NYISO

Adjusting for the Current Overstatement of Resource Availability in Resource Adequacy Studies

Introduction

In addition to the operation of the wholesale electricity market for the New York Control Area (NYCA), the other primary mission of the New York Independent System Operator (NYISO) is to ensure the reliable operation of the NYCA. This mission is accomplished by complying with and enforcement of the reliability rules for planning and operating the New York State power system. The New York State Reliability Council (NYSRC) is the primary entity in New York State for establishing reliability rules and monitoring overall compliance with the rules. Annually, the NYSRC with support from the NYISO establishes the statewide Installed Capacity Requirement (ICR). This requirement is established as required by Rule A-R1 "Statewide Installed Reserve Margin Requirement". The calculation of this requirement is critical to ensuring that sufficient resources are available to the NYCA such that the probability of involuntarily disconnecting load do to lack of available resources is on average no greater than once in ten years.

The purpose of this paper is two fold: 1) To demonstrate that the data used to model generating resource availability does not fully capture the full range of outage conditions and has the potential to overstate the capability of generating resources; and 2) Propose modeling adjustments which more accurately reflect the availability of generating resources.

Background

The primary tool used in calculating the annual ICR is General Electric's Multi-Area Reliability Simulation (MARS) program. MARS is a Monte-Carlo simulation tool which based on the inputs calculates the probability of disconnecting load – A.K.A., loss-of-load-expectation (LOLE). The primary data inputs are collected and maintained by the NYISO. The NYISO also maintains the MARS model and conducts the simulations. Key inputs include such factors as generator availabilities, generator ratings or dependable maximum net capability (DMNC), special case resources (SCR), load uncertainty, load shape, transmission system transfer capabilities, etc. Customer specific data such as generator availabilities and ratings, SCR ratings are confidential and can only be reviewed by individuals who are subject to the NYISO code-of-conduct.

Data Issues

For resource availabilities and ratings data the NYISO depends on performance and test data submitted by market participants. In order for a resource to participate in the NYISO installed capacity (ICAP) market, they are required to conduct a DMNC test consistent with the rules/procedures and submit generator availability data (A.K.A, GADS data) consistent with the rules/procedures. This data is used to determine a resources' unforced capacity (UCAP) which establishes the amount of capacity that can be sold into the market. It is also used as input into the MARS studies. Once a resource is selected as an ICAP supplier it has certain obligations such as bidding in to the day-ahead market its full ICAP capability on daily basis unless it is forced out or derated - i.e., partially forced out.

Concerns regarding the overall accuracy of the GADS data began with the realization that under the ICAP market rules and procedures, resources are not required to report all derates or forced outages. For instance, derates or forced outages attributable to transmission limitation such as generator step-up transformer failure, or fuel and environmental limitation, are not required to be reported as derates or forced outages but can instead be reported as reserve shutdowns.

The second concern with the resource data began when the Market Monitoring and Performance Unit of the NYISO began physical audits of both generating and SCR resources. An audit is triggered when a resource is perceived to be not fully compliant with market rules. For instance, a resource unexplainably fails to bid in its full ICAP capability or its bidding pattern suggest economic withholding. During the conduct of these audits two concerns came to light. The first was related to how a resource was reporting its GADS data. The second was how a resource was conducting its DMNC test.

With respect to reporting of the GADS data, the primary finding was that in a number of instances resources were reporting a forced outage as a reserve shutdown. For instance, a generator would be forced out and report that status for the balance of its day-ahead contract. However, starting at the expiration of the day-ahead contract the unit would begin reporting the unit as in reserve shutdown whereas the rule requires the unit to continue to report its status as forced out until it has a successful start. This reporting of reserve shutdowns VS forced outages has been clarified with market participants.

With respect to DMNC testing, the audits found a number of instances where extraordinary actions were taken to increase the output of the generator or the results of the DMNC test. In many instances it would be difficult to take those actions in real-time to realize the maximum output of the machine in the event of a system emergency. These extraordinary actions ranged from shutting down of auxiliary equipment to physically disconnecting and reconnecting steam supply piping in a different configuration. In another instance, a generating unit, which uses coal as its primary fuel, utilizes a blend of

coal with varying sulfur and BTU content to meet emission requirements. In conducting the DMNC test, the unit ran strictly on coal with the highest BTU content. None of the extraordinary actions taken during the DMNC testing, which were uncovered during the audits, are prevented by the ICAP market rules and procedures. However, it does indicate a need to tighten up these testing rules and procedures.

