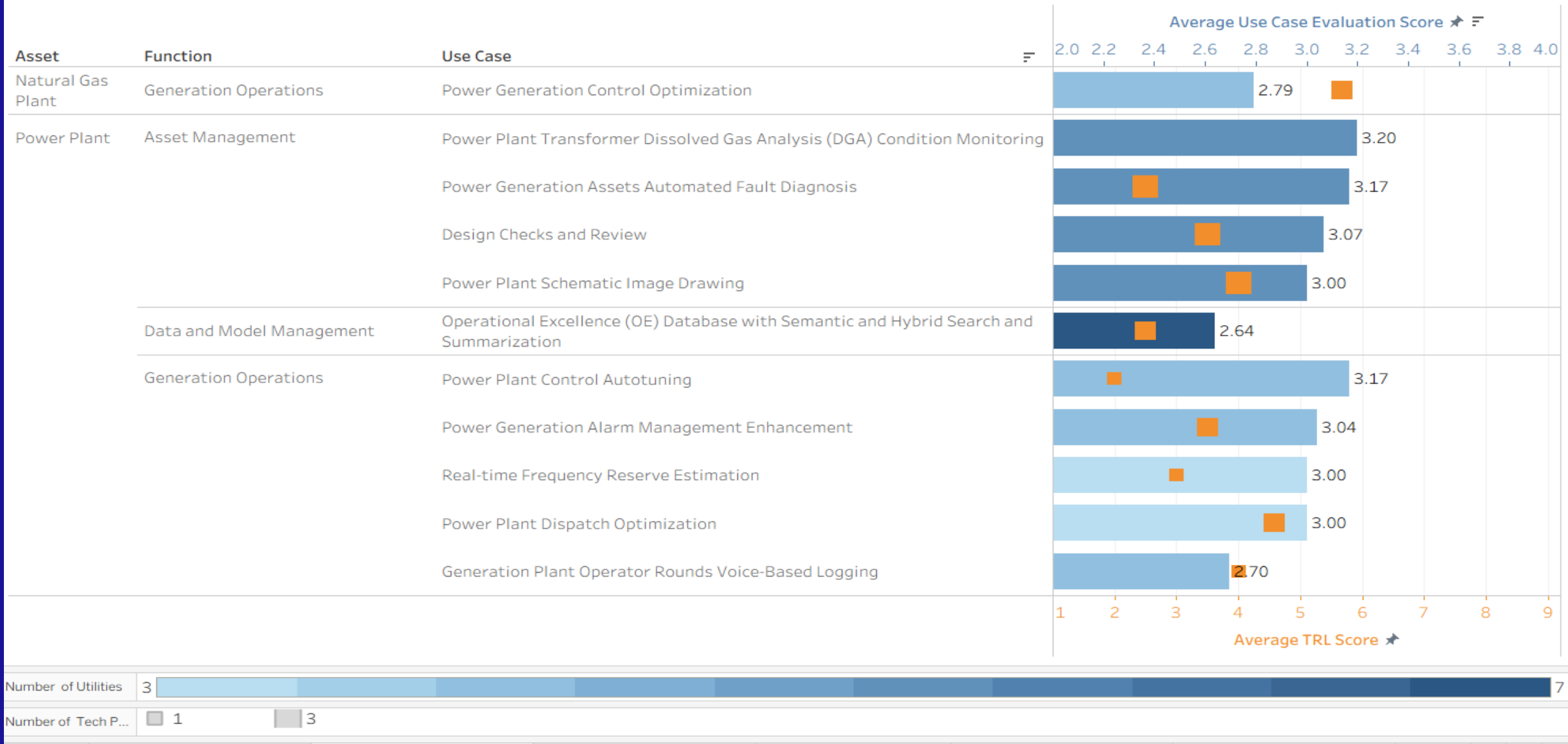
Nuclear Power Plant

Top 15 Use Cases Base - Nuclear



