PJM Position on Design Components

10/12/2012
What should be the target time for restoration of the transmission system following a complete blackout without outside assistance? Target defined as a goal, not a guarantee. (All options assume restoration of the system happen as soon as possible)

**Preferred Target Time** n=88

- Retain current target of 24 hours: 53%
- 48 hours: 36%
- 72 hours: 7%
- Do not document a specific target time: 4%

[Image of pie chart showing the distribution of preferred target times.]
PJM can not support a 24 hour restoration target time based on the current definition (restoration of BES)

If stakeholders support retention of a 24 hour restoration target time in M-36, it must be redefined

TOs may include specific restoration time targets within their individual plans if desired

In EOP-005-2, R1, NERC defines the scope of a restoration plan as:

- The restoration plan shall allow for restoring the Transmission Operator's System following a Disturbance in which one or more areas of the Bulk Electric System (BES) shuts down and the use of Blackstart Resources is required to restore the shut down area to service, to a state whereby the choice of the next Load to be restored is not driven by the need to control frequency or voltage regardless of whether the Blackstart Resource is located within the Transmission Operator’s System.
- PJM believes that it can achieve this state of restoration within 24 hours

Suggested M-36 language:

- A system assessment following a blackout is a critical first step in identifying an overall restoration time. While PJM and its Members work to restore integrity to the interconnection as quickly as possible, there are a wide variety of factors that can influence a system restoration. Once the system conditions following a blackout are known, estimates of restoration times of the BES transmission and customer load restoration estimates can more accurately be made.
Who should be the entity responsible for determining Black Start generation?

**Responsible Entity**  \( n=88 \)

- **TO, with PJM input 68%**
- **PJM, with TO input 32%**
• A majority of participants selected TO as the responsible entity for BS identification. This is in conflict with NERC Standards that specify that the TOP is responsible for System Restoration Plans
• PJM will work closely with member TOs to identify BS resources to include in system restoration plans
• If disagreement, PJM (as the TOP) would make decision as to location, amount and number of BS resources.
  – Decision is based on critical load requirements, minimum number of units per zone/region and available timeframes to supply critical loads
  – TO would have the option to procure additional BS resources if necessary outside the PJM OATT
Should cross zonal / regional Restoration Plans be allowed to be aggregated if Black Start generation shortages exist in a TO zone?

**Cross-Zonal/Regional Restoration Plans n=88**

- Yes: 69%
- No: 31%
A majority of respondents support the idea of allowing cross-zonal or regional restoration plans.

This could take several forms:

- **Proactive** – Identify areas of the system where it would be beneficial to aggregate system restoration plans based on:
  - Current or potential BS resource shortages/excess
  - Transmission topology
  - Decrease in overall BS cost
  - Geography
  - Affiliated transmission zones
  - TO desire to aggregate plans

- **Reactive** – Keep system restoration plans on a Transmission zonal basis unless:
  - Critical load requirements or number of BS unit requirements can not be met in a zone
    - This would force aggregation of System Restoration plans or supply of critical loads from BS resources in adjacent zones

- PJM would support either of these approaches
What should be the minimum number of Black Start units per transmission zone, assuming the zone has some critical load (exceptions permitted, as needed)?

**Black Start Units per Transmission Zone**

- 57%: 1
- 32%: 2
- 11%: 3

n=88
• There seemed to be confusion over the scope of the question
  – Does it refer to zones? Regions? Both?

• Question should refer to number of BS resources “allocated” to each
  Transmission Zone (that has a critical load requirement).

• For example: If Transmission Zone A has a BS shortage and
  Transmission Zone B has excess BS; it would be possible to aggregate
  these zones for the purposes of supplying critical load. Unit(s) residing in
  Zone B would specified as the sources of cranking load in Zone A.
  – If, for example, 2 units per zone are required; then each transmission zone would need
    to have at least 2 BS resources dedicated to supply their critical load (even if they were
    located in adjacent zones) for a total of 4 BS resources for the aggregated region.

• PJM supports requiring 1 or 2 BS resources per zone for zones that have
  critical load requirements
  – These resources do not have to be physically located within the zone but dedicated to
    supplying critical load within the zone (example on next slide)
• Zone 1 requires 3 BS to meet its Critical Load Requirements. This would be supplied by the 3 units in red.
• Zone 2 only has 1 BS unit within its zone. It requires 2 BS units, so it could utilize a unit in Zone 1. Critical load in Zone 2 will be supplied by the green units. This will be reflected in both Zone 1 and Zone 2 restoration plans.
• The blue BS unit will not be committed as it is not needed to meet critical load requirements.
• Current proposed definition of Stage A Critical Load
  – Auxiliary Power for all generators with 8 hour or less Hot Startup Time (minus existing BS units)

• Is this the best definition?
  – If Hot Startup Time is increased
    • Higher Critical Load requirement
    • More cranked ICAP
  – If Hot Startup Time is decreased
    • Lower Critical Load requirement
    • Less cranked ICAP

• Large quantities of generation can not be fully utilized early in the System Restoration process
  – Limited by transmission restoration and amount of load restored
RTO Agg. ICAP and Est. Cranking Power by min. Hot Start Times

* all post-retirements data

<table>
<thead>
<tr>
<th>Hot Start Time</th>
<th>Estimated Cranking Power</th>
<th>ICAP</th>
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<tbody>
<tr>
<td>0 Hrs to 4 Hrs</td>
<td>3,539</td>
<td>70,772</td>
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<tr>
<td>0 Hrs to 8 Hrs</td>
<td>4,918</td>
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<tr>
<td>0 Hrs to 10 Hrs</td>
<td>5,589</td>
<td>111,780</td>
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<tr>
<td>0 Hrs to &gt; 10 Hrs</td>
<td>6,086</td>
<td>121,725</td>
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