



Emerging Technologies Survey

Scott Baker
Applied Innovation Department

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Emerging Technologies Forum

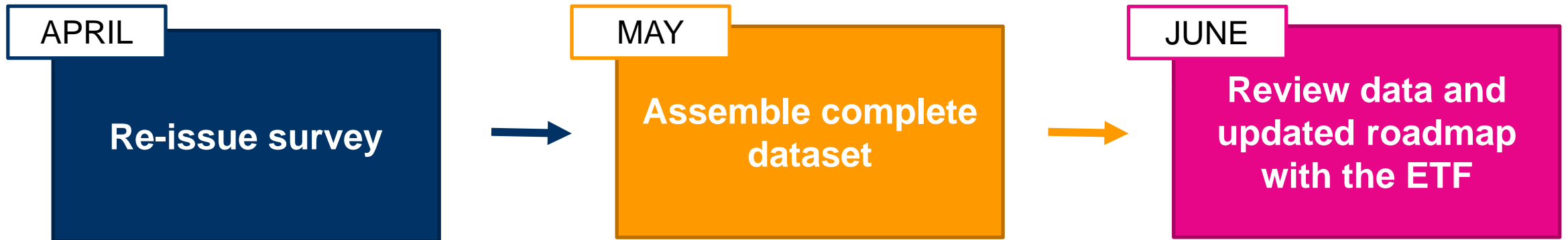
- Initial survey issued October 2020
- 11 individual responses; 74 affiliate companies
 - (see appendix for detailed results)
- Response data is being used to focus PJM emerging technology efforts and provide a roadmap for this Forum.
- However, a greater quantity, and diversity, of input from the membership is being sought to supplement existing responses

The following supplemental questions will be added to the survey:

- In what areas are your organization(s) using big data analytics and machine learning?

- In what areas should PJM pursue applying big data analytics and machine learning technology?
 - Examples: decarbonization / carbon pricing impacts, risk management, emerging technology evaluations and economic analyses, operations, etc.

- *If you already filled out this survey, we are only asking that you provide a response to the additional questions.*
 - Revising or supplementing initial responses would also be appropriate, but is not necessary. PJM will reconcile survey data from the previous version.



APPENDIX: RESULTS OF INITIAL SURVEY

11

Individuals

9

Voting Members

74

Affiliates

In what area of PJM’s business do you feel exploration and adoption of emerging technologies could be most transformational?

	Number (#)	Percentage
Transmission system operations	62	33%
Competitive markets	43	23%
Long-term transmission planning	43	23%
Costs associated with transmission upgrades	10	5%
Other (please specify):	32	17%

RESPONSES

Comments
<ul style="list-style-type: none"> • The PJM ETF should be technology-neutral and allow for the exploration of a range of technologies not limited to one business area • Holistic long-term transmission planning and modeling • PMUs, batteries, dynamic line ratings and other technologies could be impactful for planning, markets and operations • Generation and changes to energy dispatch and capacity market design

Out of the following technologies, please rank your level of interest in the technology.

	1		2		3		4		5		6		7		Weighted Avg.	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%		
RESPONSES	Dynamic line rating technology	1	1%	2	2%	0	0%	9	11%	15	19%	26	32%	28	35%	2.22
	Distributed energy resources technologies	24	30%	37	46%	1	1%	19	23%	0	0%	0	0%	0	0%	5.81
	Topology optimization	0	0%	41	51%	0	0%	28	35%	1	1%	11	14%	0	0%	4.73
	Hydrogen (“Power to Gas”)	0	0%	0	0%	16	21%	0	0%	35	43%	29	36%	1	1%	3.01
	Energy storage as a transmission solution	56	69%	1	1%	15	19%	2	2%	0	0%	0	0%	7	9%	6.02
	Blockchain	0	0%	0	0%	2	2%	0	0%	21	26%	15	19%	43	53%	1.80
	Flexible Alternating Current Transmissions Systems (FACTS)	0	0%	0	0%	47	58%	23	28%	9	11%	0	0%	2	2%	4.40

What technologies are not listed that you would like to see on the list?

Technologies

- Small modular reactors/modular nuclear generation
- Maintenance inspection automation/optimization tools
- Preemptive system detection technology (Asset Health-type systems)
- ELMP
- Improved hardware/software to solve market engines (e.g., DAM, FTR) quicker
- Fuel cells
- Advanced software to perform all planning studies (load flow, stability & short circuit)
- EMS changes to handle capacity predominated by renewables
- Automated fault analysis tools
- Smart devices (e.g., smart wires)
- Line coatings and other transmission technologies
- Linear state estimation for Transmission Operations
- Relay and automation technology that enhance system resiliency

Would you like to see PJM engage in more, less, or the same amount of Advanced Technology Pilots and why?

