ADJUSTING FOR THE OVERSTATEMENT OF RESOURCE AVAILABILITY IN RESOURCE ADEQUACY STUDIES

FOR THE NEW YORK CONTROL AREA
During the 2006 – 2007 Capability Year
8/23/2005

Adjusting for the 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.

Last year the NYISO demonstrated that because of reporting issues the reported availability of generating units was being overstated. An adjustment to capture the under reporting was developed. The purpose of this paper is to update last years findings which demonstrated that 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. Also, this paper will update the other 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 SCR ratings and generator availabilities and 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 resource's 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 reporting its availability and bidding in to the day-ahead market.

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 were 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 in 2004 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.

Adjustments to Resource Availability Data

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 combustion turbines to operate at their DMNC levels at temperatures above design conditions. Finally, in 2004 (for the 2005 IRM study), a GADf derate was added to account for the discrepancy seen between a resource's reporting of its available capacity in GADs versus what was being offered into the market. Below is a discussion of the adjustments currently in use:

Hydroelectric Derates

The small hydroelectric plants which represent an installed capability of slightly in excess of 1000 MW that are scattered throughout 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 DNMC 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. The 2004 data does not indicate a change to the derate is warranted.

[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.

[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).

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. The cooler temperatures observed in 2003 and 2004 do not indicate this derating should change. 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 design level. The derate occurs over several levels of load above design conditions.

GADf Derate

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 GADf derate accounts for the discrepancy seen between a resource's reporting of its available capacity in GADs versus what was being offered into the market under its obligation to bid into the Day Ahead Market.

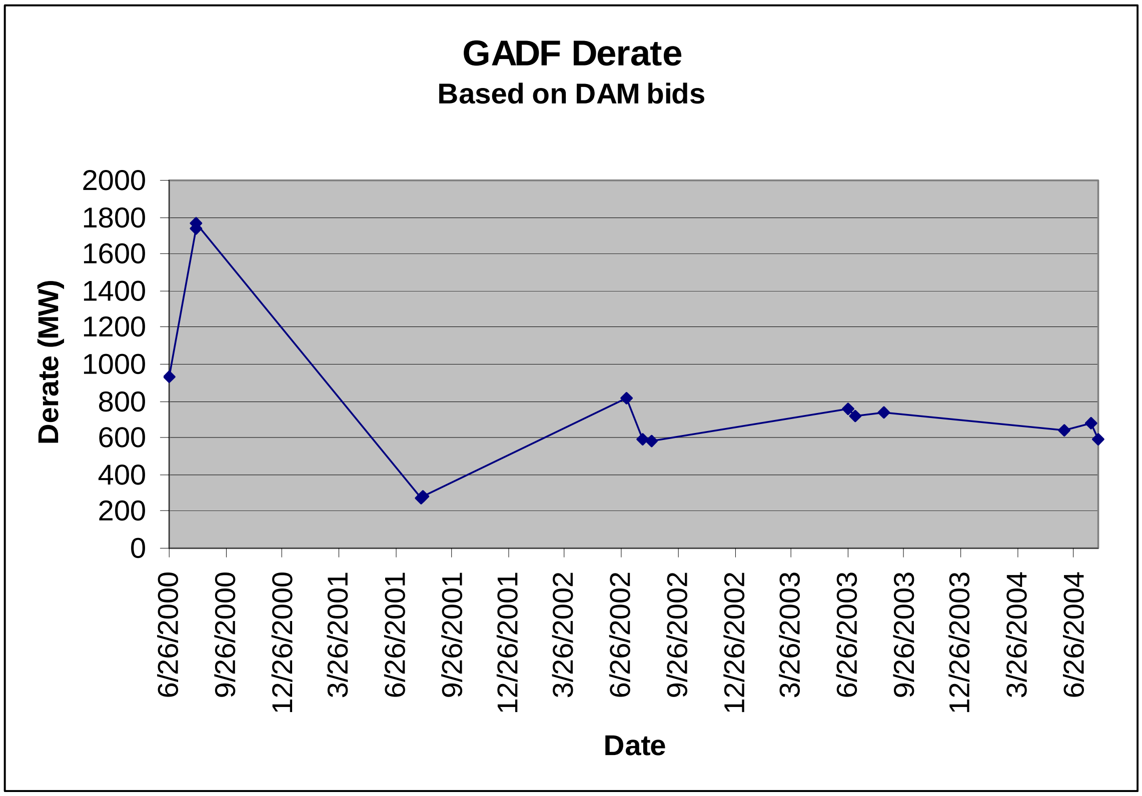
The method for estimating the amount of under-reporting is described in Appendix A. Although data over a five year period was examined for both the HAM and DAM bids, only the 2004 DAM bid data will be used to determine the derate for the 2006 IRM study. Although the HAM data is useful in determining how the bidding changes from the day ahead time frame to closer to real time, resources do not have an obligation to bid into the HAM. Further, the HAM and DAM bid data shown in years 2000 and 2001 seems erratic. It is difficult to verify the quality of that data and therefore, for this analysis, it has been discarded.

The zonal totals for these derates are shown over the fifteen data points chosen, in appendix B.

Figure-1, below shows the GADf derate over the first five years of operation of the NYISO. After discounting the first two years due to data quality concerns, it can be seen that there is a consistent pattern of unreported (into the GADs data) derates in years 2002, 2003, and 2004 that are not being captured in the MARS model. The figure also shows a decrease in the derate going from 2003 to 2004. This decrease is believed to be due to the exposure of this behavior both generally and through direct contact by the NYISO market monitoring group.

[3] "New York Control Area Installed Capacity Requirements for the period May 2002 Through April 2003", December 14, 2000, pp18.

