Effective Load Carrying Capability: Summary of Proposed Process and Discussion of Potential Results

Andrew Levitt, Market Design and Economics Department

August 7, 2020

PJM CCSTF

ELCC Application

- Accredited UCAP = UCAP MW eligible for offer or delivery to the Capacity Market (incl. FRR) for a given delivery year. CCSTF has also used the term "UnitELCCMW" for the same thing.
- **Accredited UCAP** for a given delivery year = **NameplateMW*ClassELCC%$_{dy}$*UnitPerformanceAdjustment$_{dy}$**
- For Intermittent Resources and combination resources, NameplateMW = Maximum Facility Output.
- For limited duration resources (incl. Energy Storage Resources), NameplateMW = lesser of MFO or MFO*(X*MFO/MWhCapability), where "X" is the duration of the class, and MWhCapability is the storage inventory size in MWh.

Summary of ELCC Process Planned Resources

Enter Queue and Request CIRs

- CIRs (as firm deliverability) are an input to ELCC analysis, not vice versa.
- Indicative estimated ClassELCC% results will be available 10 years forward.

Sign ISA/WMPA

- Strawman proposal would provide a table with guaranteed minimum floor ClassELCC% values for the next 10 delivery years.

Offer into Capacity Auction

- Offers capped by estimated ClassELCC% values for the target delivery year, as well as by a unit-specific Performance Adjustment (as well as any other applicable caps, such as CIRs).
- A Performance Adjustment is developed for each Planned Intermittent Resource using a site-specific backcast (except during transition phase).
- Strawman proposal would use a guaranteed minimum floor for this initial ClassELCC% value.

First delivery year

- The final ClassELCC% value is calculated immediately prior to the third Incremental Auction, a few months before the start of the delivery year.
- Resources should buy back any shortfalls in case the ClassELCC% value falls between the BRA and the 3d IA.

Cont'd

Summary of ELCC Process Planned Resources

Subsequent Delivery Years: Performance Adjustment

- Final Performance Adjustment updates for each unit are provided before the 3d Incremental Auction.
- Actual output of Intermittent Resource added to the backcast to produce 10 years of data for Performance Adjustment updates.
- Most recent available Performance Adjustment used for capping offers into auctions, as well as determining the amount of UCAP provided in any given delivery year.
- In the 3d IA, resources should buy back any shortfalls based on declines in Performance Adjustment and/or declines in ClassELCC%.
- Limited duration resources use (1-EFORd) as a performance adjustment, using the same EFORd calculation method as today.

Subsequent Delivery Years: ClassELCC%

- Final ClassELCC% values continue to be released each year before the 3d Incremental Auction, and continue to be used to cap offers and actual UCAP delivered.
- Under straw proposal, ClassELCC% floors would apply for 10 delivery years following the ISA/WMPA execution.
- Indicative estimated ClassELCC% values continue to be made available each year for 10 years forward.
- Currently, neither ClassELCC% values nor Performance Adjustment values have any bearing on CIR retention (which is based on summer tests or output).

Discussion of Potential Direction for ELCC Results

Deployment (in Gigawatts) for the 6 Scenarios

#	Wind	Solar	Storage (4,6, or 10 hour)	Storage (8 hour)	Solar + Storage Hybrid (Open Loop)	Solar + Storage Hybrid (Closed Loop)	Hydro w/o Storage	Landfill Gas	Hydro w/ Storage*
1	12	7	0.4	5	0.3	0.3	0.7	0.3	2
2	15	11	0.9	5	0.5	0.5	0.7	0.3	2
3	19	16	1.5	5	0.8	0.8	0.7	0.3	2
4	22	22	2	5	1	1	0.7	0.3	2
5	23	31	3	5	2	2	0.7	0.3	2
6	25	40	5	5	2	2	0.7	0.3	2

Note: PJM had not completed the first draft approach for hydro w/ storage when developing these results. Hydro w/ storage was represented with a placeholder in this draft of the ELCC model.

https://www.pjm.com/-/media/committees-groups/task-forces/ccstf/2020/20200710/20200710-item-05-first-draft-prelim-ELCC-results.ashx

