ECAR Reliability Analysis of the EPA NO_X SIP Call

00-GRP-63

East Central Area Reliability Coordination Agreement

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Contents

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FOREWORD

The U.S. Environmental Protection Agency (EPA) has undertaken several initiatives that target fossil fired utility boilers for significant reductions in emissions of oxides of nitrogen (NO_X). These specific actions by EPA and others are discussed in the Regulatory Overview section of this report. Because the majority of the generating capacity in ECAR is coal fired, these various initiatives would prompt the retrofit installation of NO_X controls (primarily Selective Catalytic Reduction facilities) on many generating units. ECAR members installing these controls will need extensions to currently scheduled unit outages as well as additional outages. Concentrating large amounts of retrofits in a very limited time could seriously degrade system reliability. ECAR does not take a position on the need for or the magnitude of any emission reductions ultimately implemented. ECAR is concerned with electric system reliability. Therefore the amount of time allowed for installation of these retrofit facilities is of serious concern because of its potential impact on reliability.

In August of 1998, ECAR became aware of impending final NO_X SIP Call regulations by the U.S. Environmental Protection Agency (EPA). That regulation calls for significant reductions in utility NO_X emissions in a 22 state region in the eastern U.S. (including the ECAR region) to be achieved by May 1, 2003. ECAR was requested by its members to review studies performed for the Utility Air Regulatory Group (UARG), the Ozone Attainment Coalition (OAC), and the EPA of the impact of EPA's rule on reliability. As a result of this review, it became clear that many of the assumptions and analytical methods differed from those that ECAR historically used. This left it unclear as to whether the reliability issue had been adequately and accurately addressed.

In October, 1998, the Coordination Review Committee (CRC) of ECAR directed the Environmental Advisory Panel (EAP) to review the reliability issue and coordinate reliability activities in ECAR related to NO_X compliance. The EAP, with assistance from the Generation Resources Panel (GRP), has reviewed the previously mentioned studies and also reviewed and participated in the oversight of a similar study prepared for the Reliability Assessment Subcommittee (RAS) of NERC. This report, prepared for the EAP by the GRP, represents ECAR's reliability assessment of the impact of the NO_X SIP Call regulations finalized by EPA in 1998. The analysis presented in this report uses the same methodology that was used in *Assessment of ECAR-Wide Capacity Margins 1999-2008* (ECAR report 99-GRP-57).

SUMMARY

Conclusion

Installing NO_X controls will have an impact on reliability, but the significance of this impact depends on many factors. The most critical factor under regulatory control is the length of time or "window" available in which to accomplish retrofits after the rules are in place. An analysis of the time required to install NO_X controls to meet U.S. EPA's NO_X SIP Call in the ECAR region demonstrates that a 42 month window is needed to avoid undesirable impacts on reliability. The window is already less than 42 months, given the rule's May, 2003 compliance deadline. In fact, unless construction outages begin early in 2001, there will not be time for a 30 month outage window. If a period less than thirty months is mandated, the reliability impacts are significant.

ECAR strongly endorses maintaining a 42 month construction window for retrofit of controls . . .

The EPA rule is in litigation and the ultimate level of NO_X control required and the compliance deadline are uncertain. ECAR strongly endorses maintaining a 42 month construction window for retrofit of controls if the final NO_X emission reduction requirements are comparable to those in the original rule.

Once a company commits to a NO_X control project, time is needed to complete activities (engineering, procurement, site preparation, etc.) which must occur prior to proceeding with the installation outage.

Observations

There is a reliability reduction resulting from the additional outage time required for SCR retrofit work. Any additional outage time HAS to impact reliability in a negative manner. The issues are how much of a negative reliability impact is likely to occur, is the impact excessive, and can the impact be mitigated. The long standing ECAR generating system reliability criterion (now embodied in ECAR Document 15) is based on a probabilistic analysis of load and capacity. A Dependence on Supplemental Capacity Resources (DSCR) of from 1 to 10 days per year is considered to indicate a marginal but satisfactory level of reliability. The annual DSCR resulting with the additional SCR outages is within this criterion for some of the years examined, but not for 2002 for any scenario *(see Table A)*, and also not for 2003 with an 18 month window.

