Framework for RPM as a Fully Seasonal Construct

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Consultant to the consumer advocates of NJ, PA, MD, DC, DE; views expressed are my own and not necessarily those of any client.

RPM as a Seasonal Construct (RASTF KWAs 3, 8)
Topics for Today

1. Seasonal Capacity Market: Purpose, Design Objectives
2. Demand Side: Seasonal requirements and demand curves
3. Supply Side: Resource offers and market clearing logic

Appendix: Q&A

RASTF KWA 3: Review… any benefits or drawbacks to setting the desired metric and level by season; KWA 8: As applicable, determine any remaining design details for a seasonal capacity market construct not addressed in other KWAs... Determine the appropriate solutions for those design elements.

RPM as a Seasonal Capacity Construct: Topic 1: Purpose

- Why RPM Should Become a Fully Seasonal Construct:
  - **Demand Side:** Requirements are highly seasonal. Winter peak loads are 90%, off-season monthly peaks 65%, of summer (PJM 2022 Forecast); and some zones are winter-peaking
  - **Supply Side:** Resource accredited capacity and costs are seasonal for nearly all resource types (wind, solar, gas-fired, DR, EE…)

- Much of What Needs to be Done is Already Done or Underway:
  - Seasonal capacity defined (ER17-367, for "aggregation") 2017-2018
  - Winter season capacity requirements analyzed (Issue Charge: Winter Season Resource Adequacy and Capacity Requirements, 2016-2018)
  - RASTF other KWAs, especially regarding accreditation

RPM as a Seasonal Capacity Construct: Topic 1: Purpose (continued)

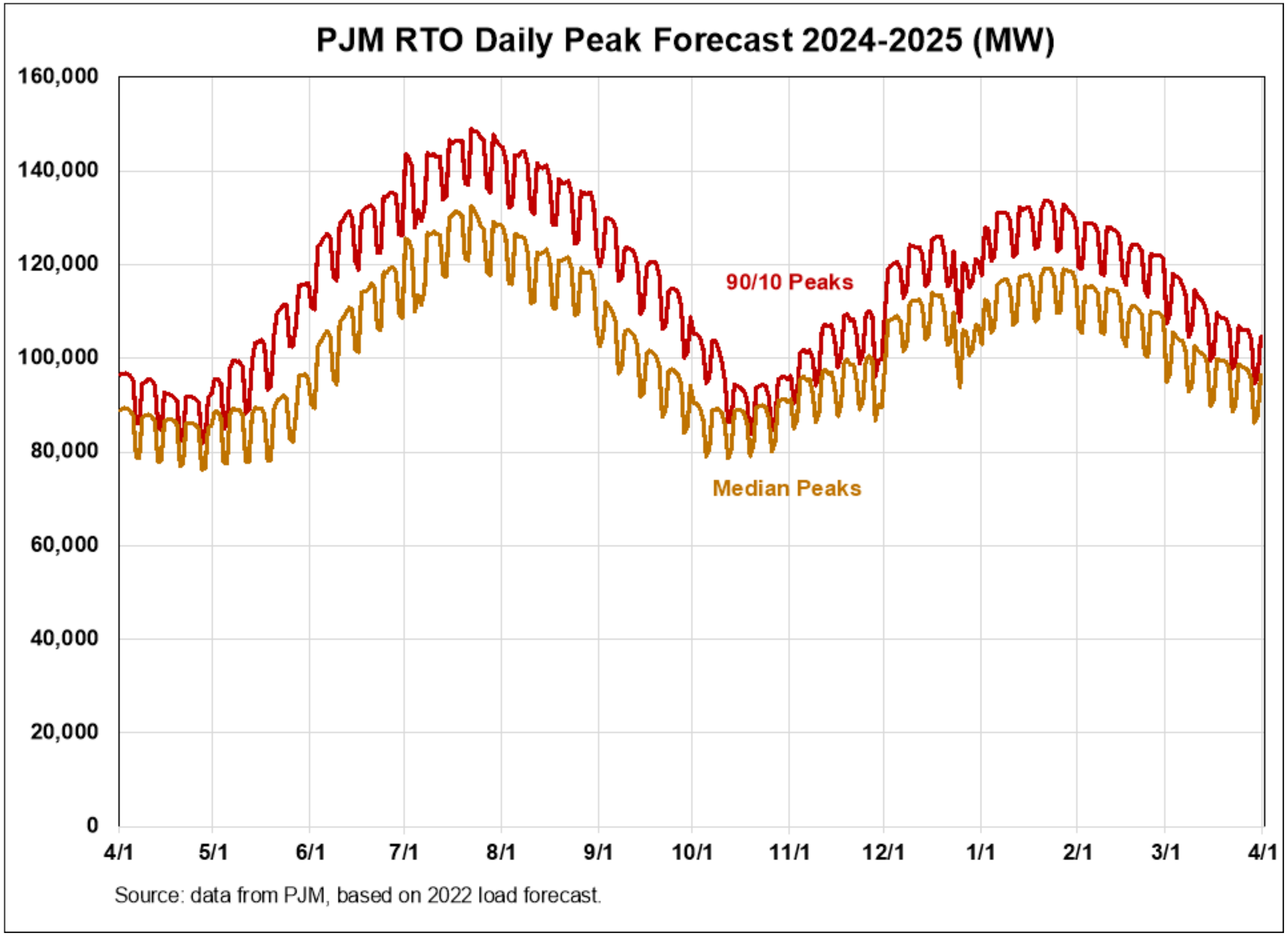
- Electricity market design over the past 2-3 decades has been a process of increasingly recognizing things that matter in the markets. Examples:
  - Zonal pricing → nodal pricing → locational marginal pricing, LMP
  - Energy pricing → identification of, procurement of ancillary services
  - Many other examples, and now:
  - Annual capacity → seasonal capacity (NYISO, MISO, now PJM)
- Ignoring things that matter (such as seasonality of capacity requirements, resource costs, resource capabilities) leads to inefficiency and treating resources unfairly.

