PJM's Proposed Solution Options for Accreditation

ELCCSTF

February 3, 2025

Today's Presentation

Review our current set of proposed solution options for accreditation reforms:

- **BRA to Third IA Accreditation Uncertainty:** There are currently two approaches we are further considering and hope to receive additional stakeholder feedback on today.

- **Improving Investment Incentives – Weighting Approach:** Implement a weighting approach that puts greater emphasis or weight on more recent observations of performance within each temperature bin in the reliability risk analysis and ELCC accreditation.

- **Update to ELCC Classes:** Two ELCC Class Additions (Steam-Waste to Energy and Oil CTs)

Note: These reflect current thinking on a proposed set of reforms for stakeholder consideration to implement with the 2027/28 BRA, recognizing that there are additional potential reforms and accreditation topics to further explore and discuss with stakeholders in the ELCCSTF.

BRA to Third IA Accreditation Uncertainty

Review of the concern that has been raised:

Most existing generators have a must offer requirement in the BRA for their full accredited UCAP value, as determined using the ELCC analysis run prior to the BRA. That accredited UCAP value gets updated over time based on the latest ELCC analysis for the relevant Delivery Year, with the final value being determined just prior to the 3rd IA. When the final accredited UCAP value falls below the amount committed in the BRA, which may be driven by factors unrelated to a decrease in ICAP or performance of the resource, the resource owner is subject to deficiency charges at roughly 120% their capacity revenue for the shortfall MW when they are unable to procure replacement capacity. Market sellers are looking for reforms to address that uncertainty and risk, particularly given it may be difficult or not possible to procure the replacement capacity when the system is tight.

Example

Generator A is accredited at 100 MW UCAP and clears the full amount in the BRA at a clearing price of $250/MW-day. Accreditation is then updated prior to the 3rd IA and due to changes in system risk profiles, the final accreditation of the resource is 90 MW UCAP. If unable to procure replacement capacity, the resource owner would be subject to a daily deficiency charge for the 10 MW UCAP shortfall times $300/MW-day (1.2x BRA price)

BRA to Third IA Accreditation Uncertainty (cont'd)

Potential options to help address the uncertainty / risk of a lower final accredited value:

1) Lock in accreditation values, or certain inputs into the accreditation, at the time of the BRA.

2) Allow market sellers to price in the risk of lower accredited UCAP and deficiency charges in their sell offers

3) Allow market sellers to offer at a level below the full accredited UCAP at the time of the BRA (e.g. based on a minimum of recent and forecasted ELCC values, or X percentage below the full accredited amount)

4) Differentiate between ICAP and UCAP driven deficiencies. For UCAP deficiencies, lower the penalty rate to 100% of the clearing price to remove sellers' exposure to deficiency penalties that exceed the auction revenues being paid for the shortfall MW.

Further considering these 2 options that were introduced and discussed during the prior ELCCSTF meeting.

BRA to Third IA Accreditation Uncertainty (cont'd): Approach 1 Review

Approach 1: Lock in BRA ELCC Class Ratings and Accredited UCAP Factors

- New units in the IAs would still have accreditation based on the BRA ELCC ratings and analysis
- The Reserve Requirement Study and IRM would still be updated prior to IAs and reflect the latest set of available inputs for weather, load forecast, projected resource mix, and performance
- The FPR would be determined for IAs based on the updated IRM and the Pool-wide average Accredited UCAP Factor from the BRA (with any small adjustments needed to reflect updates to the resource mix)

Considerations:

- Removes the BRA to 3rd IA uncertainty and risk of deficiency charges driven by lower ELCC ratings from market sellers (retains risk of ICAP deficiencies). Similarly, removes the upside of any increase in ELCC ratings for sellers that would have otherwise resulted in additional capacity value for sale.
- All updates to the inputs or shifts in risk profiles in the resource adequacy analysis and accreditation would effectively be captured in the determination of PJM Buys or Sells in the IAs with no ELCC updates, regardless of whether the driver of the changes were related to resource performance or not.