TABLE A
Dependence on Supplemental Capacity Resources

	Additional Maintenance			
	Base	2 weeks	4 weeks	6 weeks
Retrofit Window	DSCR Neg-Days	DSCR Neg-Days	DSCR Neg-Days	DSCR Neg-Days
2001				
42 months	6.03	6.49	7.06	na
30 months	6.03	6.46	7.20	8.44
18 months	6.03	6.03	6.03	6.03
2002				
42 months	9.87	11.37	13.93	na
30 months	9.87	11.66	15.04	20.52
18 months	9.87	na	19.64	32.31
2003				
42 months	7.21	7.72	8.48	na
30 months	7.21	7.82	8.80	10.19
18 months	7.21	na	10.11	13.40

Based on TID.
na = not available, case not run.

There are a number of factors within and outside of utility control, which can mitigate or exacerbate the reliability situation studied in this report.

- Equivalent Availability – Reliability can be maintained within the current criterion if the equivalent availability can be increased to 83% prior to accounting for the additional outages. This level of equivalent availability has been achieved only twice in the last ten years. It will be difficult to make availability improvements prior to the retrofit window.

- Merchant Capacity – The addition of capacity within the region by non-regulated merchant facilities can make up some or the entire potential equivalent 2,500 MW shortfall in regional capacity resources. However, utilities do not have control over merchant plant construction or when these units go in service.

- Centralized Maintenance Scheduling – The ECAR region has no authority over individual company maintenance schedules. If the companies agree, ECAR could tabulate company maintenance

schedules and identify those periods where maintenance could be changed to create a more "optimal" schedule for the region.

- Project Commitment – Companies are hesitant to commit to construction projects for NO_X control while there is uncertainty as to the outcome of the pending litigation. Utility commissions are likely to be critical of projects, which do not have a clear legal requirement. In addition, if a generation provider is unregulated and makes a bad investment decision, it will not likely recover its costs.

- Scheduling Limitations – The length of individual outage extensions can be influenced to some extent by the facility owners, but is limited by physical constraints.

- Engineering and vendor availability – It is unknown as to whether there is sufficient engineering firm and equipment vendor availability and capacity to be able to accommodate any of the outage windows in this study. Insufficient availability of resources to complete SCR construction in a timely manner could increase construction schedules and outage durations, further impacting unit availability and regional reliability.

REGULATORY OVERVIEW

Background

The Federal Clean Air Act was last amended in 1990. Since that time many parts of the country continue to have problems attaining the 1-hour ground level ozone standard. These include parts of several northeastern states as well as Chicago, Atlanta and others. The most widespread problems occur in the Northeast.

The Clean Air Act Amendments of 1990 called for significant reductions in NO_X emissions from utilities and other sources. The second phase of utility reductions takes effect in 2000. To deal with their ongoing ozone non-attainment, several of the Northeastern States in recent years have implemented additional NO_X reductions from utilities and other sources in their region. Many of the more cost-effective reductions have already been utilized.

In the past few years intense pressure has been building from several states, environmental groups, and the EPA to impose additional NO_X reductions on utilities in the southeast and Midwest. Their premise is that studies have shown "transported" emissions are of sufficient importance that local ozone attainment in many areas can not be reached without major reductions from distant power plants. However, studies by other states, utility groups and others present strong evidence to refute this claim.

To address these claims, U.S. EPA promulgated the NO_X SIP Call rule in the fall of 1998, calling for a stringent level of NO_X reductions in 22 states. In addition, several northeastern states filed petitions under Section 126 of the Clean Air Act asking EPA to impose a similar level of NO_X control on upwind states. EPA has granted petitions from four states and is likely to approve petitions from other states. Both the NO_X SIP Call and Section 126 petitions call for compliance by May, 2003.

