Discussion: Value of Annual, Extended Summer and Limited Capacity Products When Reliability Requirements & Targets are Exceeded

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Background

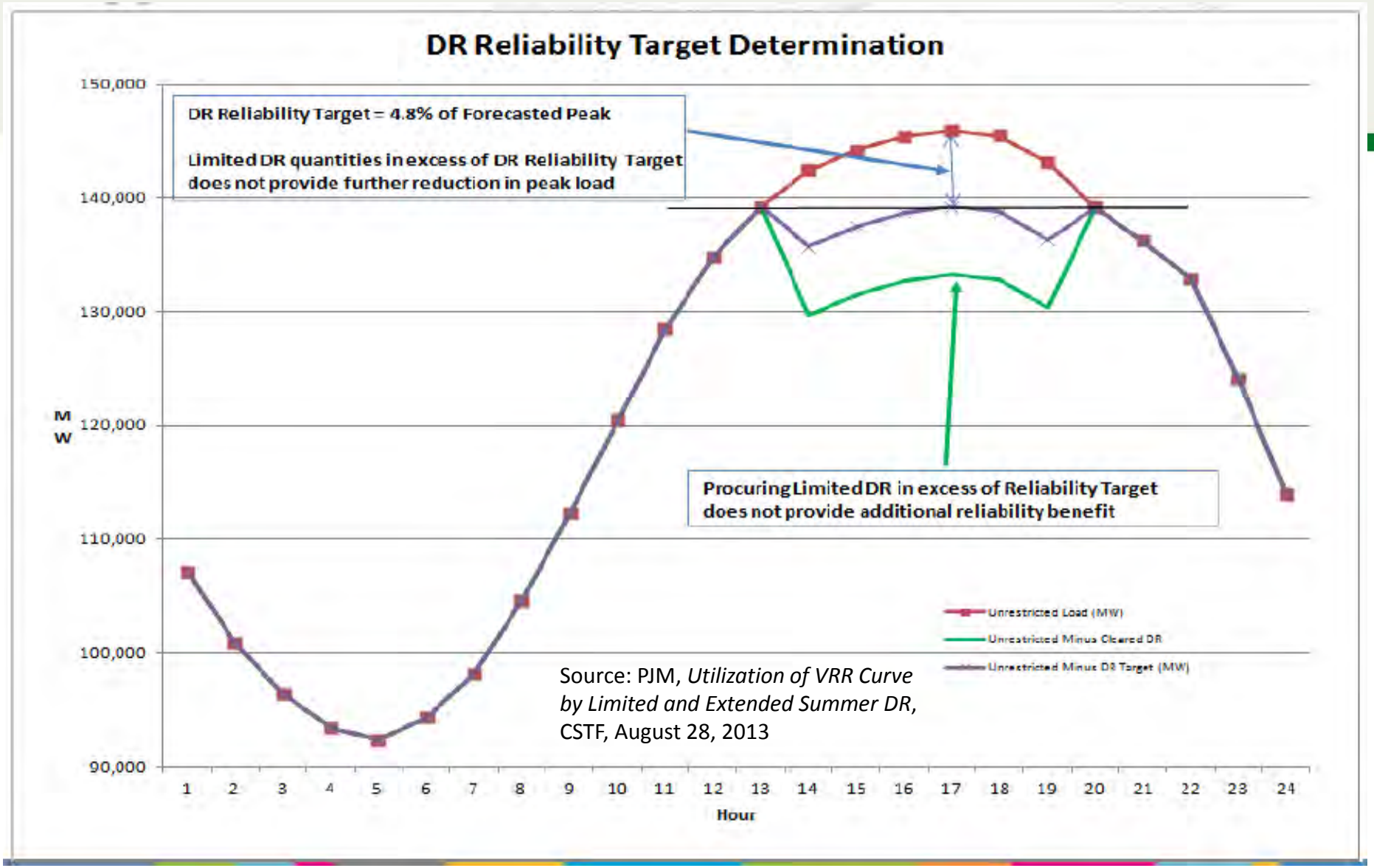
- Concerns expressed that under current auction clearing mechanism, once Minimum Annual and Minimum Extended Summer ("ES") Resource Requirements are satisfied, excess capacity cleared against sloped VRR curve can be 100% Limited Demand Response
- PJM claims quantities of Limited and ES Demand Response products in excess of DR Reliability Targets provide "little incremental reliability benefit, if any" and "does not translate to increased reliability" (PJM, *Utilization of VRR Curve by Limited and Extended Summer DR*, CSTF August 28, 2013)
- PJM proposes to implement DR Reliability Targets as maximum limits; simulation based on 2016-2017 base residual auction shows this would procure annual resources in excess of the quantity necessary for reliability and raise capacity cost (CSTF July 31, 2013)