BRA to Third IA Accreditation Uncertainty (cont'd): Approach 4 Review

Approach 4: Update ELCC Class Ratings and accreditation values with each IA. However, for commitment deficiencies driven by lower UCAP factors, apply a lower penalty rate to the deficient MW based on 100% of the resource's clearing price

- Deficiencies driven by a decrease in ICAP (e.g. a planned generator clears and then fails to come online in time) is penalized at existing penalty rate based off 120% of the resource's clearing price.
- Deficiencies driven by a lower Accredited UCAP Factor than the factor used when clearing is only penalized at 100% of the resource's clearing price.

Considerations:

- Continues to expose market sellers to updates in ELCC accreditation values between the BRA and IAs (up or down), regardless of the driver of those changes, but removes exposure to deficiency penalties that exceed the auctions revenues being paid for the shortfall MW when the deficiency is driven by lower UCAP factors.
- Provides revenues back to load when accredited value of resources drop and replacement capacity is not procured.
- Can result in lower IA buy bid prices from owners of deficient resources than status quo and lower than the price PJM would buy at under Approach 1 in certain scenarios.

Improving Investment Incentives - Weighting Approach

Reflect improved performance in accreditation and risk model as it happens, and quicker than status quo

- Under status quo, all historical days in a temperature-performance bin are weighted equally when making Monte Carlo draws
- By using a weighting approach, more recent historical days in a temperature-performance bin can receive a higher weight, making such days to be more likely to be drawn by the Monte Carlo (and therefore, older historical days in a bin, less likely to be drawn)
- This increases investment incentives given more recent observations of performance will now hold greater weight when determining the capacity value of resources and the capacity compensation they can receive going forward

Approach to Weight Years: Exponential Smoothing (ES)

As an example, let's assume there are 11 historical days in a temperature-performance bin from 11 different Delivery Years

Delivery Year Rank (Performance Temperature bin)	Weight	alpha = 0.1	alpha = 0.05
1	α	0.1000	0.0500
2	$\alpha(1-\alpha)$	0.0900	0.0475
3	$\alpha(1-\alpha)^2$	0.0810	0.0451
4	$\alpha(1-\alpha)^3$	0.0729	0.0429
5	$\alpha(1-\alpha)^4$	0.0656	0.0407
6	$\alpha(1-\alpha)^5$	0.0590	0.0387
7	$\alpha(1-\alpha)^6$	0.0531	0.0368
8	$\alpha(1-\alpha)^7$	0.0478	0.0349
9	$\alpha(1-\alpha)^8$	0.0430	0.0332
10	$\alpha(1-\alpha)^9$	0.0387	0.0315
11	$\alpha(1-\alpha)^{10}$	0.0349	0.0299

Interpretation:
If alpha=0.1, the Monte Carlo method will sample 0.1/0.0387, which is 2.6 times more often from performance in a day in Delivery Year Rank 1 than from performance in a day in Delivery Year Rank 10

How Weighting using ES Impacts the Monte Carlo Sampling in a Temperature-Performance Bin

For example, let's use the 9 historical days in the coldest bin used in the analysis of the 25/26 BRA planning parameters

Sampling weight calculated for each Date

Date	DY	DY Rank	Weight (alpha=0.05)	Weight (alpha=0.1)	Weight (alpha=0.25)
1/31/2019	2018/19	1	0.05	0.1	0.25
1/30/2019	2018/19	1	0.05	0.1	0.25
2/24/2015	2014/15	2	0.0475	0.09	0.1875
2/20/2015	2014/15	2	0.0475	0.09	0.1875
2/16/2015	2014/15	2	0.0475	0.09	0.1875
1/8/2015	2014/15	2	0.0475	0.09	0.1875
1/28/2014	2013/14	3	0.0451	0.081	0.1406
1/22/2014	2013/14	3	0.0451	0.081	0.1406
1/7/2014	2013/14	3	0.0451	0.081	0.1406