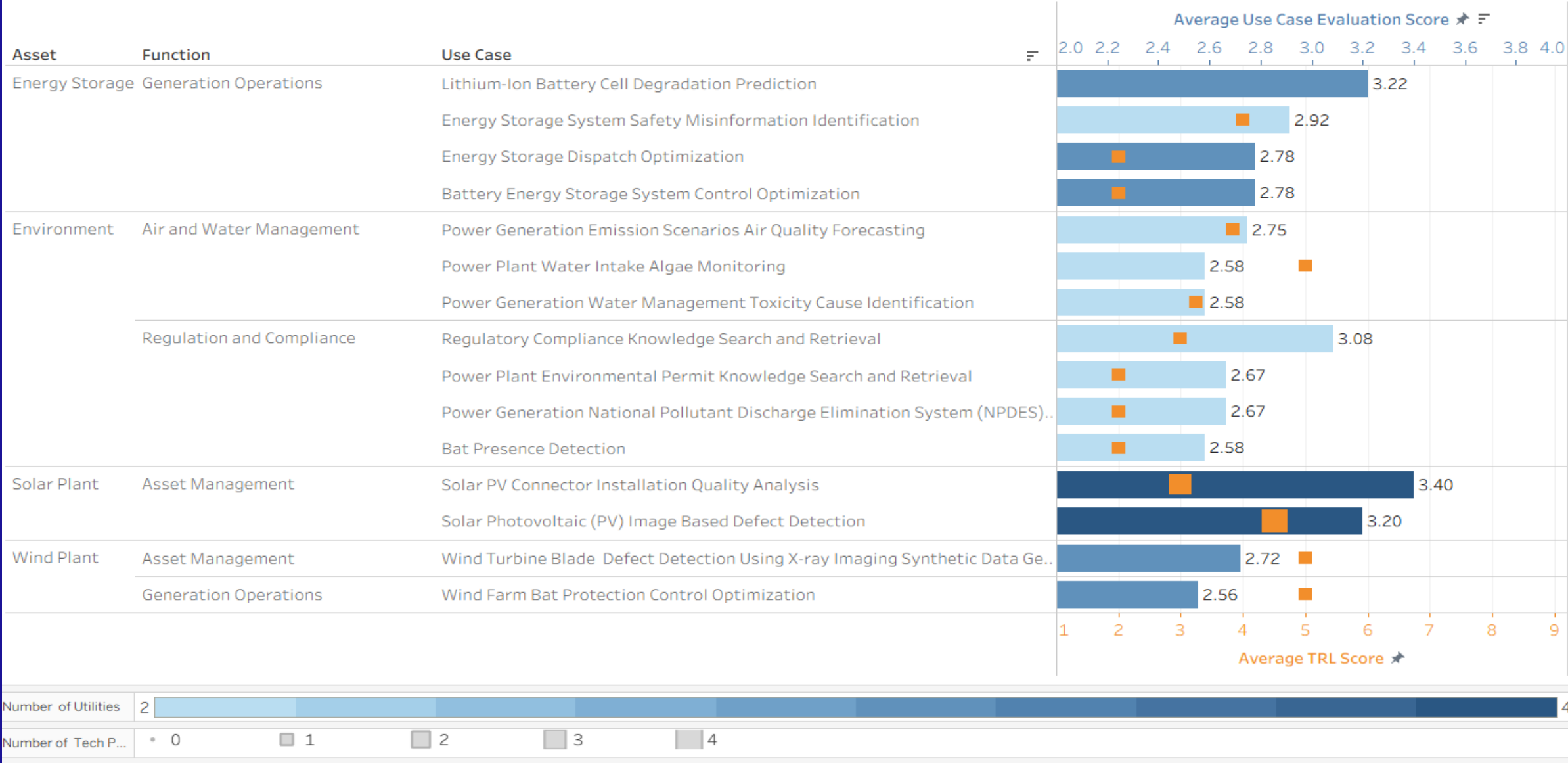
Conventional Thermal Power Plant

Top 15 Use Cases Base - Thermal Power Plant