1st Draft ELCC Results w/ New ESR as 4-hour Duration

These results may change significantly in subsequent drafts

#	Wind	Solar	Storage (4 hour)	Storage (8 hour)	Solar + Storage Hybrid (Open Loop)	Solar + Storage Hybrid (Closed Loop)	Hydro w/o Storage	Landfill Gas
1	10%	64%	47%	96%	91%	91%	48%	59%
2	9%	58%	47%	95%	92%	92%	47%	58%
3	9%	49%	48%	94%	74%	74%	51%	61%
4	10%	40%	50%	93%	64%	64%	52%	61%
5	11%	33%	58%	94%	65%	65%	53%	61%
6	12%	27%	67%	94%	70%	69%	50%	55%

Pending new dispatch method

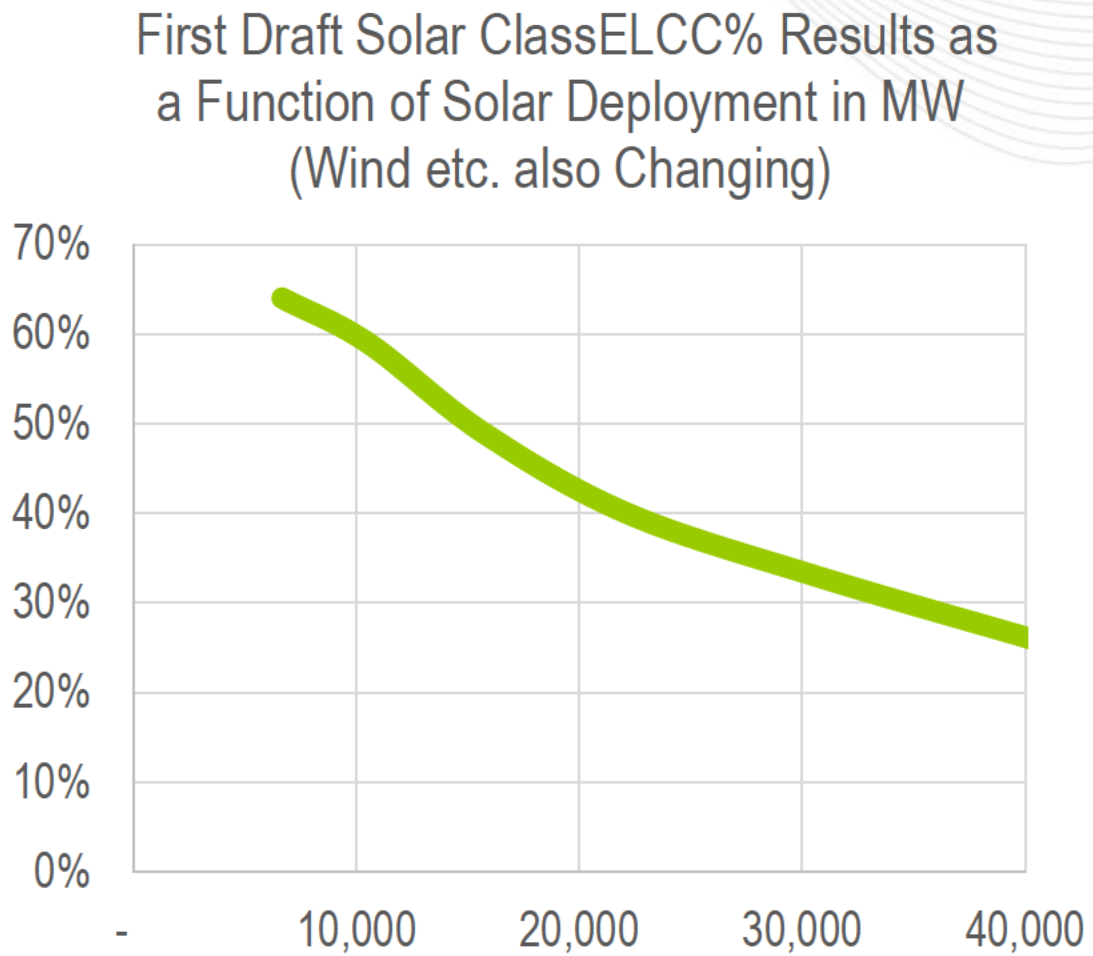
For Simplicity: Remove Hybrids from Directional Discussion