Expected sampling from each Date (out of 100 samples)

Date	Status Quo	Weight (alpha=0.05)	Weight (alpha=0.1)	Weight (alpha=0.25)
1/31/2019	11.11	11.76	12.45	14.95
1/30/2019	11.11	11.76	12.45	14.95
2/24/2015	11.11	11.17	11.21	11.22
2/20/2015	11.11	11.17	11.21	11.22
2/16/2015	11.11	11.17	11.21	11.22
1/8/2015	11.11	11.17	11.21	11.22
1/28/2014	11.11	10.60	10.09	8.41
1/22/2014	11.11	10.60	10.09	8.41
1/7/2014	11.11	10.60	10.09	8.41
Total	**100**	**100**	**100**	**100**

As the alpha value increases the older observations in the bin
(from Jan. 2014) are less likely to be drawn in the Monte Carlo sampling
(e.g., 8.41 < 10.09 < 10.6)

Weighting Approach: Sensitivity Analysis

- Inputs / Assumptions for Weighting Approach Sensitivity Analysis
  - Based on 2026/27 BRA case from June 2024
    - Note: The resulting parameters from such case will no longer be used due to the postponement of that BRA
  - PJM decided to merge the two coldest temperature bins because it was likely that an approach weighing more recent performance more heavily would result in WSE performance, located in the second coldest bin, to contribute more risk than the PV1 performance, located in the coldest bin (and such an outcome would be counterintuitive if we believe that the worst system conditions during winter should occur during days in the coldest bin)
  - PJM used ES with 3 different alpha values (0.05, 0.1 and 0.25) to determine the sampling weights in each of the temperature-performance bins

Weighting Approach: Sensitivity Analysis (cont'd)

	LOLH Risk Contribution of Jan 7 2014 Performance Pattern	LOLH Risk Contribution of Dec 24 2022 Performance Pattern	LOLH Risk Contribution of Winter 2013/14 Performance Pattern	LOLH Risk Contribution of Winter 2022/23 Performance Pattern	Overall Winter LOLH Share	IRM
Status Quo	37.5%	13.3%	51.5%	17.5%	71.3%	18.6%
Alpha = 0.05	18.0%	27.3%	37.7%	35.9%	75.6%	18.7%
Alpha = 0.10	14.7%	29.7%	33.4%	41.4%	76.6%	18.7%
Alpha = 0.25	10.0%	44.1%	20.8%	58.4%	81.1%	19.0%

- The weighting approach (with the 3 alpha values) reduces the LOLH Risk Contribution of Jan 7, 2014 and Winter 2013/14 Performance Pattern relative to Status Quo
- As the alpha value increases, the LOLH Risk Contribution of Jan 7, 2014 and Winter 2013/14 Performance Pattern decreases. Conversely, the LOLH Risk Contribution of Dec 24, 2022 and Winter 2022/23 Performance Pattern increases.
- As the alpha value increases, the overall winter LOLH share increases. In other words, winter becomes riskier than summer. This is because several of the high forced outage observations in the "hottest" bins have occurred in the past and are less likely to be drawn in the summer temperature-performance bins.
- As the alpha value increases, the IRM increases. This effectively means that the model observes more overall risk when more recent observations have a higher sampling weight in each temperature-performance bin.

