OPAI AI Use Case Work Stream

Open Power AI Consortium

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OPAI Use Case Workstream

Why?

AI is expensive. Need to know where to prioritise effort and resources

- There are example of use case repositories in industry, mostly incomplete, impartial, pre-mapped to solutions
- No broad-based utility-assessment

What?

EPRI have a long list (200+) of energy sector AI use cases gathered through workshops, experience, industry engagement

- Need to streamline them:
  - TO identify what are actual priorities over nice to have
  - Streamline for further development in OPAI

How?

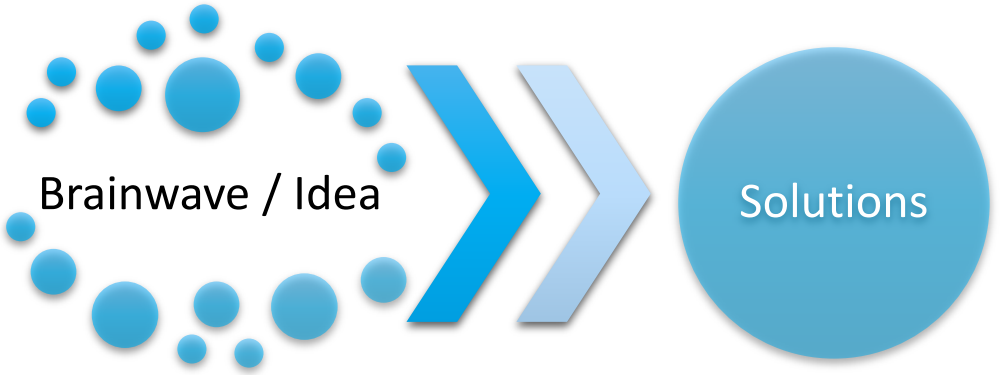
We need your help:

- Two surveys

1. Utility prioritization
2. Technology Provider Maturity Assessment

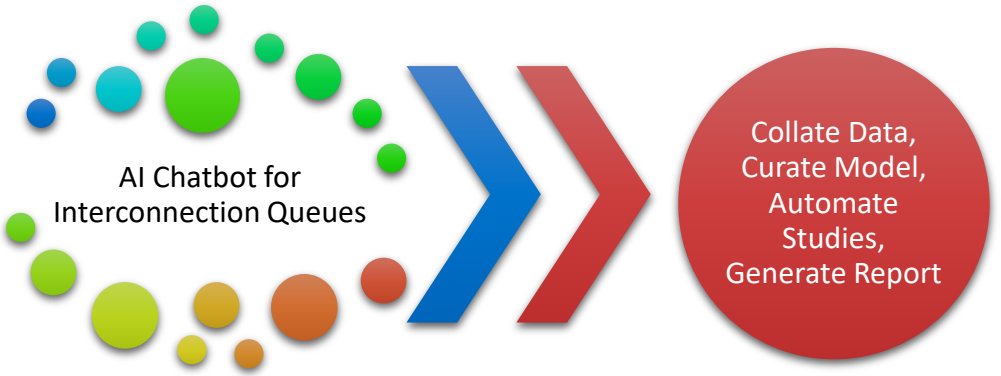
Why We Need to Organise Use Case Information

Streamlining Ideas to Map to Engineering Processes



What Problem is this Solving?

Engineering Process Enhancement, Efficiency, Automation

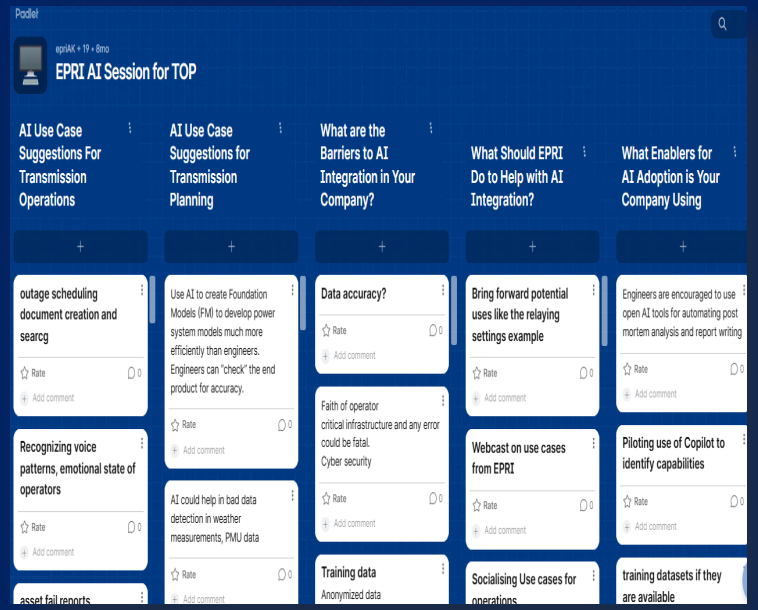


What Problem is this Solving?

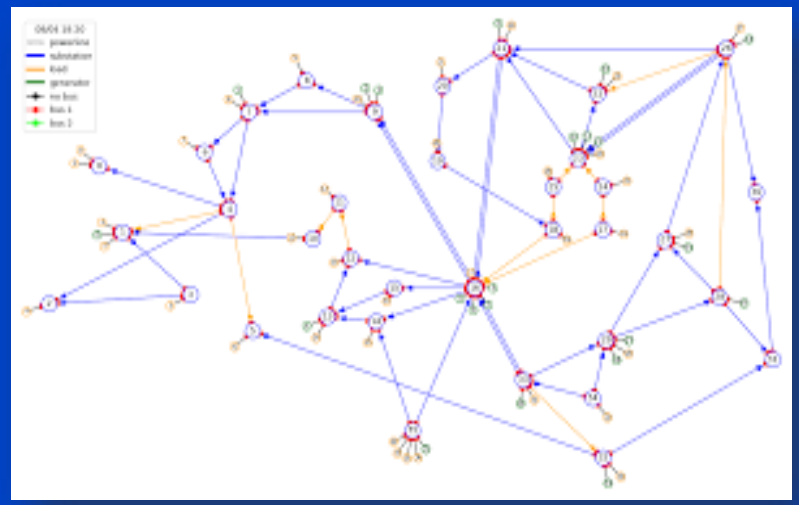
Engineering Process Enhancement, Efficiency, Automation

Where Do Use Case Ideas Come From?