Refresher: DR Saturation Study, Reliability Targets, and Minimum Resource Requirements

- "DR Saturation" study determines maximum amounts of Limited and ES DR consistent with full reliability value of the resources
  (procedure described in PJM Manual 20, PJM Resource Adequacy Analysis, Section 5)
  - "Limited DR Reliability Target" (4.8% of peak for RTO, 2016/17)
  - "Extended Summer DR Reliability Target" (10.5% of peak for RTO, 2016/17)
- Minimum Annual Resource Requirement = Reliability Requirement minus ES DR Reliability Requirement in UCAP
  (Planning Period Parameters.xls)
- Minimum ES Resource Requirement = Reliability Requirement minus Limited DR Reliability Requirement in UCAP

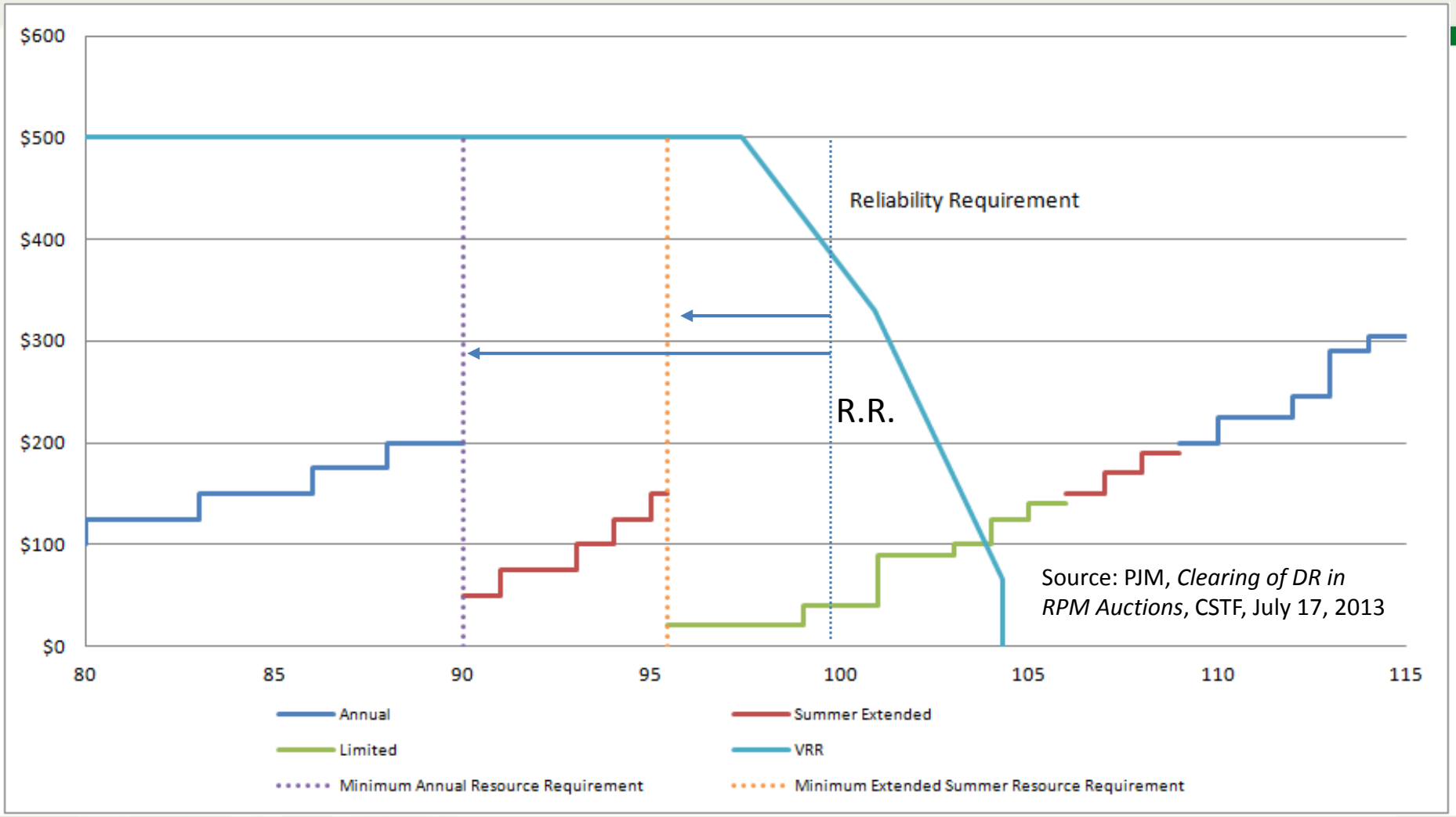
Refresher: Determination of Limited DR Reliability Target