Weighting Approach: Sensitivity Analysis (cont'd)

Impact on ELCC Class Ratings under the sensitivity of Alpha=0.1

ELCC Class	2026 BRA Rating	Alpha = 0.1 Rating	Delta
Onshore Wind	34%	37%	3%
Offshore Wind	61%	61%	0%
Fixed-Tilt Solar	8%	7%	-1%
Tracking Solar	13%	11%	-2%
Landfill Intermittent	54%	50%	-4%
Hydro Intermittent	38%	38%	0%
4-hr Storage	57%	52%	-5%
6-hr Storage	65%	62%	-3%
8-hr Storage	68%	65%	-3%
10-hr Storage	78%	75%	-3%
Demand Response	74%	70%	-4%
Coal	84%	83%	-1%
Diesel Utility	91%	90%	-1%
Gas Combined Cycle	78%	76%	-2%
Gas Combustion Turbine	68%	68%	0%
Gas Combustion Turbine Dual	79%	81%	2%
Nuclear	95%	95%	0%
Steam	74%	75%	1%

Weighting Approach: Sensitivity Analysis (cont'd)

Impact on historical weighting of individual resource performance in determining Accredited UCAP for resources in an ELCC Class (under varying alpha assumptions):

Delivery Year	Status Quo	0.05	0.1	0.25
2012/2013	4.0%	2.7%	2.1%	0.7%
2013/2014	24.7%	23.2%	21.1%	15.7%
2014/2015	24.9%	20.6%	20.0%	17.9%
2015/2016	2.2%	1.9%	1.7%	0.9%
2016/2017	3.8%	3.1%	2.9%	1.7%
2017/2018	11.7%	18.8%	19.3%	20.6%
2018/2019	14.1%	10.9%	11.5%	13.1%
2019/2020	2.8%	2.6%	2.7%	2.3%
2020/2021	2.6%	2.7%	3.0%	3.1%
2021/2022	3.2%	3.5%	4.2%	5.4%
2022/2023	6.0%	9.9%	11.6%	18.5%
	100%	**100%**	**100%**	**100%**

- Under a higher alpha value, the greater the impact that recent observations of individual unit performance will have when determining ELCC Resource Performance Adjustments and Accredited UCAP, directionally increasing investment incentives
- For example: If we had been under this accreditation framework going into 22/23 with that DY as the most recent, the impact that a resource's performance during WSE would have had on its accreditation under a 0.25 alpha is significantly greater than under status quo.

Weighting Approach: Conclusions

- The Weighting Approach using Exponential Smoothing (ES) to the Delivery Year Rank observations within a temperature-performance bin effectively decreases the LOLH Risk Contribution of older performance observations relative to newer ones
  - The degree of such decrease depends on the value of the parameter alpha.
- Because LOLH Risk Contribution is the key factor driving ELCC accreditation resulting from the ELCC model, we can conclude that the Weighting Approach using ES could also result in accreditation values that are more heavily impacted by recent performance during extreme weather (as observed on the prior slide), which directionally tend to increase incentives for investment and improved future performance.
- There are other impacts to consider when deciding the "best" alpha value. For instance, the IRM, which can provide a measure of overall system risk.

We are currently leaning towards a proposed alpha of 0.25 under the Weighting Approach

Proposed ELCC Class Additions:

1. Steam - Waste to Energy: This new class would consist of certain generators that currently fall under the broader "Steam" ELCC Class today that utilize steam technology with a primary fuel source of muni waste or wood waste.

Est. ELCC Class Rating based on a 25/26 Third IA sensitivity: **83%** *(Steam remains at ~73/74%)*

2. Oil CTs: This new class would consist of certain generators that currently fall in the "Other Unlimited Resource Class" today that utilize combustion turbine technology with a primary fuel source of oil / diesel

Est. ELCC Class Rating based on a 25/26 Third IA sensitivity: **85%**

Appendix

Additional Sensitivities on Alpha Weighting based on 2026/27 BRA Run from June 2024

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Alpha = 0.10	14.7%	29.7%	33.4%	41.4%	76.6%	18.7%
Alpha = 0.25	10.0%	44.1%	20.8%	58.4%	81.1%	19.0%
Alpha = 0.35	6.8%	53.9%	13.7%	71%	86.3%	19.5%
Alpha = 0.5	2.3%	66.8%	5.5%	86.0%	92.4%	20.4%
Only merging of two coldest temp. bins	22.1%	24.1%	43.2%	31.1%	75.6%	18.7%

