System Restoration Strategy

1) **Matrix Item #4 – Determine Quantity and Size of Black Start Generation**
   a) Change the Critical Load Definition in Attachment A or M-36 to include only Critical Steam (<8 hour start) Auxiliary Load.
      i) To allow for redundancy, 125% of this total load will be used to determine the Tier 1 Critical Black Start requirement. (See 2-a-i)
      ii) This will be the minimum amount of Black Start required for RTO restoration.
b) Maintain priority of restoration of Nuclear off-site power and critical gas infrastructure load in Restoration Plan
   i) Maintain a 4 hour target restoration time for this load.
   ii) This load can be supplied by Tier 1 Black Start generation, Tier 2 Black Start generation or other non-Black Start generation.
      (1) The total nuclear aux load and Gas infrastructure load will be calculated.
      (2) An analysis will determine if enough generation would be available within 4 hours to meet the 4 hour load restoration target.
      (3) Additional Tier 1 or Tier 2 Black Start will be acquired to meet these timeframes if necessary.

2) **Matrix Item #3 – Black Start requirements considering number, availability and location of Black Start; Matrix Item #6 Classification of Black Start Generators**
   a) Define 2 Black Start products – Tier 1 and Tier 2
      i) Tier 1 Black Start units are units that meet the existing definition and requirements of a Black Start unit. (90 minute or less start)
         (1) The Tier 1 Black Start requirement is based on 125% of Critical Steam Auxiliary Load.
      ii) A Tier 2 Black Start unit would have the same requirements as a Tier 1 Black Start unit except the time to start can be up to 4 hours.
         (1) PJM will not identify a minimum requirement for Tier 2 Black Start.
         (2) PJM will compensate up to the total of Critical Steam Aux Load, Nuclear off-site power and critical gas infrastructure load (minus the total Tier 1 BS Generation)
            (a) Example: In a given zone:
               Critical Steam Aux Load = 30 MW
               Nuclear off-site power = 40 MW
               Critical Gas Infrastructure Load = 25 MW
               Tier 1 Black Start requirement = 30 MW
               Maximum Tier 2 compensated = (95 MW – 30 MW) = 65 MW
   b) PJM would ensure a minimum of one Tier 1 Black Start unit would be available for each transmission zone.
      i) The current exception process would be retained for zones with no generation.
      ii) Tier 1 Black Start generation physically located in one transmission zone may supply Critical Load in another zone through agreements between the zones and PJM and documented in Restoration Plans.
c) Relax the current restriction on only 3 Black Start units per location.
d) Transmission Owners may nominate additional Tier 1 or Tier 2 Black Start Units (above the PJM minimum amounts). PJM will evaluate the justification, with stakeholder input, for this additional Black Start and make the determination of compensation. Any additional Black Start above PJM minimum levels will be charged to load in the applicable zone.

3) Matrix Item #5 – Black Start requirements considering restoration time
   a) Target System Restoration timeframe from a complete blackout with no outside assistance available within a 24 to 48 hour window.
      i) Analyze restoration timeframes given Black Start generation with the EPRI software.
      ii) If restoration timeframe falls outside of the 24-48 hour range for the RTO, this would justify acquiring more or less Black Start generation.
      iii) Utilize EPRI analysis to determine most optimal location of additional Black Start if overall restoration time exceeds 48 hours.

4) Matrix Item #7 – Initial Restoration Assumptions
   a) Develop System Restoration plans for worst case scenario of complete blackout with no outside assistance.

5) Matrix Item #8 – Restoration Strategy Alternatives
   a) Maintain TO based Restoration Plans but allow for Black Start to be supplied from neighboring zones where it makes sense. Incorporate Black Start sharing into TO and PJM Restoration Plans as required.

6) Matrix Item #9 – Alternate technology for Black Start
   a) Any resource capable of meeting the Black Start requirements is eligible to be considered as a Black Start resource.

7) Matrix Item #10 – Entity responsible for identification of Black Start quantity and location
   a) PJM, with TO assistance, would identify the Tier 1 Black Start units (minimum requirement).
   b) TO may nominate additional Black Start generation. PJM will evaluate the justification with stakeholder input.