- EPRI Workshops and Advisories



- Industry Initiatives Demos and Concepts



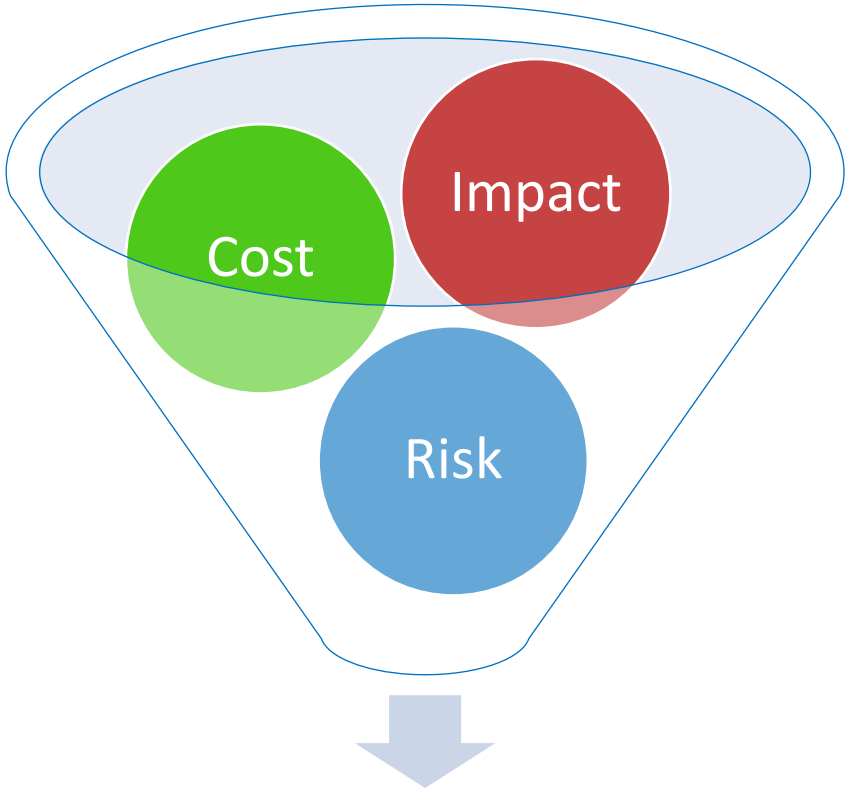
- EPRI R&D, Global Engagement With Technology Providers

Developing Use Cases for Transmission Operations and Planning

Use Case Maturity

- AI adoption is going to be difficult in Energy industry
  - For good reasons, we will never be first adopters!
- Generally low level of maturity so far
- Data Science and AI Teams Being Established
- Most companies are leveraging corporate LLMs (e.g. MS Co-Pilot) for text-based process efficiencies
- Most use case ideas focus on chat bots for knowledge search and retrieval
- Agents require interactions with systems. Vendors working on their own “agents”
  - Agent interoperability is the next frontier

Evaluating Use Cases



Public Use Case Lists – Too Generic, Non-Functional, Not Linked to Processes, Not Linked to Utility Needs

Spark Optimus

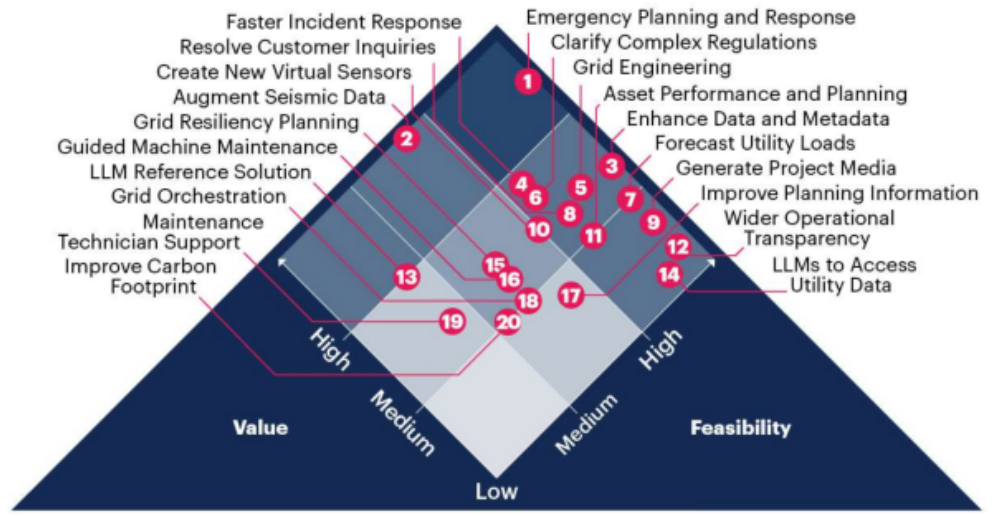
Table of contents

1. Generated self-service repair guides
2. Partly-automated replies for resolving disputes and complaints
3. Automated call logging and summarization
4. Automated market, competitor, and pricing reports
5. Automated payment or churn risk alerting `
6. Assisted data field entry
7. Localized marketing content `
8. Maintenance & technician assistance
9. Automated chatbot improvements
10. Personalized training for customer service & tele sales agents

Gartner

Gartner

Figure 1: GenAI Use-Case Prism for Energy and Utilities



What wil We Do in the Use Cases Workstream?

