

Sufficiency of Indiana Generating Capacity in NO_x Retrofit Outage Periods

**State Utility Forecasting Group
Purdue University
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1. Background

This report examines the reliability impacts of generator retrofit outages resulting from nitrogen oxides (NO_x) restrictions. Initially, the Clean Air Act Amendments of 1990 required reductions in NO_x emissions from certain boilers by 2000. In 1998, the Environmental Protection Agency proposed further reductions as of May 2003 and that deadline was pushed back to 2004 last year.

In order to meet the new restrictions, utilities will have to install NO_x removal equipment on some of their largest generators. The installation process, known as retrofitting, will require the generating unit to be shut down for an extended period of time. Concern has been expressed that simultaneous retrofits by individual utilities of their larger generating units could result in capacity shortages during the normal spring and fall maintenance seasons.

In this report the State Utility Forecasting Group (SUFG) compares the expected supply and demand during those periods to determine whether a shortage is likely to exist.

2. Methodology

The methodology involves collecting information on planned outages from the utilities to determine the amount of capacity that is expected to be available on any given day. The available capacity is then compared to the expected demand to find the reserve margin for each day. The reserve margins are then examined to identify any periods where a shortage may be a concern.

2.1 Available Capacity

The first step in determining the amount of available capacity was the collection of generation maintenance schedules from the various utilities. This information is considered competitively sensitive by the utilities and was provided confidentially. The level of detail provided by the utilities varied greatly. In some cases, the exact projected dates were provided throughout the period of interest (through 2004). In others, the season for the retrofit was provided, but not the dates. In one case, the information was not made available.

In cases where less than complete information was available, SUFG created a maintenance schedule for the utility based on the best available information. For instance, in cases where the particular season of the retrofit was available but not the timing, SUFG used that information, in conjunction with information regarding non-retrofit outages, to construct a reasonable maintenance schedule. This process is illustrated generically in Figure 1. All maintenance outages were fit into either the spring or fall maintenance season in a manner that is consistent with typical utility practices but should not be considered optimal. Within the season, the outages were spread out so that the least amount of capacity would be unavailable at the beginning and end of the season, when extreme weather might cause a

problem. The largest amount of capacity out of service occurs during the middle of the maintenance season. In this example, unit 1 is a large unit out for a long period of time, while units 2, 3, and 4 are smaller units scheduled for shorter outages.

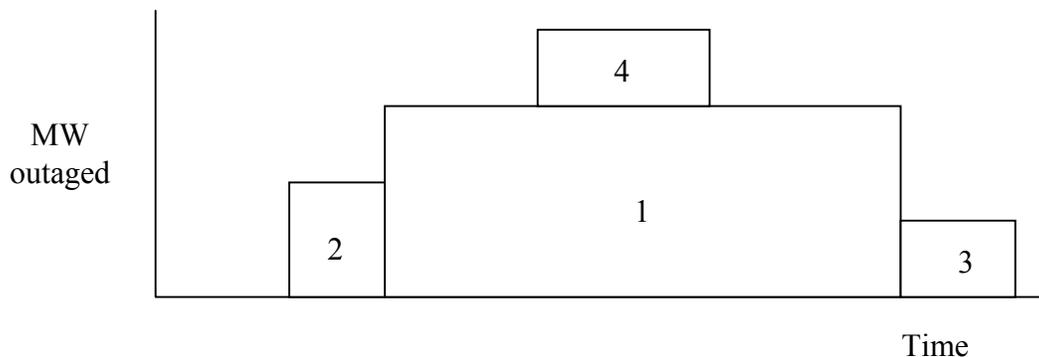


Figure 1. Generic Maintenance Schedule Pattern

Once the maintenance schedule was either provided or developed, the amount of capacity available for each day was determined. This was done by subtracting the capacity unavailable due to maintenance from the installed capacity. Since some generators have reduced capacity during warmer months, the seasonal capacity rating of each generator had to be taken into account.

Next, the available capacity was adjusted to account for any long-term sales or purchase contracts of which SUFG was aware. For those sales that are tied to a specific unit, the unavailable capacity had to be adjusted accordingly. In this case, the utility only provides power to the purchaser when the unit is operating. Therefore, if the unit was counted as unavailable due to maintenance and the capacity was adjusted for the sale, double counting would occur.

By using the seasonal capacity ratings and the maintenance schedule of the generators, along with the long-term contracts to buy and sell power, the expected available capacity for each day through 2004 was determined.

2.2 Projected Demand

Daily peak demand was projected from actual hourly load data for the most recent year available, 1999, and SUFG projections of future growth. SUFG obtained 1999 control area hourly load data for each control area within the state. These hourly observations were summed by hour to obtain statewide loads then converted to daily maximum loads. To each of the daily maximum 1999 loads SUFG added an estimate of the baseload generation available from other (non-control area) Indiana utilities. This results in SUFG's estimate of total 1999 Indiana maximum daily loads. Projections for 2001 through 2004 maximum daily loads were made by growing the 1999 values by the amounts projected in SUFG's 2001 Indiana Electricity Projections.