Although confidentiality prevents the NYISO from disclosing more specifics, the NYISO Market Monitoring and Performance personnel did meet with NYSRC personnel who are subject to the NYISO code-of-conduct to review their findings. These findings clearly indicate the GADS data overstates generating unit availability and DMNC testing potentially overstates the maximum output a generator could provide in the event of a major emergency. These above discussions clearly indicate that adjustments to the MARS input data need to be developed to more accurately reflect the availability of resources.

Proposed Adjustments to Resource Availability Data

Adjusting MARS input data to provide a more accurate accounting of the true availability of resources has been incorporated into the MARS modeling in the past. The two being the "Combustion Turbine Derates" also called the Gas Turbine or GT Derate - to reflect the fact the performance of combustion turbines degrades with increases in ambient temperature, and the "Hydro Derate" - to reflect the reduced capability of hydro units in the middle of the summer due to lower water levels – i.e., a fuel restriction. As part of this paper these derate adjustments currently being applied will be reviewed. The primary purpose of this paper is to present a third proposed adjustment. This adjustment is designed to capture the under reporting in the GADs data and the potential overstating of generating ratings given how a particular DMNC might have been conducted. This proposed new adjustment will be defined as the "Generator Availability Data Adjustment Factor" or GADf. What follows is a discussion of the availability adjustment already modeled in MARS, as well as, the proposed GADf adjustment.

Existing Adjustments

The Multi-Area Reliability Simulation (MARS) was used, with the advent of the NYISO in 1999, for the 2000 IRM study. During this Installed Reserve Margin (IRM) study and prior New York Power Pool studies, there were a set of derates applied to the smaller upstate hydroelectric units[1] that have, in aggregate, an installed capability slightly in excess of 1000 MW. For the 2002 IRM study, a second set of derates were developed to capture the inability of small combustion turbines to operate at their DMNC levels at temperatures above design conditions. Below you will find a discussion of the adjustments currently in use:

[1] Upstate hydroelectric units with the exclusion of the Niagara and St. Lawrence units – these have their own probability distribution pattern representing outages. The pump station at Blenheim-Gilboa is also modeled separately.

Hydroelectric Derates

The small hydroelectric plants which represent an installed capability of slightly in excess of 1000 MW that are scattered around zones A-G normally experience low water levels during the summer months when the New York system peaks. Prior to the 2002 IRM study, these plants were derated by 25% of their DMNC rating to account for this lack of fuel during the system peak. During the summer of 2001, the northeast experienced a drought in which these units could provide only 35% of their ratings on peak[2]. That year it was decided to model a 45% derate for these units. Recent analysis for the 2003 and 2002 system peak days has shown that this value remains valid.

Combustion Turbine Derates

As a modeling enhancement to the 2002 IRM study, an adjustment was introduced to represent the inability of combustion turbines to achieve their DMNC output at temperatures above design conditions. At conditions above 92° F, the study[3] found an 80 MW per degree derate for the system. This derate has been observed in both the 2001 data, and later in the 2002 data. There have been several modeling methodologies used to capture this derate with the latest being a direct methodology developed by GE. This methodology derates individual units when the load exceeds the related design level. The derate occurs over several levels of load above design conditions.

The Proposed GADf Adjustment

This year, the analysis was expanded to answer the following question: Over and above the adjustments already modeled, are generating units available on peak days at the same level that they are available as represented in the MARS model? The MARS model assumes that a unit is available at its DMNC rating unless scheduled out of service by the provided maintenance schedule, or forced out of service as provided by previously supplied GADs data. If these units are not available at their DMNC level and they are not reporting the difference in the GADs data, then the model is over estimating the amount of capacity available.

The following method was developed to estimate the amount of under-reporting. The under-reporting discussed here is for purposes of identifying shortfalls in the GADs data collection used for MARS analysis. It is not meant to suggest inappropriate or invalid bidding behavior.