Goals of the OPAI Use Cases Workstream

1. To create and curate the world's most complete source of information on energy sector AI use cases.

2. Energy utilities assess and prioritize each use case by function

3. Technology providers match their solutions to use cases and assess maturity.

4. Take forward the high priority use cases to be co-developed by the OPAI community

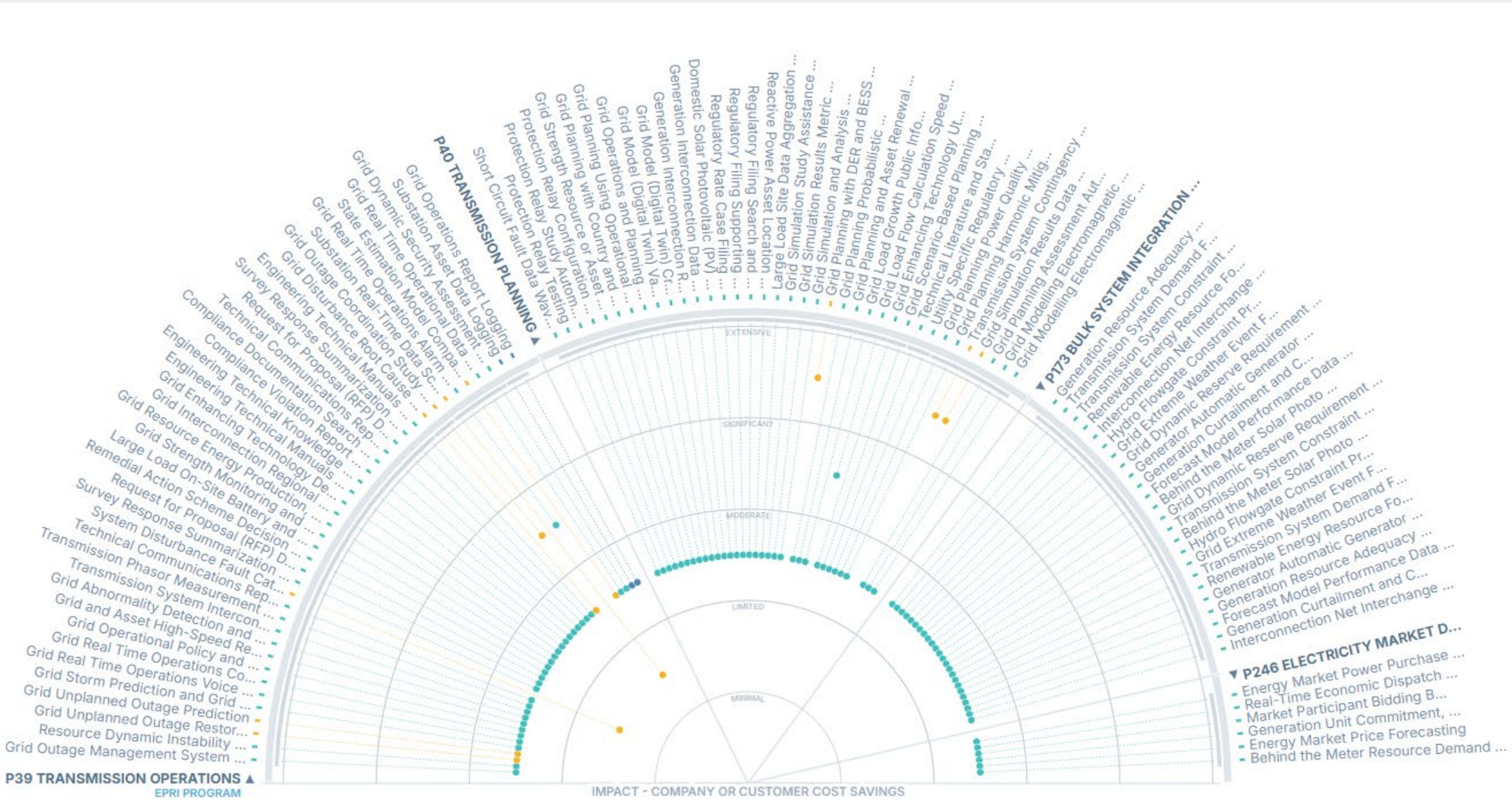
Proposed Workstream Research Output

1. Webpage with lists of use cases and metadata

2. Graphical, interactive summaries of use case meta data

3. Co-Development platform(s)

Energy Sector AI Use Case Repository



Use Case Maturity Assessments

Need to Prioritize Resources

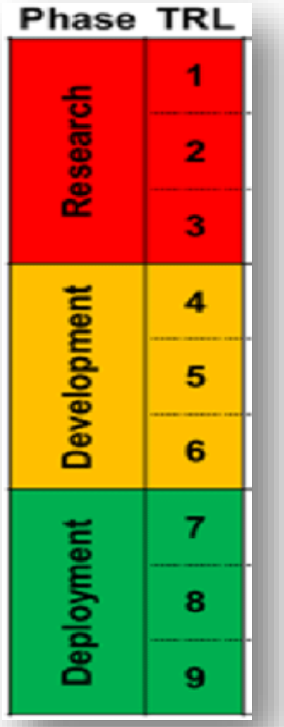
- ✓ In the OPAI Initiative - Each use case will be evaluated by EPRI SME and by industry participants
- ✓ Long list → Short List → Co-Development and Demos
- ✓ Need a suitable way to prioritize member use case development
- ✓ We are logging utility use case demos, in production solutions, viable technology provider solutions.

Matrix Evaluations

Use Case Maturity Assessments

Matrix Evaluations

Use Case ←→ Technology Matching



Co-Development of Use Cases

- Virtual Co-Development Space 1
- Virtual Co-Development Space 2
- Virtual Co-Development Space 3
- Virtual Co-Development Space 4
- ....

What Will We Do With the Data ?

Use Case Functional Prioritisation	• Top 5 10 Asset Management • Top 5-10 Operations • Top 5-10 Markets, Planning….etc
Use Case Assessment Criteria Prioritization	• Top 5-10 Reliability and Resilience • Easiest to implement • Least risky…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
Utility and Industry Demo Spotlights	• May reference and spotlight utility or technology use case implementations
Company Benchmarks	• Utilities that fill in the survey will receive their individual company results, relative to industry averages
Tech Provider Call to Action	• Are there gaps in industry that your technology can address
Regular Updates	• Survey can be rerun regularly to assess state of the industry

How Will We Obtain the Information We Need?