RPM as a Seasonal Capacity Construct: Topic 1: Design Objectives (my suggestions)

- Primary Design Objectives:
  - Reliability: Satisfy resource adequacy objectives in all seasons
  - Efficiency: Efficient and cost-effective capacity procurement
    - Demand side: requirements track resource adequacy needs; sloped demand
    - Supply side: resources have ability, incentive to accurately express costs (opportunities for gaming are not created, any market power is mitigated)
    - Market engine: efficiently selects supply to satisfy demand; technology neutral, all resources treated equally and fairly
- Secondary Design Objectives:
  - Minimal Changes: Strive to maintain current design elements
  - Simplicity, Understandability, Transparency

RPM as a Seasonal Capacity Construct: Topic 2: Demand Side

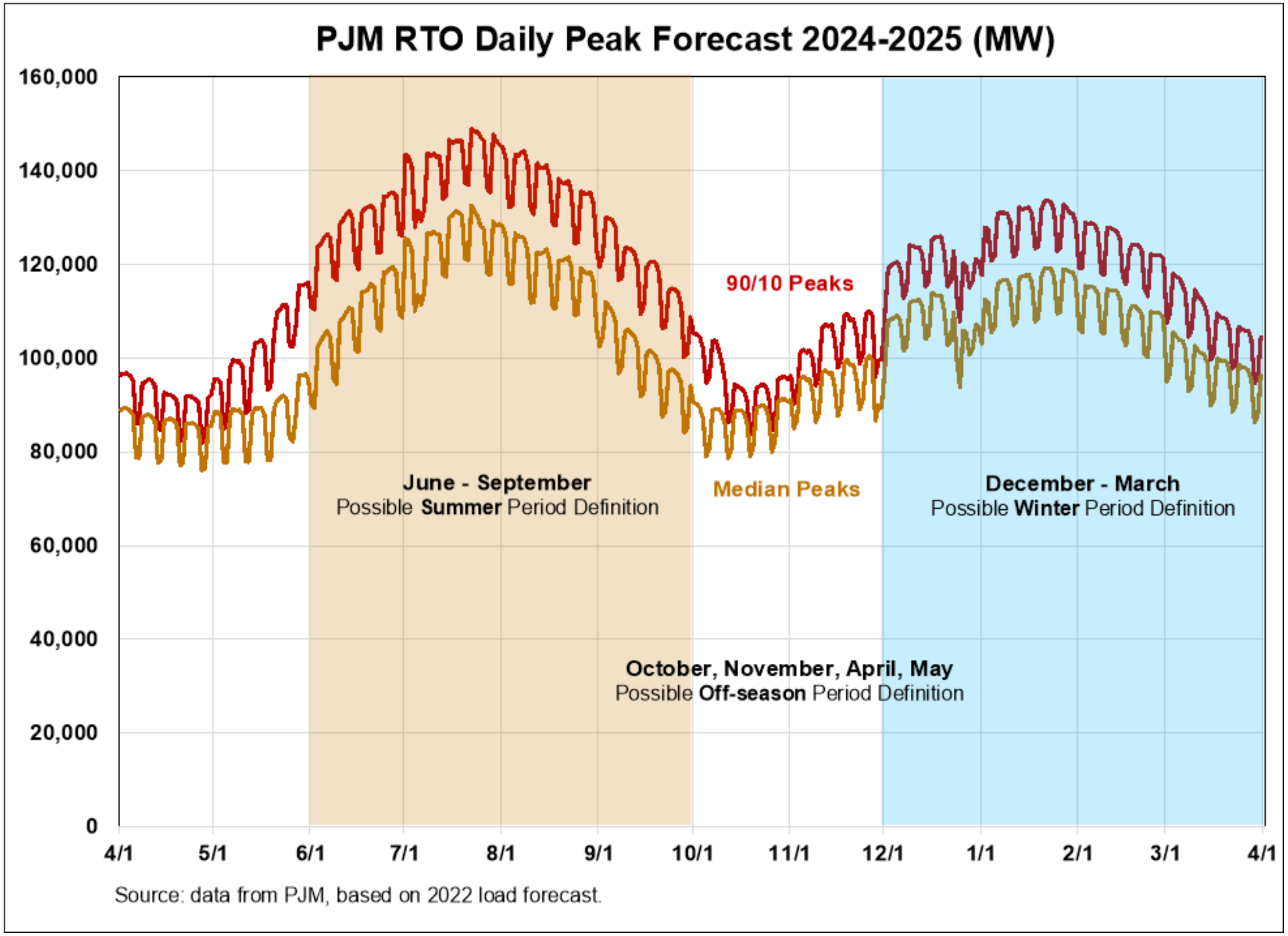
1. Define seasons
2. Identify requirements for each season
3. Define seasonal capacity demand curves (shape, requirements, price parameter)