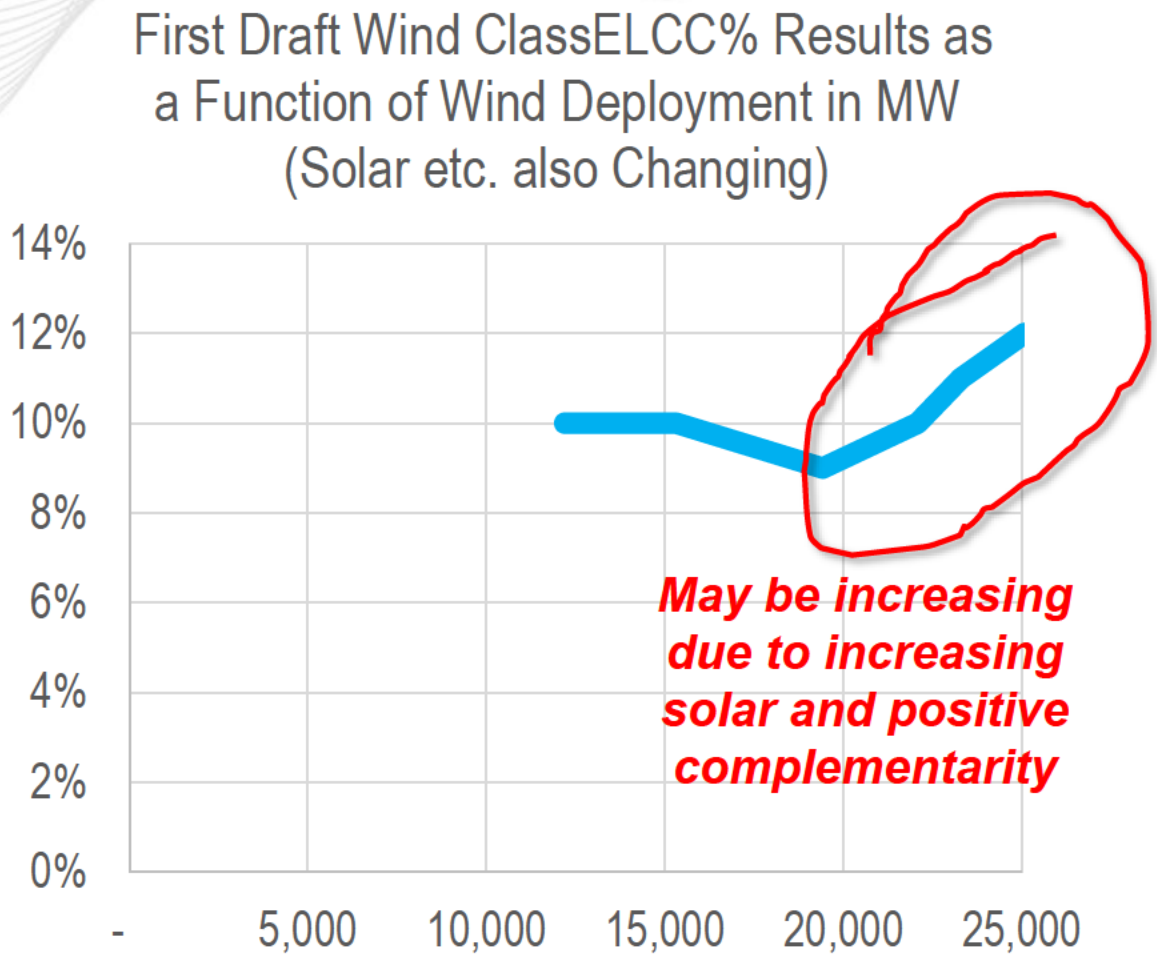
Fairly Flat

Noted Caveats About Assumptions Regarding Interaction

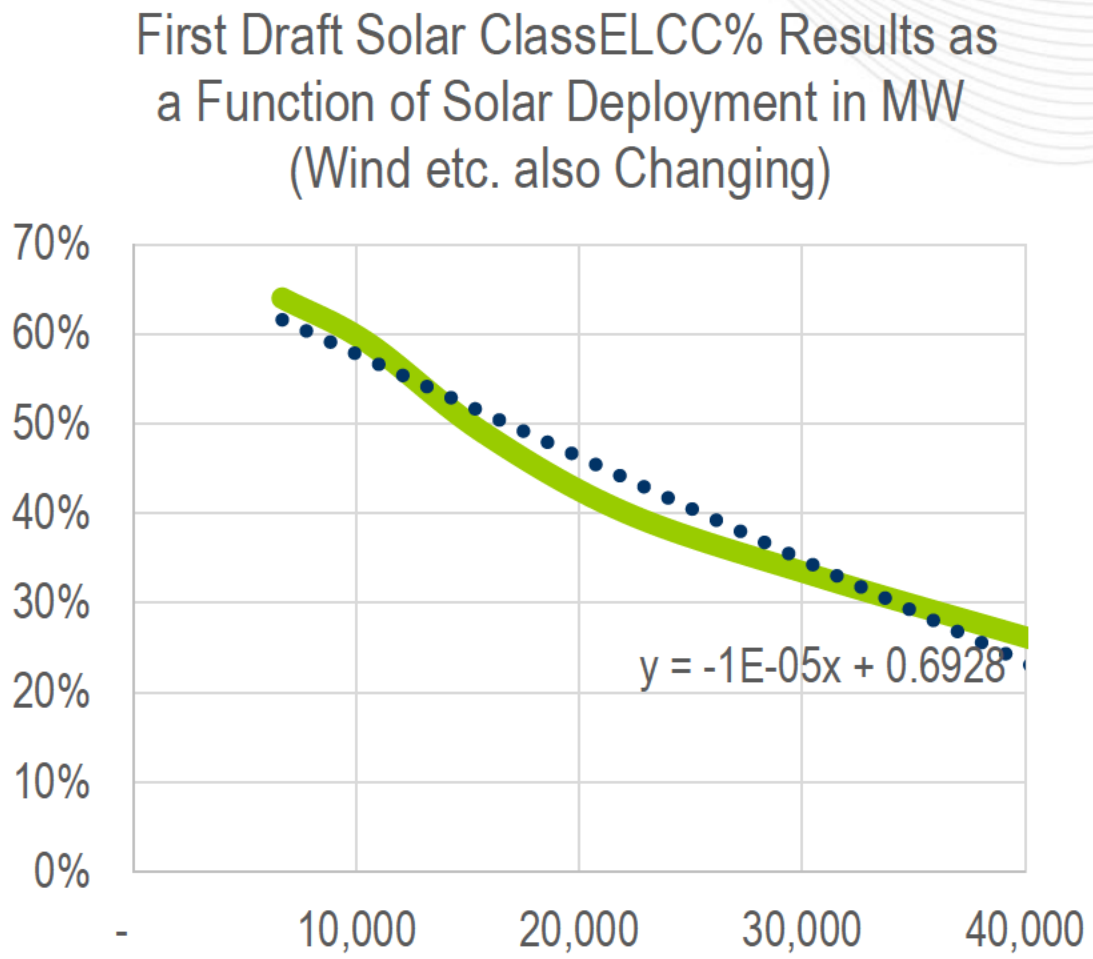
1. Classes with ClassELCC% values that are fairly flat as deployment in other classes grows may show minimal interaction in ELCC results with those classes. Therefore, ignoring assumptions about deployment of hydro, pumped hydro, and landfill gas may have minimal affect on apparent ELCC results for wind and solar.
2. Solar-battery hybrids (including 4-hour batteries with nameplate of 50% of plant MFO) are similar to solar, but different enough that it is simpler to omit them rather that decompose them back into the solar class. Neither assumption is precise. The effect of ignoring the presence of hybrids may be to slightly underestimate the ClassELCC% value for a given deployment of solar.
3. Plotting ClassELCC% results as a function of the deployment of only a single class (e.g., wind or solar) fails to demonstrate the interaction between classes. Wind and solar may be slightly complementary, and so the effect of ignoring the greater deployment of one class with greater deployment in the other may be to slightly overestimate the ClassELCC% value if only the one class were increasing.