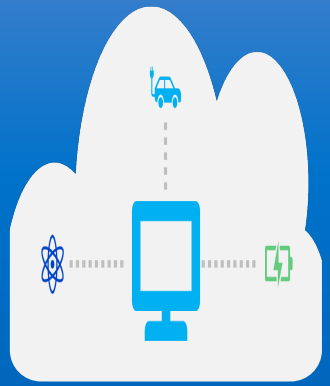
Who is the Survey Intended For? We Need to Group

Fill In

Energy Sector Utilities

- Generators and resources
- Market participants
- Grid asset owner
- Grid asset operators
- Energy suppliers
- Large energy users

Energy Utility
Energy AI Use Case
Assessment



Technology Providers and Research Institutes

- Large-scale software technology providers
- Small-scale software technology providers
- Startups
- Hardware technology providers
- Universities and academia
- Research institutes
- National labs

Technology Provider
Energy AI Use Case
Technology Maturity
Assessment

OPAI Use Case Survey Links

Energy Utility Survey

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

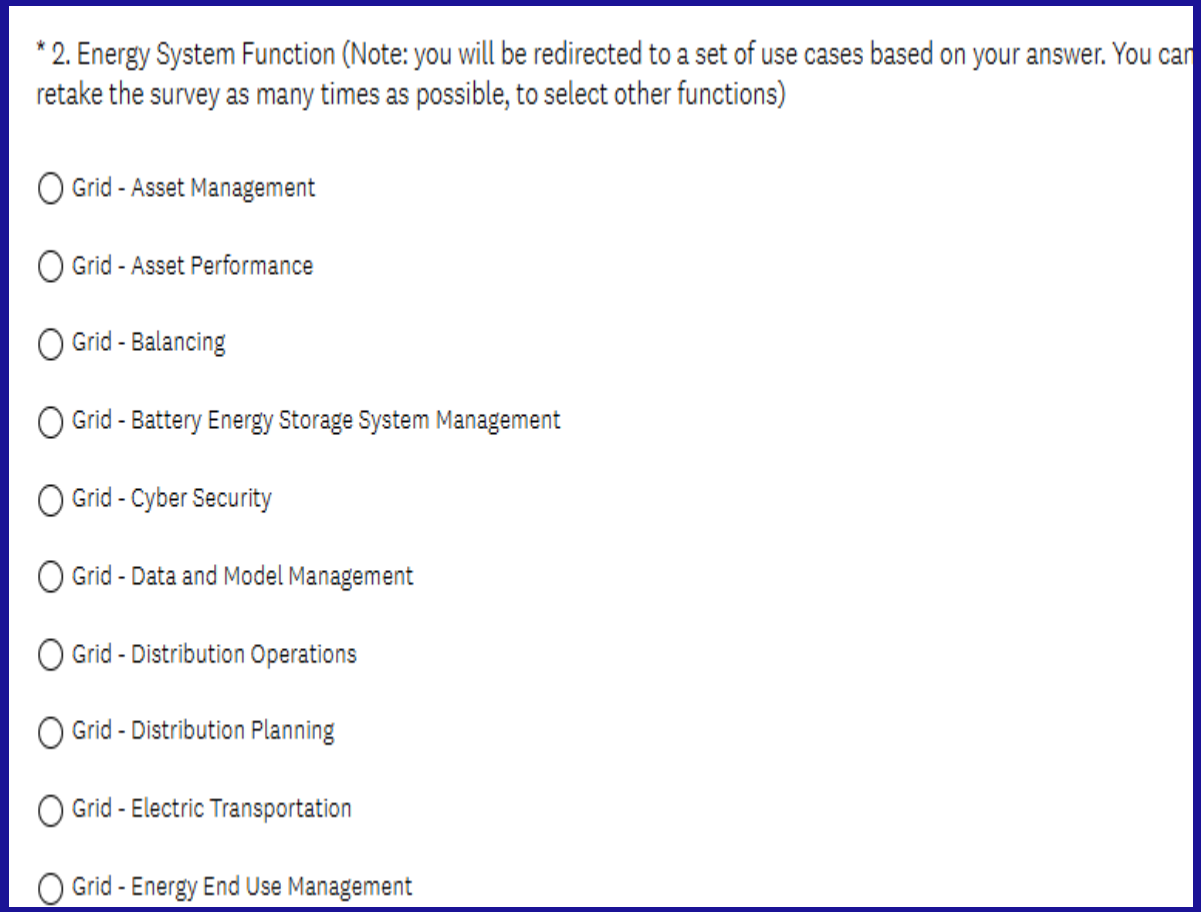
Click or Scan

Technology Provider Survey

https://www.surveymonkey.com/r/OPAI-USe-Cases-Tech-Providers

Functional Breakdown

- We tried our best to group by function.
- This is to target SMEs and for future co-development
  - Segregated by Sector – Function
    - Grid
    - Nuclear Power Plant
    - Thermal Power Plant
  - Data and models are usually function dependent
  - Solutions can be repurposed within functions
  - AI Use cases should be mapped to engineering process improvements
- Warning: Some use cases are multi functional and don't fit neatly into single categories