- The “DR Saturation” study uses the following assumptions, among others:
  - Exactly the target reserve margin is cleared (no excess)
  - When any DR is called, all DR of all types is called and activates simultaneously (not just amount needed, not zonal, not staggered; very conservative assumption)
- Three tests are applied (one regarding 10-call limit, two regarding 6-hour limit) for RTO and each LDA; lowest value of the 3 tests is used
- Analogous approach (one test) determines ES Reliability Targets



Source: PJM, *Utilization of VRR Curve by Limited and Extended Summer DR*, CSTF, August 28, 2013

Clearing of Annual, ES and Limited Products in RPM Auctions



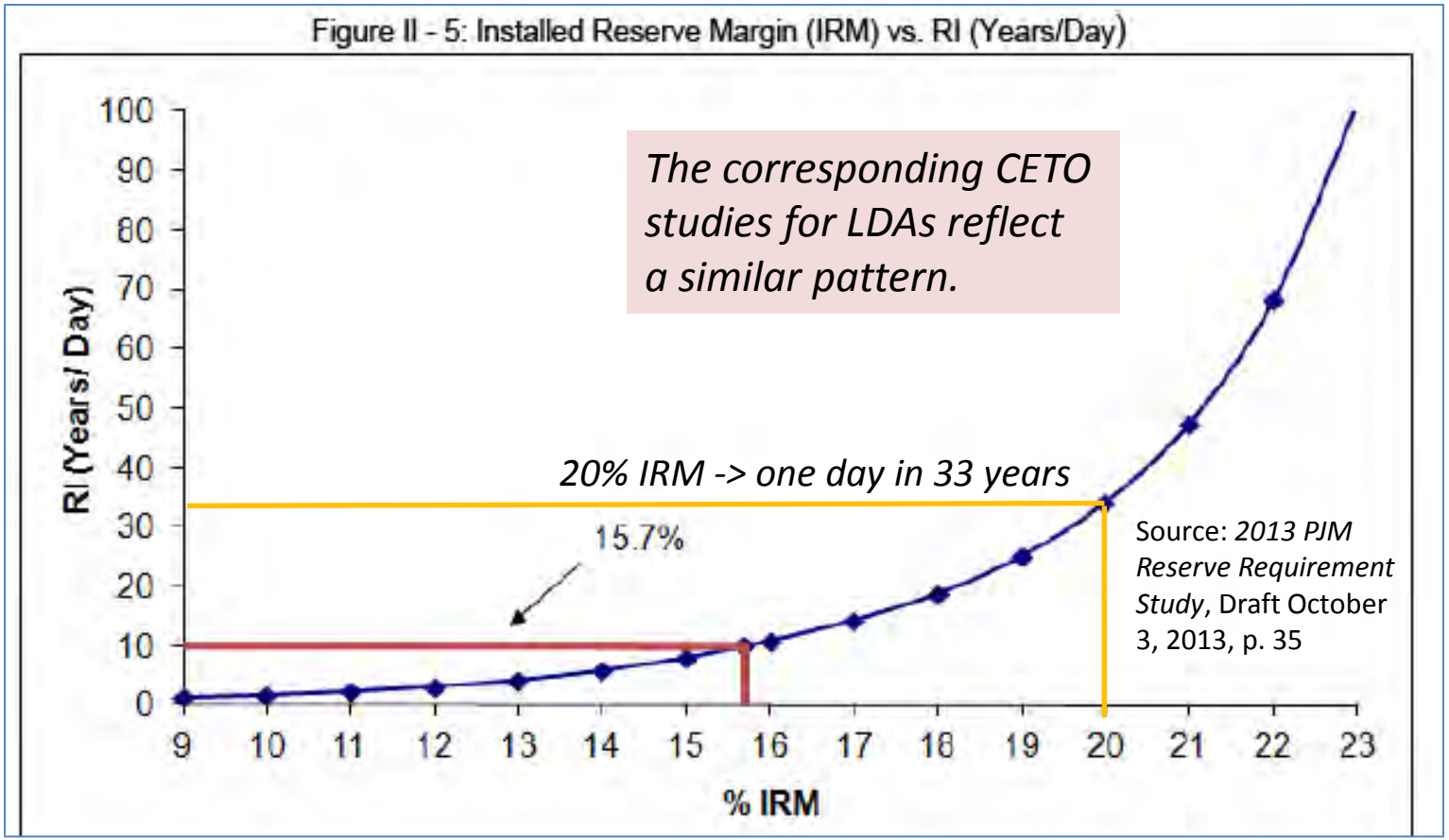
What the DR Saturation Study Does and Doesn't Say