NO_X SIP Call

In November of 1998, EPA finalized its NO_X SIP Call. This regulation culminated a long and intensive program to develop a rule that would address the persistent ozone non-attainment experienced by many areas in the eastern United States. It mandates widespread NO_X reductions in 22 eastern states and the District of Columbia. While the rule gives individual states freedom to choose where

reductions are made, EPA clearly intends that electric generating units achieve the bulk of the reductions. The rule is based an emissions target of 0.15 lb. NO_X/million Btu heat input effective May 1, 2003. This requirement represents an approximate 85% reduction from 1990 levels. States were required to file their State Implementing Plans (SIPs) in the fall of 1999. In the spring of 1999, a Federal Court granted a state request for delay of the SIP submission deadline while the rule is appealed in court. However, the court did not extend the final compliance date of May 1, 2003. The court heard oral arguments in late 1999 and a decision is expected in early 2000. The court could let EPA's rule stand with the original or an extended compliance date, or the court could require EPA to withdraw the rule and rework it. Regardless of the outcome, it is likely that another year could pass before the State SIP Revisions are approved, providing the legal requirement for retrofit NO_X controls.

Section 126 Petitions

On December 17, 1999 the EPA formally approved 4 "126 petitions" to address the transport of pollution into the Northeastern States. Under section 126 of the Clean Air Act, states can petition EPA to require emission reductions from sources in upwind states that are shown to affect downwind states. EPA approved petitions filed by Connecticut, Massachusetts, New York, and Pennsylvania. Petitions were originally filed from four additional states, which EPA disapproved. EPA is still considering additional petitions from Maryland, New Jersey, Delaware, and the District of Columbia. Power industry groups have challenged these section 126 petitions in court.

The approved petitions identify 392 facilities and require reductions that are essentially equivalent to the NO_X SIP Call (i.e. 0.15 lb NO_X/ million Btu by May 1, 2003). The petitions cite sources in the states of Delaware, District of Columbia, Indiana (partial), Kentucky (partial), Maryland, Michigan (partial), North Carolina, New Jersey, New York (partial), Ohio, Pennsylvania, Virginia, and West Virginia. A large number of the affected sources are in the ECAR region. If these petitions are not stayed or overturned by the courts, sources will have to make the reductions by the May 1, 2003 deadline. Penalties for noncompliance would be monetary and additional emission reductions.

Summary of Environmental Activities and the Implications for ECAR

EPA has established rules that require coal fired utility boilers to achieve significant NO_X emission reductions. Because the majority of the generating capacity in ECAR is coal fired, these various initiatives could prompt the installation of NO_X control technology, including selective catalytic reduction (SCR), on a significant portion of the installed capacity in ECAR. ECAR members installing these controls will require extensions to currently scheduled outages as well as additional outages. Any additional outage incrementally reduces the amount of capacity available to meet demand. Concentrating large amounts of retrofits in a very limited time could seriously degrade reliability. As its organizational mandate, ECAR is concerned with electric system reliability. ECAR does not take a position on the need for or the magnitude of any emission reductions ultimately implemented. However, the amount of time allotted for these reductions is of serious concern because of its potential impact on reliability.

DEMAND AND RESOURCE DATA

Demand

The monthly demand data for the years 1999 – 2003 are listed on *Table 1* in the Appendix. These are the same data that were used in the *Assessment of ECAR-Wide Capacity Margins 1999-2008* (ECAR report 99-GRP-57). These data were provided by the ECAR members for the 1999 EIA-411, Coordinated Bulk Power Supply Program Report.

Capacity

The capacity data listed on *Table 1* are based on the monthly net capacity including any projected additions, retirements, or changes to existing units. Unit power sales are modeled by reducing available capacity.

Interchange

Net interchange is the net total of the purchases and sales listed on *Table 1*. These are projected purchases and sales by ECAR members to companies in other Regions.

OUTAGE DATA

A survey was conducted of the ECAR members early in 1999 in order to get their best estimates of how their companies plan to comply with these new NO_X requirements. Member company responses covered approximately 92% of the 83,400 MW of coal-fired generation in ECAR. The results from the survey indicated that approximately 68% of the region's coal-fired steam capacity would utilize SCR technology for NO_X compliance. An additional 13% of the coal-fired capacity is expected to utilize SNCR technology. The survey also indicated that the additional outage time required for SCR construction varied considerably, from no additional time up to 15 weeks. The ranges provided by the ECAR members averaged 2 to 4 weeks of outage time for SCR projects beyond regularly scheduled outages. At the time of the ECAR Survey, there was about a year for design, planning and procurement before the start of the 42 month window. The average of 2 to 4 weeks of outage time for the SCR retrofits will increase as the 42 month retrofit window decreases.