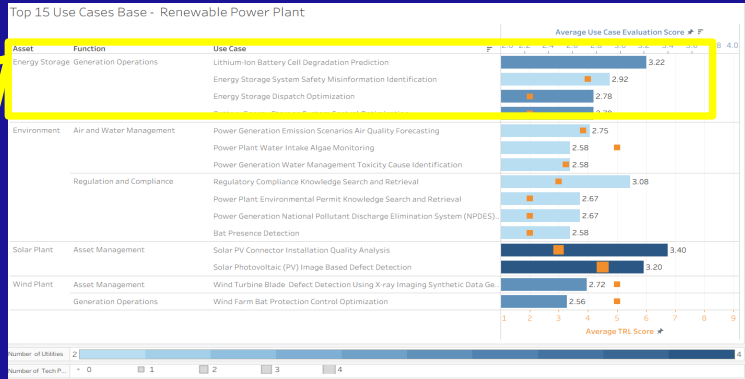
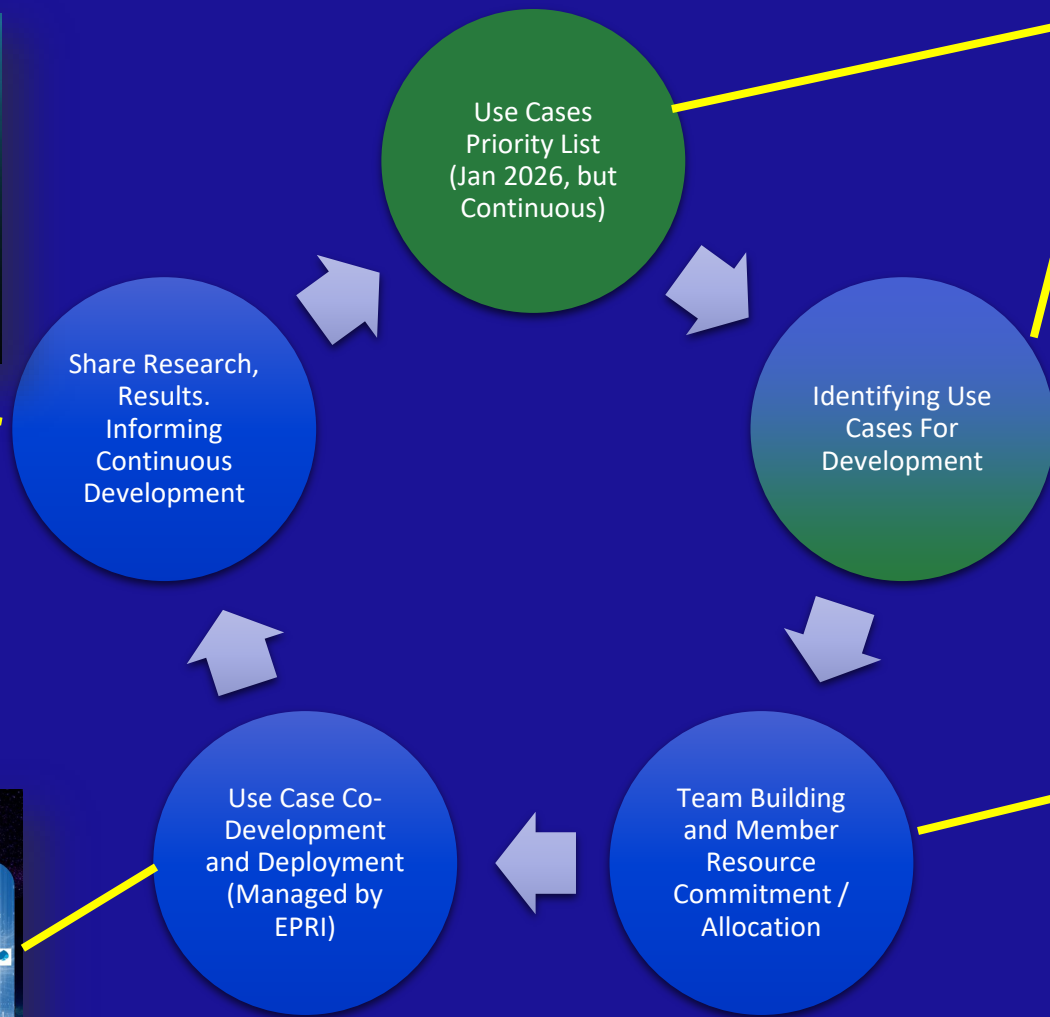
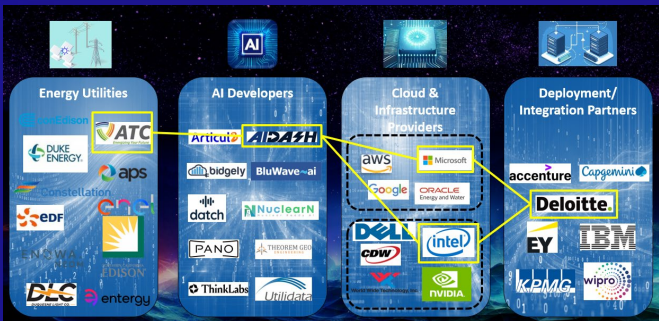