Utility Assessment Criteria Description

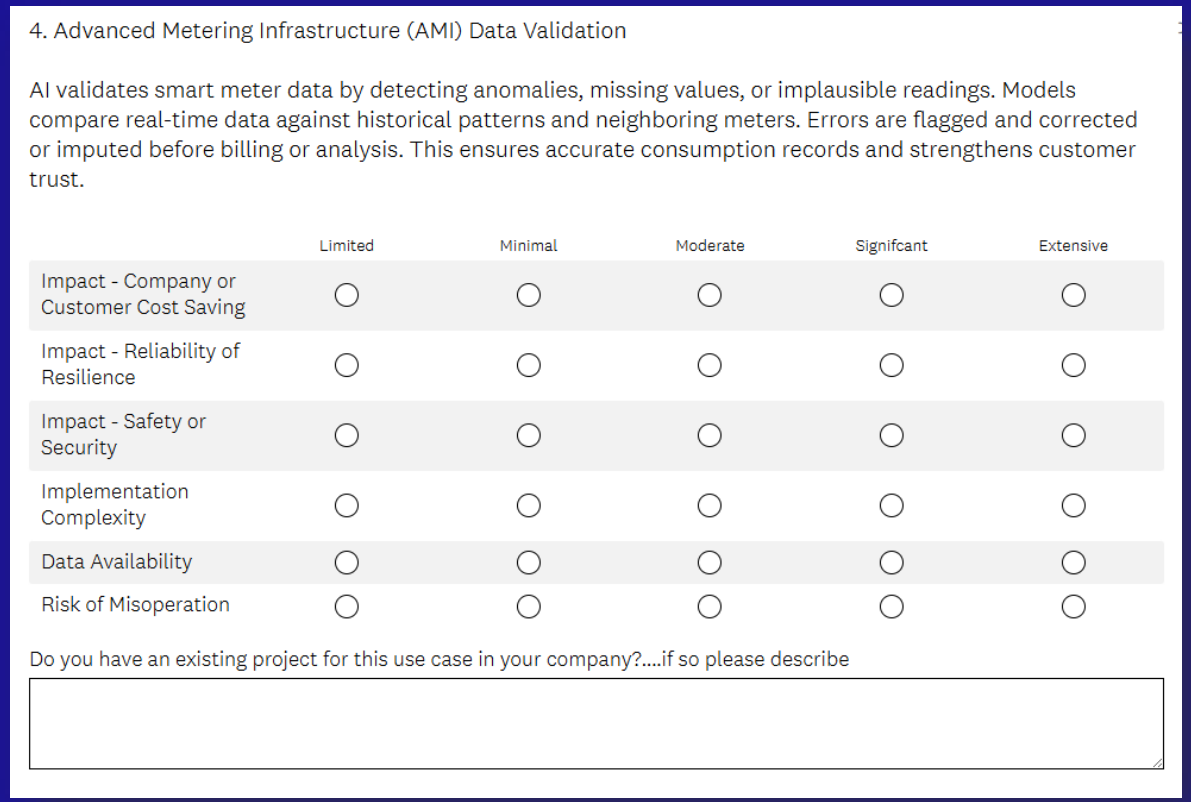
Use Case Assessment Criteria

- Impact – Reliability & Resilience
- Imact – Safety & Security
- Impact – Savings for Company & Customer
- Implementation Complexity
- Data Availability
- Risk of Misoperation

Assuming a technology solution was available

1. What would its impact be on the reliability of the asset, plant, network or infrastructure?
2. What would the impact be on worker or public safety, or cyber physical or energy asset security
3. What would be impact be on either the company costs or customer savings
4. How difficult would the solution be to develop hypothetically
5. How available and structured are data required to develop a solution
6. If the solution were to misoperate, what would the risk be to people, assets, networks, systems

Energy Utility Energy AI Use Case Assessment



4. Advanced Metering Infrastructure (AMI) Data Validation

AI validates smart meter data by detecting anomalies, missing values, or implausible readings. Models compare real-time data against historical patterns and neighboring meters. Errors are flagged and corrected or imputed before billing or analysis. This ensures accurate consumption records and strengthens customer trust.

	Limited	Minimal	Moderate	Signifcant	Extensive
Impact - Company or Customer Cost Saving	○	○	○	○	○
Impact - Reliability of Resilience	○	○	○	○	○
Impact - Safety or Security	○	○	○	○	○
Implementation Complexity	○	○	○	○	○
Data Availability	○	○	○	○	○
Risk of Misoperation	○	○	○	○	○

Do you have an existing project for this use case in your company?....if so please describe

- **Use Case Name**
- **High-level description**
  - What the use case is, how it would potentially work if an AI solution was developed.
- **6 assessment categories, 5 levels**
- **Free text box to describe:**
  - If your company has an application either in development or production

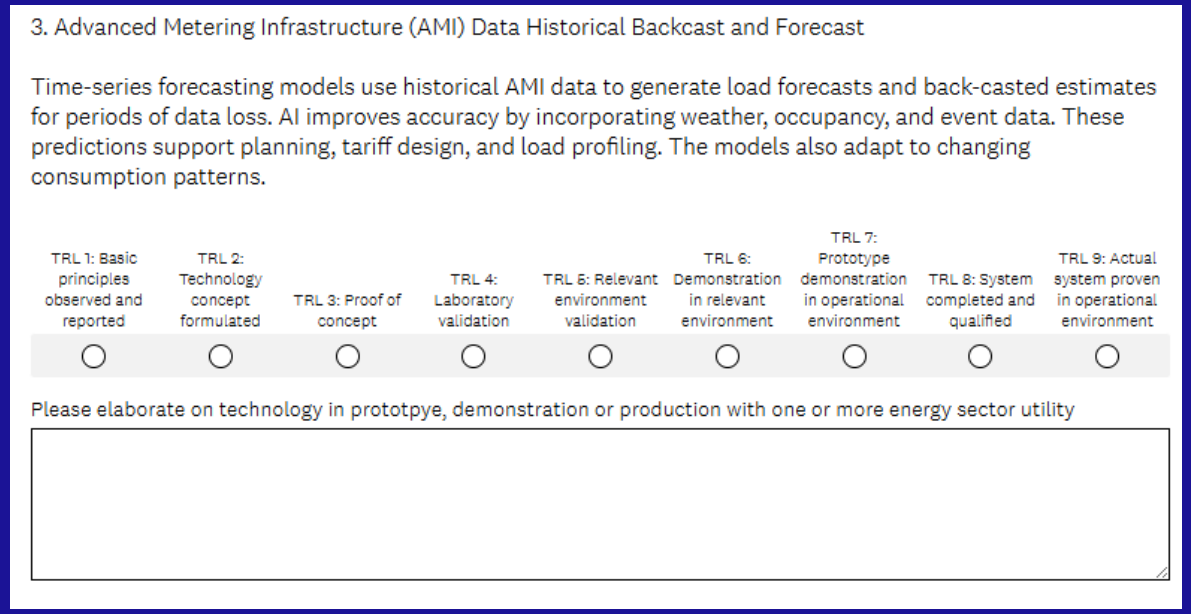
Please be decisive, resist selecting "Moderate".
We need to prioritise the high priority use case ideas and de-emphasise the low priorities

