

Frequency Response Characteristic Calculation for All India based on NLDC SCADA Data

EVENT:

On 15th May 2023, As reported, at 11:51 hrs, Multiple tripping in Rajasthan renewal generation complex in Northern Region occurred and resulted in generation loss of around 7120MW. In the Event Frequency dropped from 49.981 Hz to 49.400 Hz (Nadir Frequency) change of 0.581 Hz in around 9 seconds, after that Frequency recovered to 49.742 Hz. During the event operation of UFR(Under Frequency Relay) has been reported by RLDCs and total quantum of load relief is coming around 4041MW (NR-1660,WR-1095,SR-970,ER-259,NER-57). Accordingly same has been considered in the FRC calculation.

| S No | Particulars | Dimension | NR | ER | WR | NER | SR |
|------|---|-----------|--------|--------|--------|--------|--------|
| 1 | Actual Net Interchange before the Event (11:51:48) | MW | 4067 | -113 | -9121 | 423 | 3953 |
| 2 | Actual Net Interchange after the Event (11:52:36) | MW | 8044 | -656 | -11178 | 320 | 2004 |
| 3 | Change in Net Interchange (2-1) | MW | 3976 | -543 | -2057 | -103.1 | -1950 |
| 4 | Generation Loss (+) / Load Throw off (-) during the Event | MW | 5460 | -259 | -1095 | -57 | -970 |
| 5 | Control Area Response (3 - 4) | MW | -1484 | -284 | -962 | -46 | -980 |
| 6 | Frequency before the Event | HZ | 49.98 | 49.98 | 49.98 | 49.98 | 49.98 |
| 7 | Frequency after the Event | HZ | 49.74 | 49.74 | 49.74 | 49.74 | 49.74 |
| 8 | Change in Frequency (7 - 6) | HZ | -0.239 | -0.239 | -0.239 | -0.239 | -0.239 |
| 9 | Frequency Response Characteristic (5 / 8) | MW/Hz | 6207 | 1188 | 4026 | 193 | 4099 |
| 10 | Net System Demand met before the Event | MW | 60971 | 24574 | 65191 | 2083 | 53557 |
| 11 | Internal Generation before the Event (10 - 1) | MW | 56904 | 24687 | 74312 | 1660 | 49603 |
| 12 | Ideal load response assuming 4% per Hz (0.04*Row 10) | MW/Hz | 2439 | 983 | 2608 | 83 | 2142 |
| 13 | Ideal generator response assuming 5% droop.....40% per Hz (40% of Row 11) | MW/Hz | 22762 | 9875 | 29725 | 664 | 19841 |
| 14 | Composite ideal response (12 + 13) | MW/Hz | 25201 | 10858 | 32332 | 747 | 21984 |
| 15 | Percentage ideal response | % | 24.6% | 10.9% | 12.5% | 25.8% | 18.6% |

(*) - Data may be constant/suspected during the event
 Note: +ve exchange=> import ; (-)ve exchange => export

| | | |
|---|--------------|---------------------|
| Total Change in (MW) | 3079 | |
| FRC for NEWS GRID (dp/df) MW/Hz | 12883 | |
| Power Number (net change in MW/maximum change in frequency) | 12255 | Considering 7120MW. |

| Source Wise Generation (MW) | GAS | HYDRO | NUCLEAR | Thermal | WIND | SOLAR |
|-----------------------------|-------------|--------------|-------------|---------------|--------------|--------------|
| | 3163 | 11677 | 4465 | 130481 | 15792 | 42736 |