
LEARNING FROM EXPERIENCES

CASE STUDY 1

1977 Con Edison Blackout

Refer to Fig. 1-2 (A thru D)

It is 8PM on July 13, 1977. The system load had peaked during the day at 7248MW between 3 and 4 PM. The system load continued to decrease and at 8:30PM it was about 5900MW. A weather front of thunderstorms was passing through the service territory which consists of all the boroughs of NYC and Westchester County.

At 8:30 PM (henceforth all time will be in military time, i.e. 20:30) Con Edison was importing 2860MW and generating in-city 3008 net MW meeting a service area load of 5868MW. The only major in-city unit not in service was the NY Power Authority's Polletti Unit (then known as Astoria 6) and the only major tie feeder not in service was the Hudson to Farragut feeder B3402. The staffing at the Energy Control Center consisted of a system operator, power dispatcher, clerk, CIG coordinator, 2 each Manhattan/Bronx, Brooklyn/Queens and Westchester District Operators (6 total).

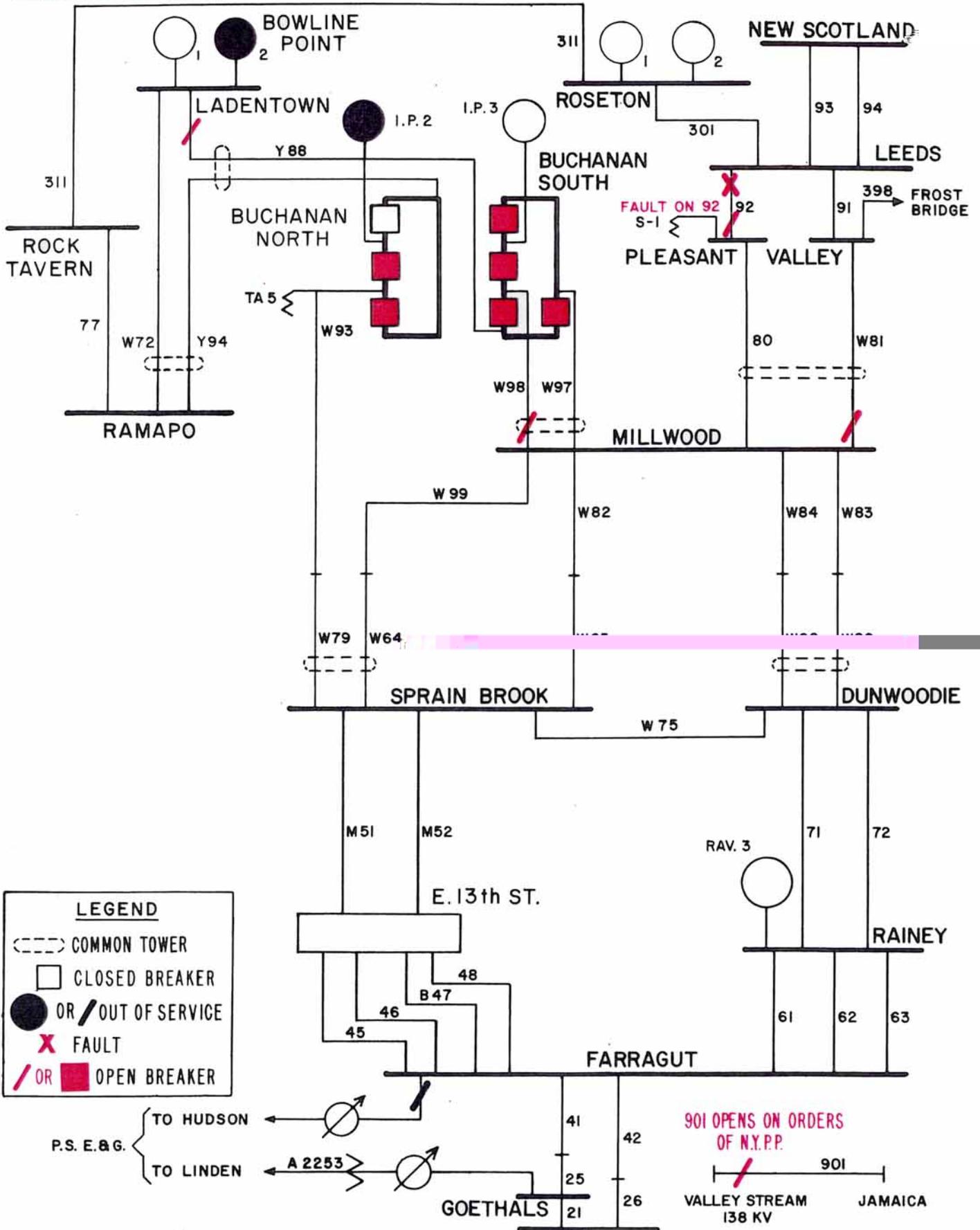
Beginning at 20:37 through 21:29 a series of lightning strikes, transient or permanent faults and protective relay malfunctions caused the equivalent of 6 high capacity 345kV tie feeders to come out of service. The remaining two - 138kV tie feeders became severely overloaded and protective relaying tripped them out of service. An electrical island was formed consisting of the Con Edison service area with the load exceeding the amount of generation in service. Under-frequency load shedding operated as designed, but due to extremely high transmission system voltage Ravenswood 3 became unstable and tripped off-line. The frequency declined to 57.5 Hz and this resulted in the generating units to begin to cascade off-line since they are not designed to operate stable at this low frequency. At 21:34 the system blacked-out.

During the period from 20:37 after the first lightning caused feeder trips until 20:55 the system operator (S.O.) attempted to make adjustments to the system to compensate for the loss of transmission feeders and generation. These actions included the initiation of the fast-load pickup alarm at 20:45, requesting the New York Power Pool dispatcher (NYPP) to terminate power being wheeled through the system from New Jersey to New England and ordering the Astoria gas turbine units in service. These actions occurred prior to the second lightning strike at 20:55 when additional lines came out of service. From 20:55 the S.O. discussed options for unloading the overloaded feeders with the NYPP and ordered the Narrows GT's and the Astoria industrial GT's into service. At 20:58 East River unit no. 5 tripped placing an additional burden on the transmission system. At 21:13, 5% voltage reduction was initiated, at 21:18, 8% voltage reduction was initiated and the S.O. had also adjusted the flow on the Linden tie to within emergency limits. At 21:20 the last remaining tie to our northern neighboring utilities tripped out of service leaving only the tie to New Jersey via Linden in service. The system operator initiated load shedding at 21:23 without success and at 21:29 the Linden tie tripped out of service and the underfrequency load shedding operated and Ravenswood 3 tripped.

SIMPLIFIED SCHEMATIC 345KV SYSTEM

FIG. 1-2C

345 KV SYSTEM
SEPARATED FROM NORTH



LEGEND

- (---) COMMON TOWER
- CLOSED BREAKER
- OR / OUT OF SERVICE
- X FAULT
- / OR ■ OPEN BREAKER

P.S. E.&G. {
TO HUDSON
TO LINDEN

901 OPENS ON ORDERS OF N.Y.P.P.
901
VALLEY STREAM 138 KV
JAMAICA