- When total cleared capacity equals the Reliability Requirement and cleared Limited DR is at the Limited DR Reliability Target, reliability is at 1-in-10
- Clearing additional Limited DR beyond the Lim. DR Reliability Target *in place of Annual or ES resources* (total cleared quantity still at Reliability Requirement) would reduce reliability below 1-in-10
- Clearing additional Limited DR beyond the Lim. DR Reliability Target, *in additional to the minimum quantities* of Annual and ES resources (excess is cleared) keeps reliability at or above 1-in-10

Incremental Value of Capacity Types Above Requirements: When the Annual and ES Constraints Are Not Binding

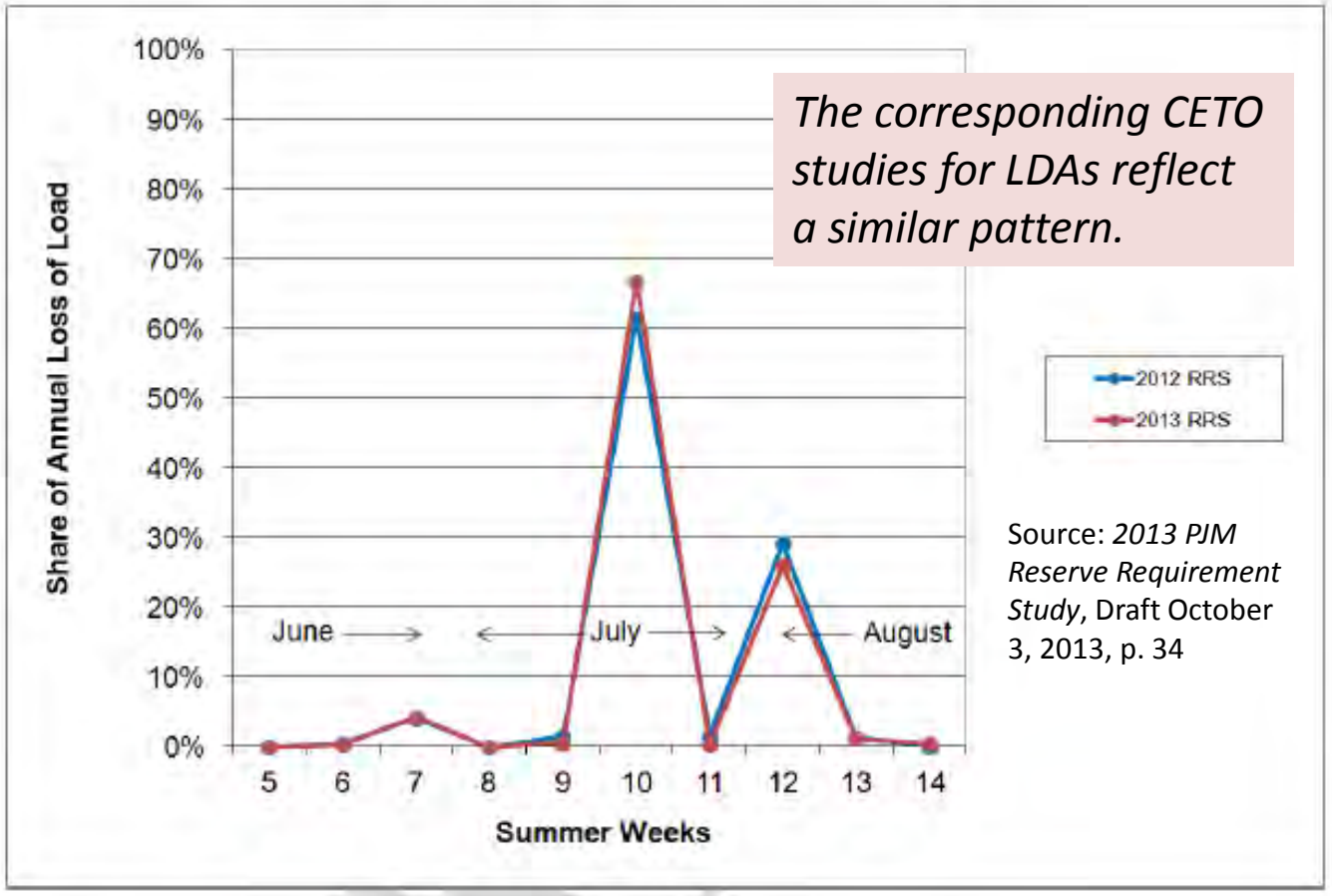
- When the Minimum Annual and Minimum ES Resource Requirements constraints are not binding (meaning, these resource types are acquired beyond the minimums, and there is no price separation in the auction) the incremental value of all three product types is the same according to the underlying reliability studies.
  - Under this circumstance, the fact that Limited DR is 10/6 and ES DR is summer only is of no reliability consequence
  - However, a more sophisticated reliability analysis might determine some very small difference in reliability value; any difference would extinguish as larger quantities of excess Annual, ES clear
- Other considerations: Some stakeholders have expressed a preference for long-term “iron in the ground” over demand response