Plot of Wind and Solar ClassELCC% vs. Deployment





Discussion of Potential Direction of ELCC Results

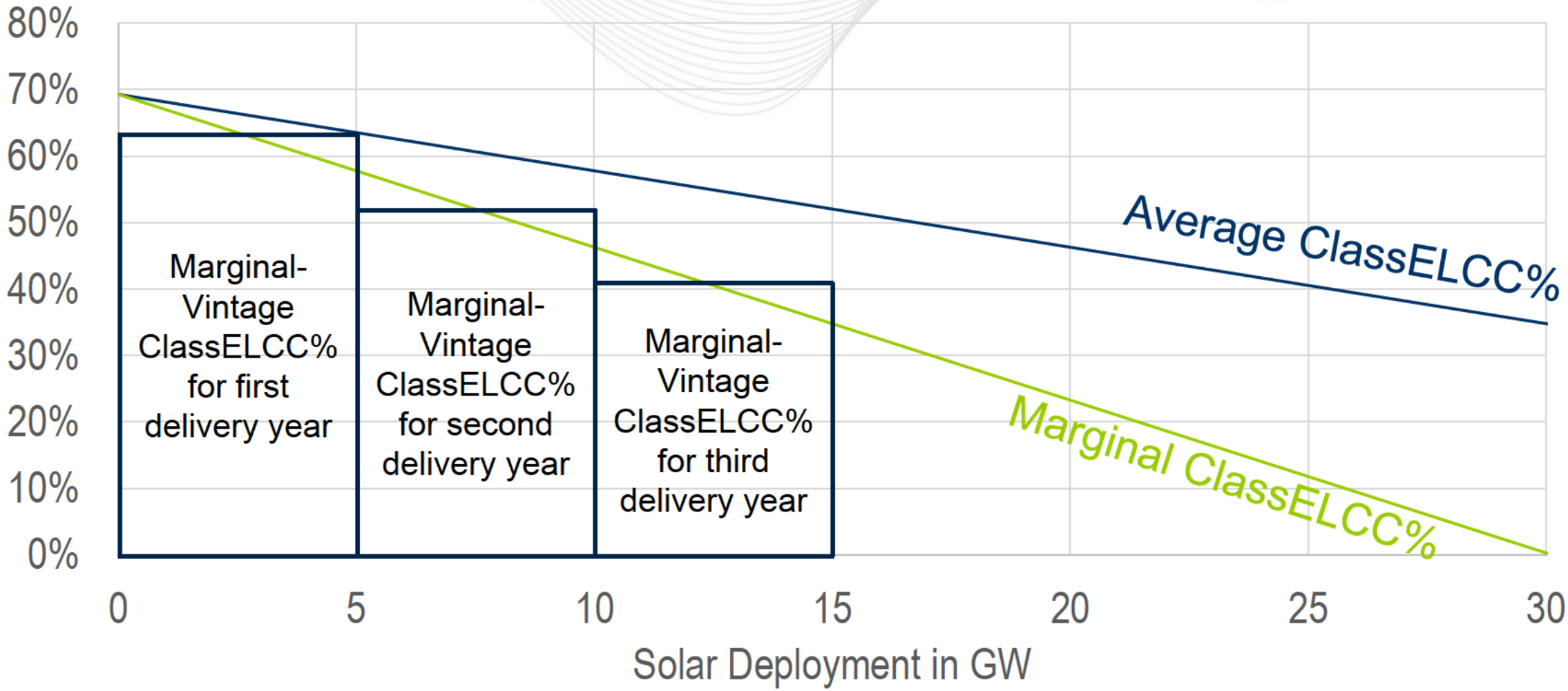


- Pretend the ELCC results for solar are ClassELCC% = -0.0115x + 0.6928 …where "x" = total nameplate of deployed solar in gigawatts. (This is not correct due to interactions, because the result is not linear, and because these are not final results).
- This would say the solar ClassELCC% declines from 69% at about 1.15 percentage points per GW
- With 2 GW, the ClassELCC% would be 67%.
- With 10 GW, it would be 58%.

Summary of Potential Direction of ELCC Results

	Status Quo Capacity Value	Potential Directional Results
Tracking Solar	~60%	Starts off higher, might be lower after around 10 GW of deployment, potentially dropping at over 1 percentage point per GW of deployment.
Wind	~13%	Potentially somewhat lower
4-hour Batteries	40%	Higher (how much depends on dispatch discussion)
Pumped Hydro	ICAP	Potentially slightly or somewhat lower (also may depend on black start commitments)
Non-Pumped Hydro	ICAP	Ranging from similar to lower depending on parameters
Intermittent Run of River Hydro	ICAP	Lower
Landfill Gas	ICAP	Lower

Linear Illustration of Marginal vs. Average vs. Marginal-Vintage Approach at 5 GW Deployment per Year



Contact

Facilitator:
Melissa Pilong,
Melissa.Pilong@pjm.com

Secretary:
Jaclynn Lukach,
Jaclynn.Lukach@pjm.com

SME/Presenter:
Andrew Levitt,
Andrew.Levitt@pjm.com

Additional Details for Capacity Market Impacts

Member Hotline

(610) 666 – 8980

(866) 400 – 8980

custsvc@pjm.com