Some companies will also install low NO_X burner projects which may require additional outage time. Companies generally expect to complete SNCR projects during regularly scheduled outages. No additional outage time was included for these types of projects.

Since the SCR related outages are expected to decrease unit availability, the impact of these outages is the focus of this study. To determine the impact for the ECAR region, the 68% survey average for SCR utilization was applied to those companies not participating in the survey, and added to confidential company-specific information on the amount of SCR utilization expected by each company.

In recent years, companies have been stretching the time between major scheduled maintenance outages. It is during these longer outages that extensive equipment repairs or replacements occur. As the time frame for completion of SCR installations shortens, the likelihood of a long outage being available to accommodate an SCR retrofit decreases. Sensitivity cases to model this effect are those with a 6-week outage extension added to the scheduled maintenance.

Retrofit Windows

EPA's NO_X SIP Call rule has a compliance date of May 1, 2003. The original rule became final in November of 1998, with the affected states originally required to submit their SIP revisions to EPA in the fall of 1999. Assuming the first retrofit outages could begin January of 2000, a 42-month retrofit window would exist.

However, soon after the NO_X SIP Call was finalized, several states and other groups appealed the rule. A Federal Court granted a stay to the states, which results in there currently being no state rules in the ECAR region that require utilities to implement the NO_X SIP Call.

For purposes of this study, three potential retrofit windows of 42, 30, and 18 months were used. These windows were based on completing the needed retrofits in time for the 2003 ozone season. The 42-month window, therefore, begins January of 2000. The 30 month and 18 month windows represent a delay of one and two years. These last two scenarios recognize that most companies will not embark on costly major emissions control projects without having a clear legal requirement to do so.

Maintenance Optimization

This study assumed a "regionally optimized" maintenance schedule for the inclusion of SCR outages. A "company optimized" schedule for 2002 was used to test the sensitivity of the results to the maintenance schedule. These assumed "optimized" maintenance schedules may not be achievable. The region does not have any authority over the scheduling of company maintenance, and maintenance schedules are considered confidential by many companies.

The maintenance schedule "optimization" that is prepared for ECAR assessments and this study allocates maintenance outages to try to levelize capacity reserves across all months of the year. In the summer months, there may not be sufficient capacity reserves to schedule any maintenance. Those months will have lower capacity reserves than the non-summer months. The other difference in capacity reserves throughout the year results from seasonal capacity rating changes. A "regionally optimized" schedule tries to maintain constant reserves for the ECAR region. The "company optimized" schedule is an ECAR aggregation of each company's "optimized" schedule.

No company in the survey was asked to identify specific units which would utilize SCR NO_X reduction technology, only the percentage of coal-fired capacity. For the purpose of developing the SCR adjustments to the maintenance schedule, the largest units from each company were assumed to be the units that would have SCRs installed. Using each company's projected percentage of SCR retrofit capacity, a list was created of 103 generating units in ECAR, with a combined summer rating of 55,626 MW. This is 67% of the existing ECAR member coal-fired capacity. Once this list of SCR installations

was prepared, annual adjustments to the maintenance schedule were developed, which incorporate the SCR outages throughout the outage window. These adjustments were determined by assuming:

- Stations requiring multiple SCRs will only install 1 SCR/ year, if the outage window is long enough
- SCRs installations will be scheduled evenly over the outage seasons, with 2 seasons/year
- Companies will schedule SCR outages such that the last unit is completed in the spring of 2003
- Each company will adjust its other unit outages as needed to schedule SCR outages in the spring and fall outage seasons; - net effect is to spread SCR outage effects over all but the summer months, June through August

Using these assumptions, the calculation for annually allocating the additional scheduled maintenance was performed, with the results listed in the Appendix (*Table 2).* The total amount (MW) of capacity times 2, 4 or 6 weeks outage time results in the additional amount of scheduled maintenance included in the non-summer months. The inclusion of the same amount of additional outage time in each non-summer month maintains the "regionally optimized" maintenance schedule. This is the same approach used to include scheduled maintenance in the *Assessment of ECAR-Wide Capacity Margins 1999-2008.*

To test the sensitivity of the results to changes in the maintenance schedule, an alternate schedule was developed. The alternate schedule is based on developing an "optimized" schedule for each company for 2002, based on the company's average annual scheduled maintenance and the additional SCR maintenance. All the "company optimized" schedules are summed to produce a "company optimized" ECAR region maintenance schedule. This is the 2002 schedule shown in the Appendix on *Table 3.*