Renewable Power Plant

Top 15 Use Cases Base - Renewable Power Plant



Proposed Use Case Solution Development Process



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)	☐	☐
Engineering Oversight and Guidance	☐	☐
Engineering Development Resources (software development, data collation)	☐	☐
Data Visualization User Interaction Design and Guidance	☐	☐
Data - Structured - Models or Streaming Data (Could be Real or Capable of Being Synthesized)	☐	☐
Data - Unstructured - Images, Documents, Videos, Sound	☐	☐
Hardware or Physical		

Use Cases – 32 Expressions of Interest Summary....So Far

Asset	Use Case	Utilities Interested	Technology Providers Interested	Team Member Count	Meets Multiple Utility Multiple Tech Provider?
Distribution	Domestic Outage Detection and Analytics using Advanced Metering Infrastructure (AMI)	OPPD, NRECA	Microsoft, Dviz, UtilityAPI	5	Yes
Distribution	Advanced Metering Infrastructure (AMI) Data Historical Backcast and Forecast		UtilityAPI	1	
Distribution	Advanced Metering Infrastructure (AMI) Data Validation		UtilityAPI	1	
Grid	Asset Image Analytics	Chubu Electric Power Co, NRECA, NPPD	IFS, Dviz, Watchfuly, Circular Solar	6	Yes
Grid	Digital Twin Model Validation	ERCOT	TII	2	
Grid	Electric Vehicle Charging Infrastructure Data Analysis	OPPD	TII	2	
Grid	Transformer Overload Analysis	OPPD, NRECA, Consumers		3	
Grid	Outage Management System Log Retrieval		TII	1	
Grid	Reliability Index Analytics		TII	1	
Grid	Energy market Price Forecasting		TII	1	
Grid	Grid Extreme Weather Event Forecasting		TII	1	
Grid	Grid Constraint Forecasting		TII	1	
Grid	Asset Rating Analytics	NPPD		1	
ICT	Cyber Anomaly Detection for Operational Technology (OT) Systems	OPPD	Leidos	2	
Power Plant	Steam Generators Predictive Monitoring	NRECA	E-signal.ai	2	
Solar	Solar Photovoltaic (PV) Image Based Defect Detection		TII	1	
All	Engineering Technical Knowledge Retrieval	Avangrid		1	

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

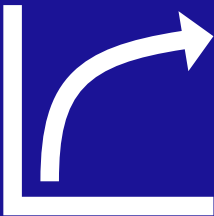
Threshold:
Multiple Utilities +
Multiple Tech Providers

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:

- *
- *

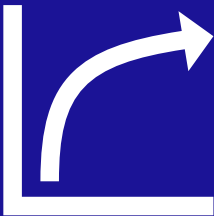
 **Threshold:
Multiple Utilities,
Multiple Tech Providers**

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:

- *
- *



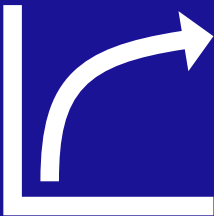
Threshold:
Multiple Utilities,
Multiple Tech Providers

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:

- *
- *



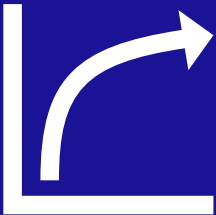
Threshold:
Multiple Utilities,
Multiple Tech Providers

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:

- *
- *



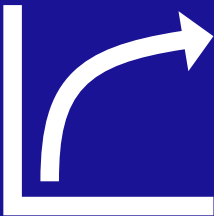
Threshold:
Multiple Utilities,
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Expressions of Interest in Use Cases

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:

- *
- *



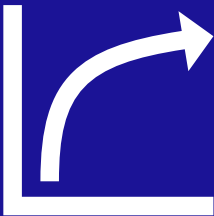
Threshold:
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Multiple Tech Providers

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:

- *
- *



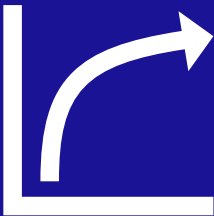
Threshold:
Multiple Utilities,
Multiple Tech Providers

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:

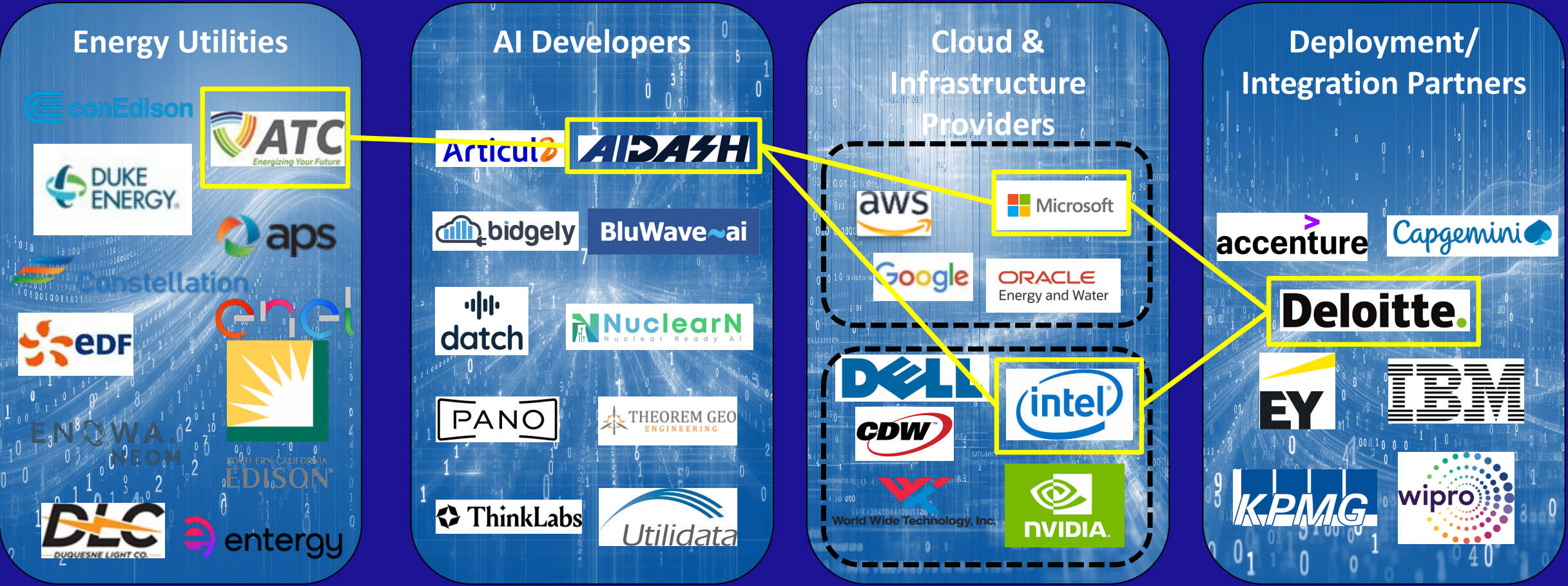
- *
- *



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

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)