-The first step was to look at the maximum DAM bid (maximum on the bid curve) and compare it to the level of ICAP sales for each unit. Since a unit is only obligated

[2] "New York Control Area Installed Capacity Requirements for the period May 2002 Through April 2003", December 14, 2000, pp17 (commonly called the 2002 IRM study).
[3] IBID, pp18

to bid to their sales number, and not their DMNC level, this seemed appropriate. The analysis was performed on the peak day (7/29) and hour (16) for 2002 and the peak day (6/26) and hour (16) for 2003.
-For those units that were short of their ICAP sales, an entry was made and termed "withheld". Since max bids were recorded in whole numbers and ICAP sales to one decimal point, only withheld amounts above 2 MW were selected. The idea was not to penalize anyone who may have been bidding to his or her sales number but was recorded inappropriately.
-The next step was to look at the supplied GADs data for each unit and determine if they reported any deratings on the unit. If they did, they were dropped from the list. Note that an attempt to catalog the differences between the GADs reporting and this analysis was not made. If the unit reported any derate it was dropped from the list regardless of amount of derate reported.
-At this point, any hydro units that remained were dropped from the list. This is because there already exists a derate for the hydro units. Of interest is the amount of MW's that were removed from the analysis when the hydro units were removed. It amounted to 45% of the existing hydro capacity and verified the existing hydro derate value.
-Similarly, the group of combustion turbines was removed from the list. They have a derate that already exists in the model, as well.
-Finally, certain Capacity Limited Resources (CLR's) were removed from the analysis. These units were excluded, on a case-by-case basis, from reporting their full capacity into the market.

This methodology was repeated against the Hour Ahead Market (HAM) bids. The idea was to see if information that was closer to real time performance of the unit would be more appropriate. To the extent that it really doesn't matter what the reason is for not showing up at the DMNC level, the **model** expects it (except for derates as provided by GADS). Therefore the true performance of the unit (i.e., closer to real time) against the DMNC is what is being sought. The following table shows the results for the DAM and HAM analyses.

Zone	03_HAM	02_HAM	Average	Proposed Derate
A	35	42	38.5	**38**
B	7	0	3.5	**4**
C	152	147	149.5	**150**
D	51	17	34	**34**
E	46	54	50	**50**
F	50	70	60	**60**
G	10	21	15.5	**15**
H	18	33	25.5	**26**
I	0		0	**0**
J	214	217	215.5	**215**
K	127	111	119	**119**
	711	711	711	711

Zone	03_DAM	02_DAM	Average
A	4	26	15
B	7	0	3.5
C	88	70	79
D	54	16	35
E	47	61	54
F	51	70	60.5
G	0	3	1.5
H	19	33	26
I	0	0	0
J	117	317	217
K	127	99	113
	514	695	605

Conclusion

It is clear that the amount and availability of resources being reported to the NYISO since the start up of the NYCA wholesale electricity market are being overstated. This does not mean that the availability and performance of generating units has not improved significantly since the opening of the market. Prior to the opening of the market the expected unavailable resources at the time of the NYCA peak for operational planning purposes was on the order of 13%. The number currently being used for operational planning purposes is in the 9-10% range. This number is still above the approximately 5% expected unavailability suggested by the current EFORd. In the past, known

reductions in generating capability at the time of the NYCA peak that have not been directly captured in the GADs data have been incorporated through modeling adjustments – e.g., the Hydro and GT derate models.

Through its market monitoring processes the NYISO has identified instances where generator availability is being overstated or has the potential to be overstated. The NYISO has proposed that an additional adjustment totaling 711 MW or approximately 2% of capacity, called the GADf adjustment, is needed to capture the overstatement of resource availability that is not currently captured in the Hydro or GT derate models. The NYISO believes it would be unwise to not address this documented overstatement of availability. It believes the approach it has recommended to address this issue is a reasonable adjustment to approximate the overstatement of generator availability.

In theory, this adjustment should be eliminated with proper recording of outages in GADs data collection. The NYISO is pursuing this by updating the GADs collection software to allow reporting of such things as transmission related outages as well as emissions related outages. Also, resources report availability status to Market Monitoring and Operations on a daily basis. Currently this data is collected in an ad-hoc way. The goal is to develop reporting protocols that would facilitate cross checking between these databases and GADs. The ultimate goal of these changes would be to be to eliminate this GADf adjustment model over time.