The projected peak demand does not include the impacts of interruptible load contracts, except for actual interruptions that occurred in 1999 and thereby affect the hourly load data used in the analysis. Since those interruptions would have occurred in the summer

rather than in the maintenance seasons, they would not impact the periods of interest. Similarly, the extreme heat wave of 1999 does not affect the study.

2.3 Reserves

The level of reserves for each hour was then determined by subtracting the projected demand from the available capacity. The reserve margin was calculated by dividing the reserves by the demand and expressing the result in terms of percent. The resulting reserve margins for each hour were compared to a target reserve margin of 15 percent in order to identify any time periods where shortages might be a concern. The target reserve margin, which allows for unexpected unit outages and abnormal weather patterns, is the same one that is used in determining new capacity needs in SUFG's traditional forecasting model.

3. Results

The reserve margins for 2001 through 2004 are shown in Figure 2. During the spring and fall maintenance seasons, the reserve margins are significantly above the 15 percent target, with a low of approximately 20 percent in the spring of 2002. Spring of 2002 appears to have the largest amount of generating capacity scheduled to be out for maintenance of any of the periods examined. The low summer reserve margins are consistent with the capacity needs identified in the traditional SUFG forecast.

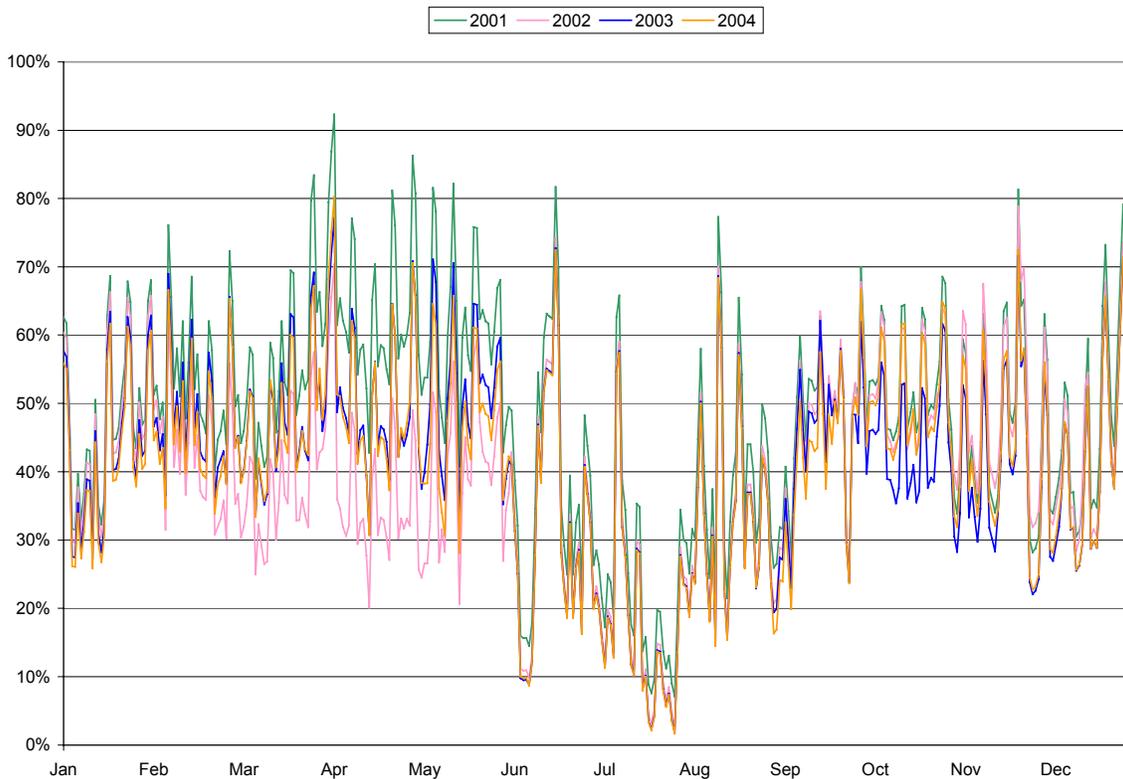


Figure 2. Hourly Reserve Margins for 2001 - 2004

While it appears from Figure 2 that there is little cause for concern, there are possible occurrences that may result in problems. The spring maintenance season typically ends in May. If a planned outage of a major unit lasts longer than anticipated and keeps the unit out of service into June, shortages become much more likely. Similarly, if Indiana experiences an early heat wave before the end of the maintenance season, shortages could occur. Finally, there is always a possibility that an unforeseen combination of events, such as severe weather, unscheduled unit outages, and transmission system limitations could result in shortages even when there appears to be adequate generation available.

It should be noted that this analysis does not include interruptible loads or wholesale purchases beyond those already in place. It also only examines the sufficiency of capacity for the state as a whole and does not examine the situation for an individual utility. That exercise is left to the utilities themselves.

In summary, Indiana should have adequate generation capacity to handle the NO_x retrofits that will occur in the next few years, barring an unusual combination of events. Times of specific concern are in the late spring and early summer when an early heat wave or an outage that lasts longer than expected may result in shortages.