RPM as a Seasonal Capacity Construct: Three Season Approach (Summer, Winter, Off-season)

Advantages: gathers weeks with similar load loss drivers and risks; tracks loads; simple; creates three valuable prices (summer, winter, off-season)

The season definitions are most likely not a critical detail, various approaches would work well (two, three or four seasons).



RPM as a Seasonal Construct: Seasonal Capacity Requirements and Demand Curves

- Goal: Use sloped capacity demand curves for each season (preserves the multiple benefits of sloped demand curves)
- Goal: Set seasonal capacity requirements such that the RPM solution and resulting prices will reflect similar marginal reliability benefit/marginal cost ratios in each season
  - Can be approximated based on simulations of expected resource mix
  - Or, status quo approach: seasonal peak load and seasonal reserve margin
  - Other approaches to setting seasonal requirements are also workable
- Current VRR curve shapes, used for RTO and smaller LDAs, could be used for seasonal demands

RPM as a Seasonal Capacity Construct: Topic 3: Supply Side

Resources should have the opportunity to submit offers by season and/or an annual offer.

- Annual offer: the total net capacity revenue needed to make operating as a capacity resource in the delivery year worthwhile
- Seasonal offers: the price needed to make providing capacity in the season worthwhile <u>assuming</u> annual net revenue is sufficient
  - Detail: resources may also identify the portion of each seasonal offer that contributes to the resource's annual net revenue requirement
- Expectation (efficient approach): resources should submit offers for each season and an annual offer

RPM as a Seasonal Capacity Construct: Topic 3: Supply Side – Market Clearing

- The RPM market engine would build the supply curves for each season and find the clearing points against the sloped VRR curves for each season.
  - Alternative: optimizing across seasons to equalize marginal reliability value, as New England does with zones. This is more complex and less transparent, and might not provide much additional value if the resource mix is rather predictable.
  - Simpler alternative, if predicting the resource mix to set seasonal requirements is more uncertain: PJM could prepare two or three alternative sets of seasonal demand curves based on reasonably likely alternative resource mix outcomes. If the initial solution fails a predefined "goodness of fit" criterion, the other demand curve sets would be evaluated, and the best fit used.

RPM as a Seasonal Capacity Construct: Topic 3: Market Clearing – Unwanted Clearing Problem

- Potential market clearing problem: Resources clear in some seasons but do not satisfy their annual revenue requirement (call this "Unwanted Clearing").
  - Note that this could occur for seasonal resources, not annual resources – truly annual resources would generally offer low and clear in all seasons, the question would be whether the annual offer is met.
- Resources with Unwanted Clearing and the largest annual revenue shortfalls could be removed from the auction, and the auction re-solved.
- Other approaches could also be used to minimize Unwanted Clearing in the auction solution, such as swapping in seasonal resources with lower annual demands to see if this improves the solution (maximum gains to trade)
- It is likely that some Unwanted Clearing will remain in the final auction solution.

RPM as a Seasonal Capacity Construct:
Topic 3: Unwanted Clearing – Possible Solutions

- Resources with Unwanted Clearing could have the option to request a Make Whole payment to satisfy their annual revenue requirement. If not requested, a resource could plan to rationalize its situation on a bilateral basis.
- If the Make Whole payment is requested, it could be contingent on a requirement to submit incremental auction ("IA") offers to offer to sell the Unwanted Clearing back:
  - The IA offer price must reflect the potential total payment including Make Whole subsidy, making it more likely to clear
  - If the offer clears, the Unwanted Clearing is extinguished.
- This approach provides incentives for resources to offer into the base residual auction in a manner that avoids Unwanted Clearing. This approach also minimizes the potential for gaming to earn a Make Whole payment.