Technology Provider Energy AI Use Case Technology Maturity Assessment

1. TRL 1: Basic principles observed and reported—Early fundamental research, theoretical foundation only.
2. TRL 2: Technology concept formulated—Potential applications identified, but not yet proven or detailed.
3. TRL 3: Proof of concept—Active research, both analytical and lab studies to demonstrate feasibility.
4. TRL 4: Laboratory validation—Basic components tested together in a controlled lab environment to validate performance.
5. TRL 5: Relevant environment validation—Integrated prototype tested in a simulated or otherwise relevant environment to demonstrate realistic performance.
6. TRL 6: Demonstration in relevant environment—A system/subsystem level prototype demonstrated in an environment simulating real-life conditions.
7. TRL 7: Prototype demonstration in operational environment—Prototype tested in an actual operational or field environment, close to real-world use.
8. TRL 8: System completed and qualified—Final form of the technology tested and validated under expected operational conditions.
9. TRL 9: Actual system proven in operational environment—Technology is fully deployed, operational, and proven in its final environment.

Please resist the temptation to select production maturity with all use cases.
While your technology may be capable in theory, we are interested in tracking demos and matching to use cases

Technology Provider Energy AI Use Case Technology Maturity Assessment



3. Advanced Metering Infrastructure (AMI) Data Historical Backcast and Forecast

Time-series forecasting models use historical AMI data to generate load forecasts and back-casted estimates for periods of data loss. AI improves accuracy by incorporating weather, occupancy, and event data. These predictions support planning, tariff design, and load profiling. The models also adapt to changing consumption patterns.

TRL 1: Basic principles observed and reported	TRL 2: Technology concept formulated	TRL 3: Proof of concept	TRL 4: Laboratory validation	TRL 5: Relevant environment validation	TRL 6: Demonstration in relevant environment	TRL 7: Prototype demonstration in operational environment	TRL 8: System completed and qualified	TRL 9: Actual system proven in operational environment
○	○	○	○	○	○	○	○	○

Please elaborate on technology in prototpye, demonstration or production with one or more energy sector utility

- **The same use case names and descriptions**
- **High-level description**
  - **What the use case is, how it would potentially work if an AI solution was developed.**
- **Technology solution maturity assessment**
  - **1-9 Scale Technology Readiness Level**
- **Free text box to describe:**
  - **If your company has a demo or solution with an energy sector utility.**
  - **Mention the utility (for verification) other pertinent details / links**

Please resist the temptation to select production maturity with all use cases.
While your technology may be capable in theory, we are interested in tracking demos and matching to use cases

OPAI Use Case Survey – Example Format

Energy Utility Survey

Technology Provider Survey

Same Use Case – Different Response

4. Advanced Metering Infrastructure (AMI) Data Validation

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Impact - Safety or Security	○	○	○	○	○
Implementation Complexity	○	○	○	○	○
Data Availability	○	○	○	○	○
Risk of Misoperation	○	○	○	○	○

Do you have an existing project for this use case in your company?....if so please describe

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

4. Advanced Metering Infrastructure (AMI) Data Validation

AI validates smart meter data by detecting anomalies, missing values, or implausible readings. Models compare real-time data against historical patterns and neighboring meters. Errors are flagged and corrected or imputed before billing or analysis. This ensures accurate consumption records and strengthens customer trust.

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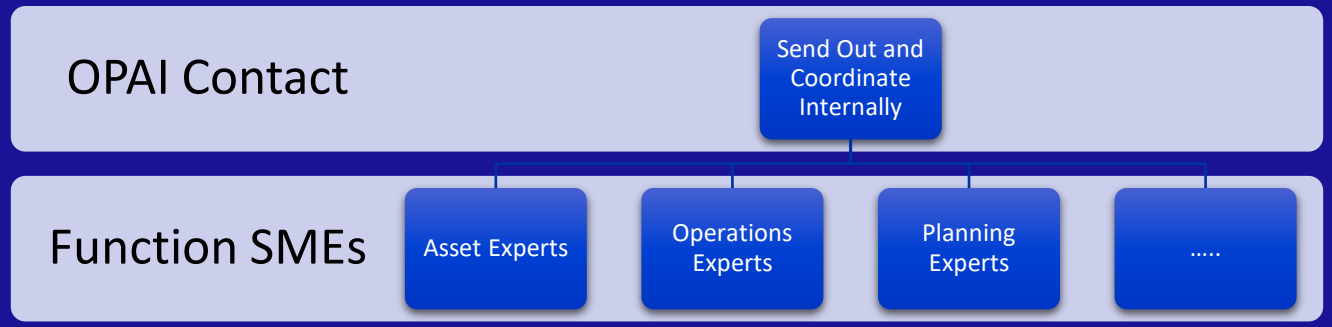
○	○	○	○	○	○	○	○	○