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

Review Company Specific Reports

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

Moving 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



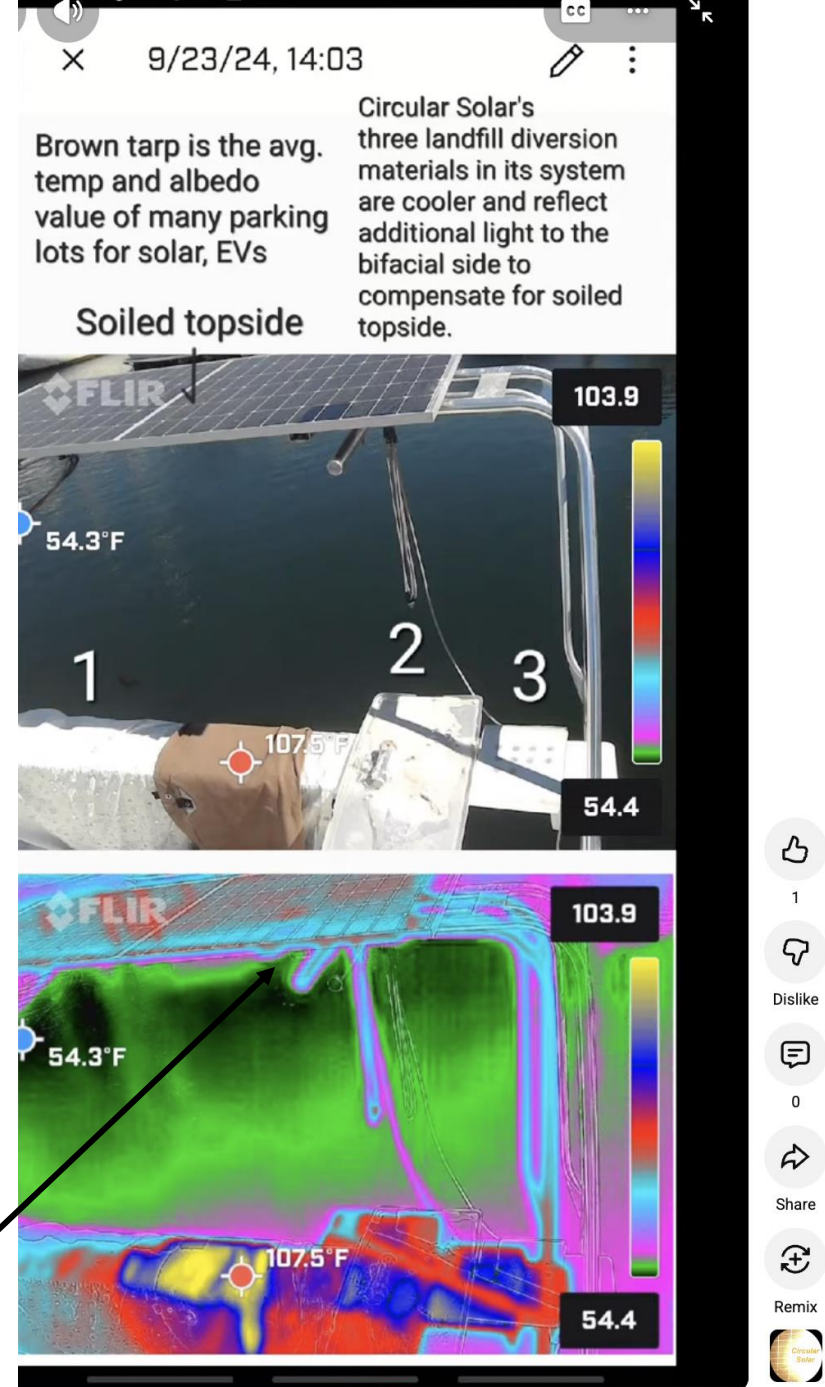
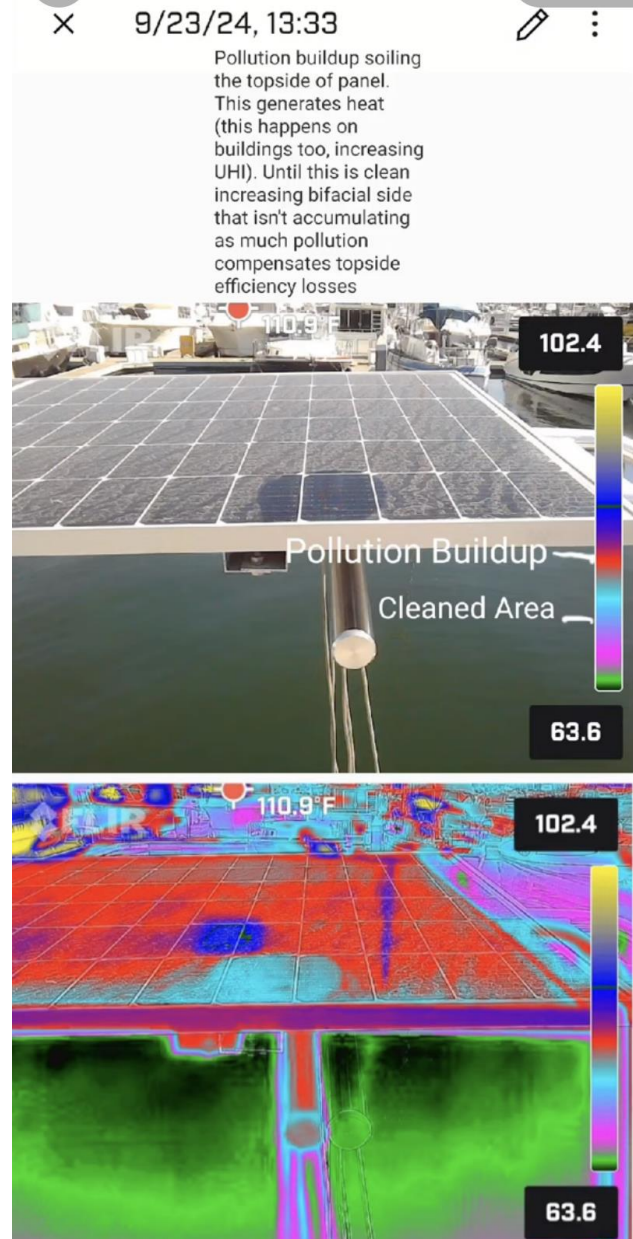
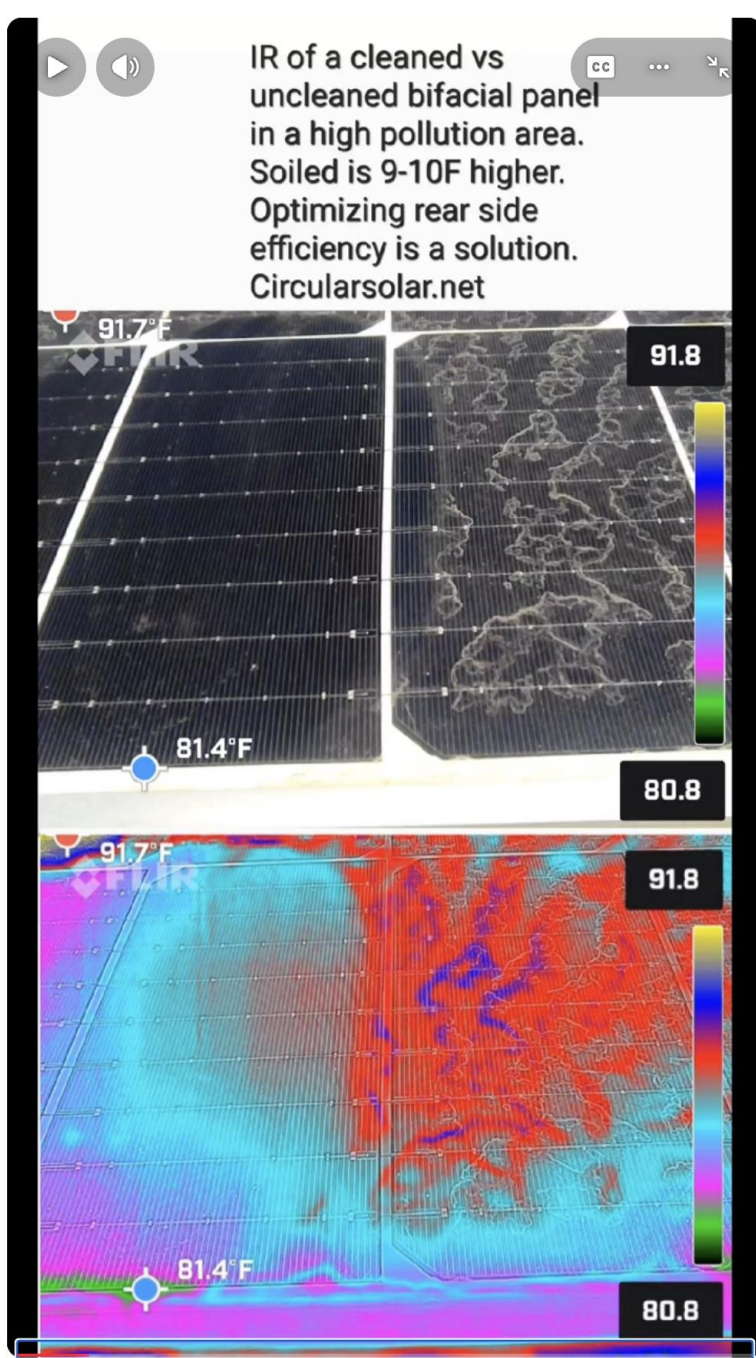
TOGETHER...SHAPING THE FUTURE OF ENERGY®

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)	☐	☐
Data Visualization User Interaction Design and Guidance	☐	☐
Data - Structured - Models or Streaming Data (Could be Real or Capable of Being Synthesized)	☐	☐
Data - Unstructured - Images, Documents, Videos, Sound	☐	☐
Hardware or Physical Energy System Assets (In a lab or in service)	☐	☐



Why IR drones are required for asset management – to get up close enough to detect soiling and thermal signature

<https://www.youtube.com/shorts/JWJer2X5f3Q>

How vegetation type and vegetation management is critical to both safety it impacts efficiency (thermal efficiency) of electrical: cables, batteries, EV hardware.

Similar results to balcony solar shade, cooling tests on Octopus.