RPM as a Seasonal Capacity Construct: Topic 3: Illustrative examples (2-season for simplicity)

Resource	Summer	Winter	Annual (avg)
Resource A offers:	**30**	**40**	**100**
Resource B offers:	**30**	**70**	**80**
Resource C offers:	**30**	**40**	**160**
Resource D offers:	**30**	**70**	**130**
Auction Result (Case 1):	**190**	**50**	**(Avg) 120**
Resource A outcomes:	**clear**	**clear**	**Met**
Resource B outcomes:	**clear**	**noclear**	**Met**
Resource C outcomes:	**(annual not met)**	**(annual not met)**	**Not Met-removed**
Resource D outcomes:	**clear (unwanted)**	**noclear**	**Not Met**

RPM as a Seasonal Capacity Construct: Topic 3: Illustrative example – Unwanted Clearing

- In the example, Resource D cleared for Summer but not for Winter, and total revenue did not satisfy its Annual offer – this is the Unwanted Clearing problem.
  - Potential solution: Summer season make whole payment to satisfy Annual requirement (= Annual offer x 2 minus Summer Price, 260 - 190 = 70)
  - Incremental auction requirement: Resource D must offer to sell back its Summer commitment at a price that reflects what it would be paid including this subsidy (190+70 = 260)
  - Suppose the IA clears at 200 for Summer, so Resource D's offer is cleared. It then has no commitments for the delivery year (the Unwanted Clearing was resolved) and it receives no payment.
    - IA settlement: the replacement resource gets 200 to replace 190, 10 is uplift.

RPM as a Seasonal Capacity Construct: Summary of Framework

- Three season approach (or two or four)
- Sloped seasonal demand curves reflect seasonal requirements
- Resources submit seasonal and annual offers
- Market clearing attempts to find least cost solution
- Remaining Unwanted Clearing largely resolved bilaterally, through Incremental Auctions, or with Make Whole payments

RPM as a Seasonal Capacity Construct: Appendix: Q&A

Q1: Won't the Off-season price be driven to zero due to excess capacity at such times?

A1: No; resources still face opportunity costs and capacity performance risk in the Off-season that will be reflected in their offers, which will lead to perhaps low but non-zero clearing prices.

Q2: Shouldn't truly Annual resources that are available 365 days per year be valued more highly than seasonal resources?

A2: The value of each resource is the sum of the value it provides in the various seasons. No additional value results from serving in all seasons.

Q3: Would the price parameters for the seasonal VRR curves be the current administrative Net CONE, or a different, seasonal parameter?

A3: The current administrative Net CONE could be used, keeping in mind that the two VRR curve parameters – price and quantity – work together to determine where the VRR curve lies, and where it intersects the seasonal resource supply curve. Or, a seasonal VRR curve price parameter could be developed, consistent with the analysis that sets the quantity parameter.

RPM as a Seasonal Capacity Construct: Appendix: Q&A (continued)

Q4: What resource adequacy criterion should be applied for establishing seasonal requirements (interpreting the accepted “One Day in Ten Years”)?

A4: One approach would be to interpret 1-in-10 as reflecting the accepted balancing of summer resource adequacy marginal cost and risk. Then we could maintain 1-in-10 for summer resource adequacy and apply the same 1-in-10 criterion, or develop a different one, for winter resource adequacy. (Yes, when both seasons are at criterion the annual loss of load risk is as high as 1-in-5).

Another interpretation would be to impose 1-in-10 as an annual limit. Then as winter resource adequacy risk increases, summer resource adequacy would have to be improved to better than the historical 1-in-10 to accommodate some winter risk, an illogical result.

Speaker Information

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James Wilson is an economist with over 35 years of consulting experience in the electric power and natural gas industries. His work has pertained to the economic and policy issues arising from the interplay of competition and regulation in these industries, including restructuring policies, market design, market analysis and market power. Recent engagements have involved resource adequacy and capacity markets, contract litigation, rate cases, modeling of utility planning problems, and many other economic issues arising in these industries. Mr. Wilson has been involved in electricity restructuring and wholesale market design for over twenty years in PJM, New England, Ontario, California, Russia, and other regions. He also spent five years in Russia in the early 1990s advising on the reform, restructuring, and development of the Russian electricity and natural gas industries for the World Bank and other clients.

Prior to founding Wilson Energy Economics, Mr. Wilson was a Principal at LECG, LLC. He holds a B.A. in Mathematics from Oberlin College and an M.S. in Engineering-Economic Systems from Stanford University.