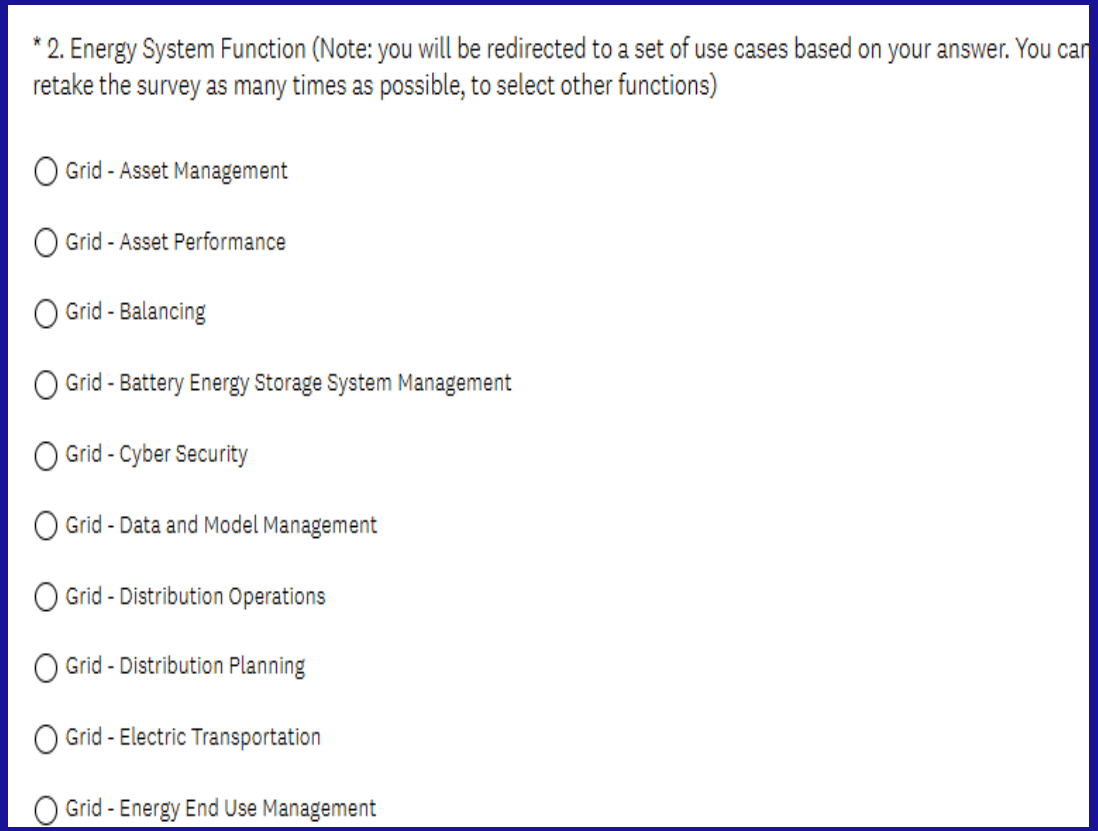
Is your entity working with an energy utility on a demo of your technology for this use case? If so please elaborate

https://www.surveymonkey.com/r/OPAI-USe-Cases-Tech-Providers

How We Intend the Survey to Work

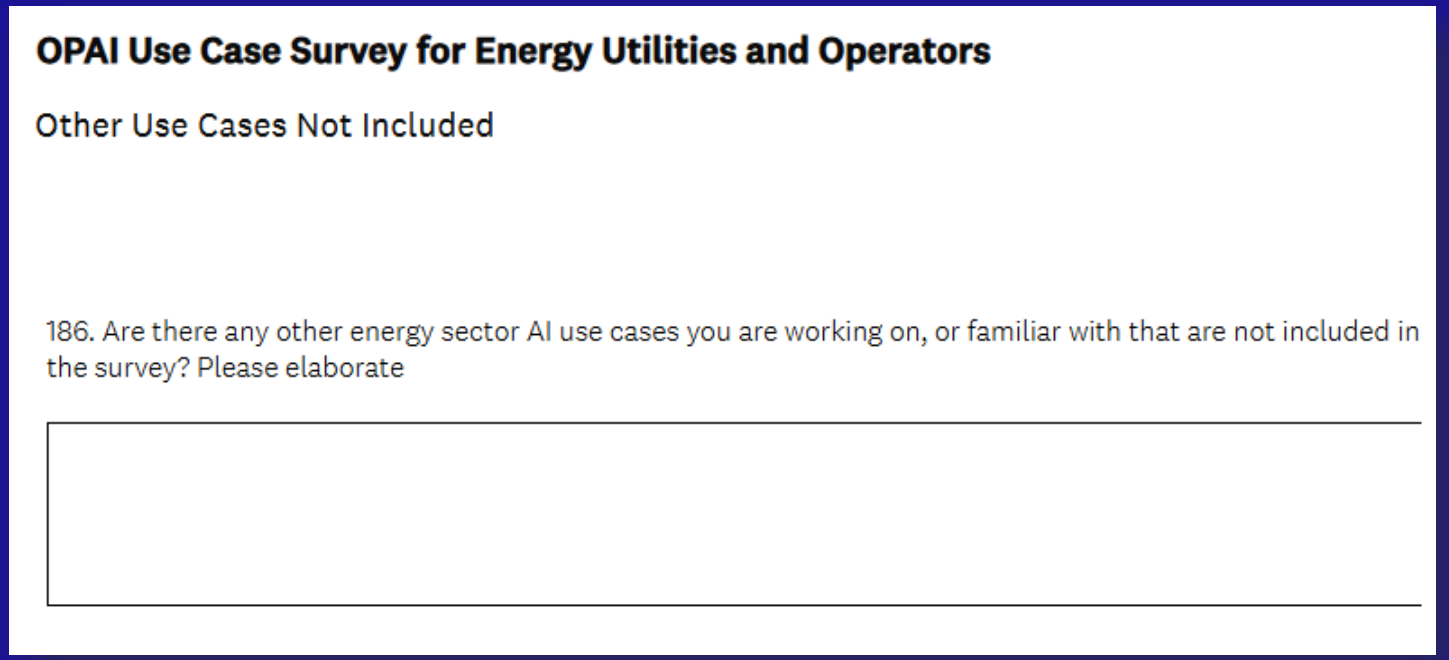


- YOU DON'T NEED TO EVALUATE ALL 300 USE CASES!
- Function SMEs evaluate use cases in their function
- Multiple SMEs per company can fill out survey
- SMEs can evaluate use cases in multiple functions by reopening the survey
- Utilities can be technology providers