PJM's Reserve Requirements Studies suggest how the reliability value varies as the cleared quantity changes



PJM Reserve Requirements Studies also suggest loss of load risk (and capacity value) are concentrated in summer (June – September)

Figure II - 4: PJMRTO LOLE Comparison 2012 RRS vs. 2013 RRS



The corresponding CETO studies for LDAs reflect a similar pattern.

Source: *2013 PJM Reserve Requirement Study*, Draft October 3, 2013, p. 34

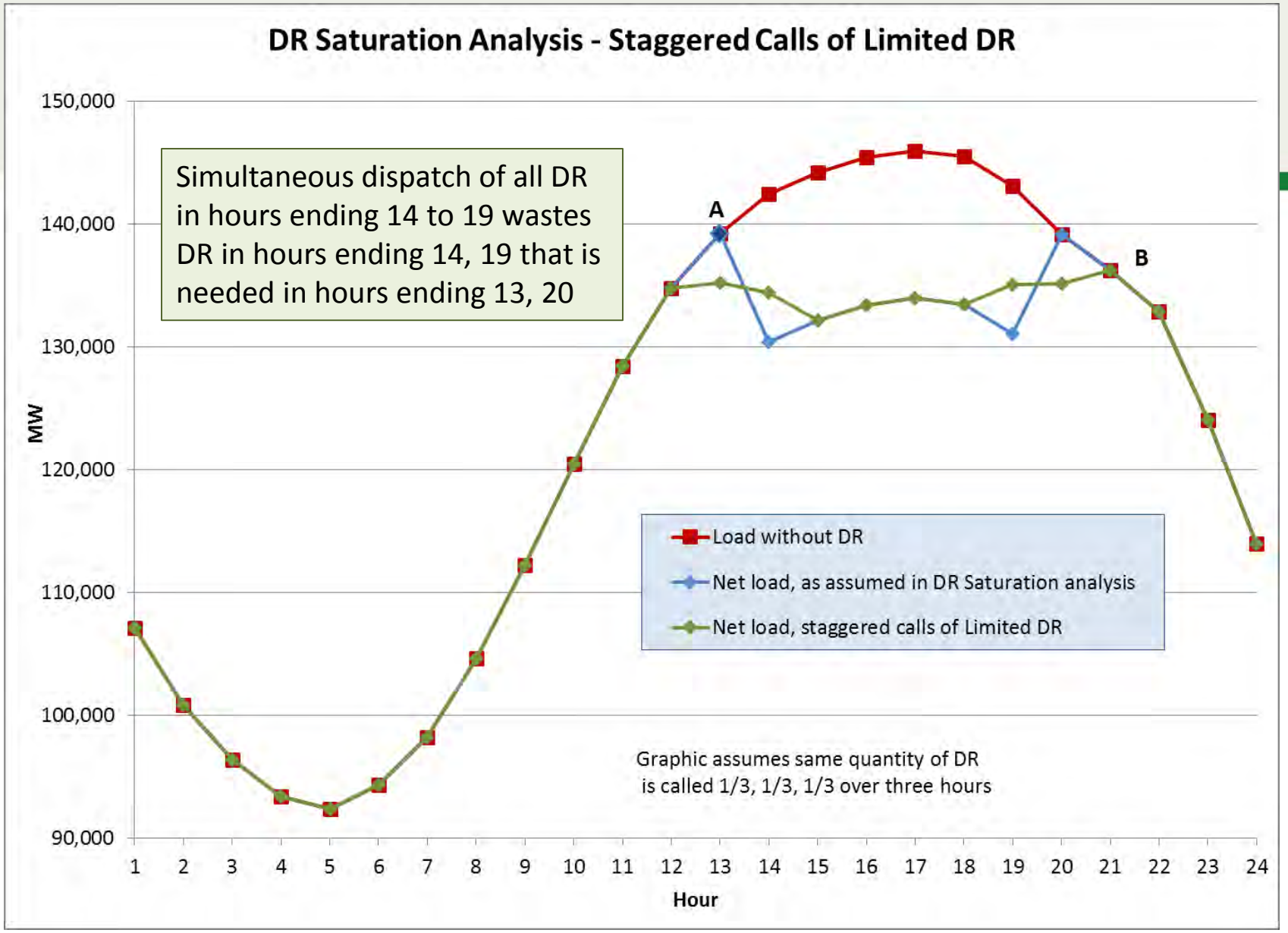
Incremental Value of Capacity Above Requirements: Annual and ES Resources at their Requirements