Comments

- More, to the extent that they occur organically. The PJM ETF provides a means for educating the stakeholder body on technologies and active pilots. This increased education and discussion will lead to additional voluntary pilot programs. Pilots should not be forced.
- Awareness of emergent technologies and related challenges, benefits and applications.
- PJM can support utility-led pilots through partnership, support and input on a case-by-case basis. Support could be provided in the form of communicating with government agencies to help promote/provide regulatory attention to technologies that benefit, as well as providing the RTO-level benefits a technology provides. However, PJM should not be in the development business allowing market participants to develop products for offering into the markets.
- The number of projects currently being undertaken is the right amount. If PJM were to take on more projects, that would negatively impact PJM's ability to adequately study and implement these pilot projects. Additionally, if too many pilots were taking place simultaneously, it may become difficult to determine or attribute grid issues from one pilot or another.

	Number (#)	Percentage
More	30	36%
Less	0	0%
Same Amount	53	64%

- We don't have complete awareness of the amount of pilots being conducted but our impression is that more would not be the correct answer – so, the same or less.
- Most PJM market rules are based on old technology limitations.

What are the most important considerations for your company regarding the PJM Advanced Technology Pilot process?

Comments

- Flexibility. Asset owners should have the opportunity to explore transmission system technologies with PJM that the asset owner believes offer safety, reliability or cost benefits to their customers and/or the PJM system. An asset owner should be under no obligation to explore or adopt a technology that may not offer safety, reliability or cost benefits. Additionally, the pilot process should not seek to rack up a high number of pilots or force their success – that’s dangerous, wastes resources, and could potentially jeopardize the integrity of the grid.
- Clear and flexible guidelines/rules for Advanced Technology Pilot process and market participation/development. Efficient and quick review process. Respect confidential and security attributes of pilots.

	Number (#)	Percentage
Transparency	60	33%
Ensuring each pilot is successful	29	16%
Amount of pilots	2	1%
PJM resources devoted to pilots	32	18%
Other (please specify):	59	32%

- A successful project does not necessarily mean it is implemented. The ability for developing a better understanding of how the technology performs and whether the project has potential for future implementation, modifications that may be needed and shortcomings of the technology should be the goal.
- We believe that pilots are beneficial, but that PJM should not be overly dedicated to them.
- There should be tests/conditions.

Regarding the following challenges for implementing a new technology, rank which is most important to you?

	1		2		3		4		Weighted Avg.
	#	%	#	%	#	%	#	%	
RESPONSES	Inclusivity – ensuring that the benefits and implementation challenges are identified and considered when comparing with a traditional technology								
	0	0%	14	17%	45	54%	24	29%	1.88
	Reliability – ensuring that the technology is sufficiently reliable and controllable, as compared to traditional equipment or software								
	56	67%	18	22%	9	11%	0	0%	3.57
Transparency of entry – ensuring that stakeholders receive timely notification of the first-time use of a new technology in PJM									
9	11%	0	0%	15	18%	59	71%	1.51	
Security – ensuring that new technology does not pose unnecessary additional cyber or physical security risk to PJM or the broader electric system.									
18	22%	51	61%	14	17%	0	0%	3.05	

What type of content or discussions are you most looking forward to at the Emerging Technologies Forum? (Rank)

		1		2		3		4		Weighted Avg.
		#	%	#	%	#	%	#	%	
RESPONSES	Discussion of active Advanced Technology Pilots	11	13%	33	40%	24	29%	15	18%	2.48
	Education about the technical details of emerging technologies	38	46%	9	11%	35	42%	1	1%	3.01
	Discussing implementation of technology within PJM	33	40%	10	12%	24	29%	16	21%	2.72
	Presentations from non-PJM staff about emerging technologies and issues (e.g., vendors, technologists, research organizations)	1	1%	31	37%	0	0%	51	61%	1.78

Confirmed focus on education on emerging tech, and evaluation of impacts on operations, planning and markets.

Strong interest in greater transparency of the pilot program

Interest in a broad and varied scope of technologies. PJM will work to address this feedback in the ETF work plan

Greater and more diverse feedback still needed; Consider survey updates semi-regularly

Strong interest in SATA and DER

SATA – Storage as a Transmission Asset

Reliability

Facilitator:

Danielle Croop, Danielle.Croop@pjm.com

Secretary:

Yuri Smolanitsky,
Yuri.Smolanitsky@pjm.com,

Presenter:

Scott Baker, scott.baker@pjm.com

Emerging Technologies Stakeholder Survey



Member Hotline

(610) 666 – 8980

(866) 400 – 8980

custsvc@pjm.com