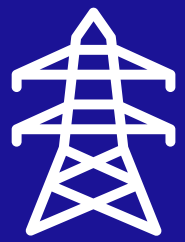


One Final Question……

- Maybe we missed something……!
- If we did - please add it before finishing the survey in the comment box
- Even if unsure, add it. We will figure out if its already covered
- We will develop an open form for new use case entry after the survey is complete



Use Case Surveys By Numbers



~54 Utilities

~ 280 Responses

~25 Technology Providers

~ 100 Responses

Be Sure to Complete

Status	Last modified	Time spent
Incomplete	2025-11-10 19:00	00:59
Complete	2025-11-10 16:52	10:21
Incomplete	2025-11-07 11:45	02:52:32
Incomplete	2025-11-07 09:16	09:06
Incomplete	2025-11-07 08:53	00:11
Incomplete	2025-11-07 08:43	23:14
Incomplete	2025-11-07 08:25	00:45
Incomplete	2025-11-07 08:16	00:50
Complete	2025-11-07 02:23	26:40
Complete	2025-11-07 01:55	27:28

Please Add Real Company Name (We Will Not Accept Otherwise)

Q1: Energy Utility or System Operator Name	Q2: Energy System Function (Nc	Q3: Grid M
test	People - Workforce Management Us	

Number of Responses per Function…

ANSWER CHOICES	RESPONSES	
Grid - Data and Model Management Use Cases	28.57%	26
Grid - Planning Use Cases	7.69%	7
Grid - Long Term Energy System Planning Use Cases	6.59%	6
Grid - Asset Management Use Cases	4.40%	4
Distribution - Metering Use Cases	4.40%	4
Hydrogen Production Facility - Regulation and Compliance Use Cases	4.40%	4
Grid - Asset Performance Use Cases	3.30%	3
Power Plant - Asset Management Use Cases	3.30%	3
People - Training and Development Use Cases	3.30%	3
Grid - Operations Use Cases	2.20%	2
Grid - Electric Transportation Use Cases	2.20%	2
ICT Systems - Cyber Security Use Cases	2.20%	2
Coal Plant - Asset Management Use Cases	2.20%	2
Coal Plant - Regulation and Compliance Use Cases	2.20%	2
Energy Storage - Generation Operations Use Cases	2.20%	2
People - Workforce Management Use Cases	2.20%	2
Grid - Infrastruture Development Use Cases	1.10%	1
Grid - Market Design and Operations Use Cases	1.10%	1
Grid - Outage Management Use Cases	1.10%	1
Grid - Protection and Control Use Cases	1.10%	1
Grid - Regulation and Compliance Use Cases	1.10%	1
Distribution - Energy End Use Management Use Cases	1.10%	1
ICT Systems - IT/OT Management Use Cases	1.10%	1
ICT Systems - Telecommunications Infrastructure Management Use Cases	1.10%	1
ICT Systems - Regulation and Compliance Use Cases	1.10%	1
Power Plant - Data and Model Management Use Cases	1.10%	1
Power Plant - Generation Operations Use Cases	1.10%	1
Power Plant - Materials Analysis Use Cases	1.10%	1
Power Plant - Regulation and Compliance Use Cases	1.10%	1

The Final Question - Use Case Ideas – Thank You

“Machine learning disaggregates AMI data to identify appliance-level usage patterns, enabling targeted energy efficiency programs.”

“Stability prediction based on network configuration and weather conditions”

“Gen AI outage planner for generating assets”

“Working on decarbonization optimization for multi-energy systems and the use of AI to interpret data.”

Raw Use Case List Data

- Would people be interested in accessing this?
- We have made it available as reference to align resources for OPAI members who have filled in at least one entry to the survey
- Note: This is an ungraded list of use cases, we want to ensure this is controlled within the group until we have sufficient responses
- Email: akelly@epri.com for access.

Name	Description	UtilityAsset	Function
Asset Field Work Crew Deployment Optimization	calls. AI can help streamline this process by analyzing real-time data on crew locations, job statuses, and priorities. With this insight, the system recommends the most efficient crew assignments, reducing response times and improving resource utilization. The result: faster service restoration, better crew coordination, and smarter use of field resources.		Workforce Management
Asset Field Work Operational Experience Synthesis for Lessons Learned	AI algorithms synthesize operational experience data from field work activities including maintenance reports, work orders, and crew feedback to extract lessons learned and best practices for continuous improvement. Natural language processing techniques analyze unstructured text from work completion reports, technical notes, and crew observations to identify recurring issues, successful solutions, and process improvement opportunities. The system creates searchable knowledge bases of operational experience that enable knowledge sharing across field crews and support evidence-based decision making for work procedures and training programs. Machine learning models identify correlations between work practices, outcomes, and performance metrics to recommend optimized approaches for similar future work activities.	People	Workforce Management
	AI systems analyze safety reports, incident data, and near-miss events from field work activities using natural language processing and statistical analysis to identify safety trends, risk factors, and improvement opportunities. Machine learning algorithms extract key information from unstructured safety reports including incident causes, contributing	People	

Next Steps and Timelines

- Implementation Work Stream Virtual Meeting
- Use-Case Work Stream Virtual Meeting
- Domain-Specific Model Virtual Meeting
- OPAI Executive Advisory Group
- OPAI Member Representative Committee
- EPRI Holiday

OCTOBER

Su	Mo	Tu	We	Th	Fr	Sa
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

Work Stream Kickoff

NOVEMBER

Su	Mo	Tu	We	Th	Fr	Sa
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9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30						

Use Case Survey Check in and Preliminary Results November 12-13

End of November Close Survey

DECEMBER

Su	Mo	Tu	We	Th	Fr	Sa
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7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

Results Collated December 16th Webcast on Survey Results

Company specific survey results released

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