If Annual and ES resources are cleared at their respective Minimum Resource Requirements:

- If total Reliability Requirement is met exactly, cleared Limited DR is at its Reliability Target, and the system is at 1 day in ten years
- If (unlikely) less than the total Reliability Requirement is cleared, cleared Limited DR is below the Reliability Target, and the system is worse than 1 day in ten years – and all resource types have similar incremental reliability value
- If the total Reliability Requirement is exceeded, excess Limited DR is cleared, and the system is more reliable than 1 day in ten years to the extent the excess Limited DR has some incremental reliability value

Value of Limited DR in Excess of the Limited DR Reliability Target

- Full value of Limited DR beyond the DR Reliability Target, up to some (unknown) higher threshold, can be realized by:
  1. Staggering the DR start times (say, 1/3, 1/3, 1/3 over three hour period) to stretch the DR use over an eight hour period (next graphic)
  2. Calling only the quantity of DR needed plus a good margin each event (so 10-call DR can be used in more than 10 events)
- The DR Saturation methodology can be used to identify the higher DR Reliability Target that would apply to DR staggered over an eight hour period and usable in more than 10 events
- Beyond some (unknown) larger quantity, additional Limited DR would have reduced value even if used flexibly.


DR Saturation Analysis - Staggered Calls of Limited DR
Simultaneous dispatch of all DR in hours ending 14 to 19 wastes DR in hours ending 14, 19 that is needed in hours ending 13, 20
A
B
Load without DR
Net load, as assumed in DR Saturation analysis
Net load, staggered calls of Limited DR
Graphic assumes same quantity of DR is called 1/3, 1/3, 1/3 over three hours
MW
Hour
150,000
140,000
130,000
120,000
110,000
100,000
90,000
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24

Value of Limited DR Beyond DR Reliability Target: Takeaways

- When the Annual and ES constraints do not bind, the incremental reliability value of all products is the same or very close, whether or not excess cleared
- According to the DR Saturation studies, Limited DR has full reliability value up to the DR Reliability Target; and the targets are very conservative
- The value of Limited DR beyond the DR Reliability Target depends upon how flexibly PJM uses DR, and at some point declines from 100% as the excess quantity grows
- The DR Saturation study methodology could be used to estimate how the value of excess Limited DR declines below 100% as a greater excess is cleared, applying additional assumptions about how it would be used
- Even better: The DR Saturation methodology should be modified to determine the DR Reliability Targets recognizing flexible use of DR (existing practices, such as zonal calls, also “DR as operational resource”)