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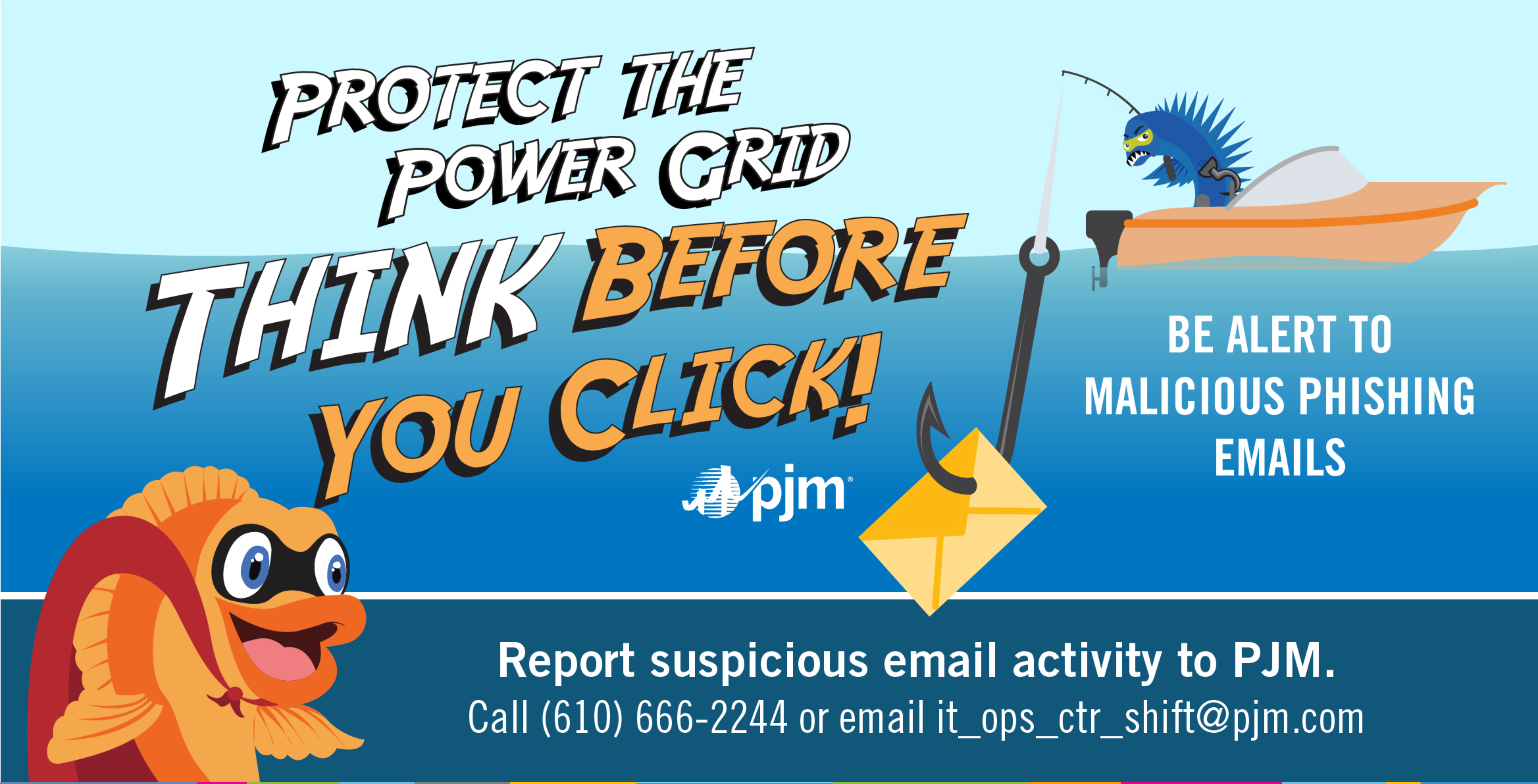
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