Figure - 1



Based on this analysis, the GADf derate for the 2006 IRM study would be:

Zone	GADf Derate
A	23
B	5
C	51
D	361
E	8
F	23
G	4
H	14
I	0
J	35
K	0
	524

Mitigation Efforts

Although the Hydroelectric and Gas turbine derate may continue to be needed in resource adequacy studies, the GADf derate should be diminished, if not eliminated, over time. Since its discovery in 2004, the NYSIO has begun several initiatives to mitigate this overstatement. For example, the GADs collection software has been modified to record outages that are caused by events outside the control of the generation plant operator. These events will not count against the operator's calculation of EFORd but will be included in the development of availability for resource adequacy studies. The NYISO has also initiated education efforts by promoting the reporting of all derate or outage events. Lastly, audits of participants along with procedural notifications have begun in earnest. The number of audits has grown from 24 in 2003 to 30 in 2004 and may exceed 30 in 2005 plus review of temperature adjustment curves and applications for CLR and ELR. These classifications are described in NYISO technical bulletin 75 and 76.

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.

This year's analysis has resulted in the reduction of the GADf adjustment from 711 MW determined last year to 524 MW. This adjustment is needed to capture the overstatement of resource availability that is not currently captured in the Hydro or GT derate models

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.

Appendix A
Method for Calculating GADf

The calculation of the GADf is based on the difference between a unit's obligation in the Day Ahead Market (DAM) and what was reported in GADs.

-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. The ICAP level is chosen because a unit is only obligated to bid to their sales number, and not their DMNC level. The analysis was performed for the top three daily peaks since the ISO start up (2000-2004).

-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. The amount of MW's that were removed from the analysis due to hydro derates is compared to the exisiting 45% derate in order to determine if changes are needed to the existing derate

-Similarly, the group of combustion turbines was removed from the list. They have a derate that already exists in the model, as well.

-The HAM bids were examined to determine if units that were not fully available at the time of the DAM became available during the hour ahead, if they did become fully available, they were removed from list.

The remaining amounts of withheld capacity, after combustion turbines and hydros were removed were classified as GADf derate.

Appendix B

GADf Summary Data by Zone   HAM Bids

					ZONE						
DATE	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**
8/3/2004	13	58	64.1	22.7	2.6	154.7	92.1	13.8	0	302.6	195.9
7/22/2004	209	2.1	100.5	361.2	15	146.8	70.1	23.2	0	430.6	266.2
6/9/2004	26	2.1	125	121.3	30	155.6	65.3	6.7	0	301.4	96.8
8/22/2003	15	19	128.3	361.9	16	20.1	58.4	3.7	0	246.6	77.8
7/8/2003	23	10.2	96.6	281.9	15	20.1	65.6	14.2	0	244	116.1
6/26/2003	14	6.5	146	362.4	12	27.9	16.5	0	0	403.4	230.1
8/13/2002	33	18	151	344.5	15.5	160.2	42.2	52.6	0	412.8	182.6
7/29/2002	31	0	147.7	94.8	7.3	27.1	36.7	29.9	0	162.5	270.8
7/3/2002	226	7.7	99.2	118.8	10.6	29.7	9.5	40.9	0	247	123.6
8/9/2001	24	0	121	327.6	0	34	26.8	5.7	0	62.1	71.4
8/8/2001	18	0	118.7	327.6	0	174.8	27.6	7.7	0	42.2	8.4
8/7/2001	12	0	112.7	106.6	0	36	80.5	2.7	0	120.9	86.2
8/9/2000	62	0	1109.4	362.4	8.7	39.9	80.8	0	0	426.6	299.2
8/7/2000	47	0	1077.4	282.4	0	33.9	71.4	0	0	426.1	257.9
6/26/2000	213.5	0	108.9	362.4	4.5	37.5	26.6	0	0	266.8	231.6

GADf Summary Data by Zone   DAM Bids

					ZONE							
	A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**	**TOTAL**
8/3/2004	34	2	32.7	361.2	5.3	24.5	3.5	13.8	0	13.8	0	491
7/22/2004	11	2.1	100.6	361.2	10	20.7	3.5	23.2	0	29.8	0	562
6/9/2004	23	12.1	21.1	361.3	8	23.5	3.5	5.7	0	61.8	0	520
8/22/2003	13	39	97.1	320	9	7.3	0	3.7	0	171.3	0	660
7/8/2003	10	18.2	47.5	320	9	7.3	0	0	0	188.3	0	600
6/26/2003	10	20.6	46	320.5	12	24.9	6.2	0	0	194.2	0	634
8/13/2002	20	35	79.6	77.5	14.8	12.6	0	48.6	0	177.2	0	465
7/29/2002	29	20.5	68.3	79.8	5.3	32.7	0	29.9	0	219.1	0	484
7/3/2002	228	17.2	67	118.8	3.3	29.7	0	16.9	0	207	0	688
8/9/2001	7	0	95.7	86.4	0	25	11.9	0	0	51.2	0	277
8/8/2001	7	0	95.7	86.4	0	0	11.9	0	0	70	0	271
8/7/2001	4	0	74.7	86.4	0	11	11.9	0	0	75.3	0	264
8/9/2000	70	0	1069.7	320.5	9.6	39.9	44.3	0	0	177.7	0	1732
8/7/2000	57	0	1059	320.5	9.6	39.9	41.7	0	0	145.7	0	1674
6/26/2000	293.4	0	64.4	282.4	9.6	48.7	6.2	0	0	173.8	0	879
04 Avg	23	5	51	361	8	23	4	14	0	35	0	524