Equivalent Availability

In the *Assessment of ECAR-Wide Capacity Margins 1999-2008,* the "critical availability" was determined to be 80.3%. This means that unit forced outages, seasonal deratings and scheduled outages were assumed to reduce generating unit equivalent availabilities to an average of 80.3%. This is the lowest average equivalent availability assumption that would maintain the ECAR DSCR criterion during the first five years of the study period 1999-2008. This 80.3% equivalent availability

case was used as the base case for this study of SCR outage impact. Sensitivity cases with higher and lower equivalent availability were also run for this study.

SCR cases have increased scheduled outages. The actual equivalent availabilities in the SCR cases will be lower than the same case data without the additional scheduled outages. The equivalent availabilities discussed in this report are the equivalent availabilities of the non-SCR outage cases with the same case data except for the SCR scheduled outages. *Table 4* in the Appendix lists the actual equivalent availabilities resulting from the additional SCR outages.

MARGINS

Forecasts of ECAR region capacity margins have been steadily decreasing in recent years (see Appendix - *Figure 1*). The latest monthly forecast for the period 1999 – 2003 lists a declining trend in monthly capacity margins through 2002 as well (Appendix - *Table 5*). In 2003, capacity margins begin to increase due to projected capacity additions.

Appendix *Tables 6-8* show the monthly capacity margin forecasts for the 42, 30 and 18-month maintenance "window" cases, with 4 weeks for additional SCR maintenance outages. Capacity margins before and after scheduled maintenance are shown. Margins after scheduled maintenance for the non-summer months in the 42 month case (Appendix - *Table 6*) range from 10.8% to 12.2% in 2002. This is less than the capacity margins forecast for July and August of 1999, (11.6% to 12.9%). Margins in 2002 for the 30-month case (Appendix - *Table 7*) range from 10.5% to 11.9%. This indicates that by 2002, the ECAR region will need to rely on power from other regions during the non-summer months, like it has done the past several summers.

DSCR ANALYSIS

The DSCR criterion in use in ECAR is an annual criterion. *Table A* lists the DSCR figures for different installation windows at different SCR additional outage lengths. In the 42 month and 30 month cases, the annual DSCR indices exceed the ECAR reliability criterion in the year 2002 for all studied additional outage lengths. The 42 month cases are 13.7% and 39.3% higher than the annual DSCR criterion. The DSCR values are 16.6%, 50.4% and 105.2% higher in the 30 month cases in 2002. The DSCR is also 1.9% greater than the criterion in 2003 for the 30 month case when the additional outage length is 6 weeks.

TABLE A
Dependence on Supplemental Capacity Resources

	Additional Maintenance			
	Base	2 weeks	4 weeks	6 weeks
Retrofit Window	DSCR Neg-Days	DSCR Neg-Days	DSCR Neg-Days	DSCR Neg-Days
2001				
42 months	6.03	6.49	7.06	na
30 months	6.03	6.46	7.20	8.44
18 months	6.03	6.03	6.03	6.03
2002				
42 months	9.87	11.37	13.93	na
30 months	9.87	11.66	15.04	20.52
18 months	9.87	na	19.64	32.31
2003				
42 months	7.21	7.72	8.48	na
30 months	7.21	7.82	8.80	10.19
18 months	7.21	na	10.11	13.40

Based on TID.
na = not available, case not run.

The ECAR survey did not indicate that the members believed the additional outage time would exceed 4 weeks, on average. However, the survey also assumed that some NO_X control work would begin as early as 2000, thereby affording a 42 month maintenance window to complete the SCR installations. As the duration of the maintenance window decreases, the likelihood that generating units will not be able to schedule SCR installation work during a major scheduled

outage increases. Cases with a 6 week SCR outage reflect the sensitivity of DSCR to longer outage times from a compressed (less than 42 month) outage window.

When the current litigation over the NO_X regulations has been resolved, if the earliest that SCR related outages could be scheduled is 2002, and the original scheduled compliance date remains 2003, the outage window will have compressed to 18 months. In both years, for 4 week or 6 week additional outage cases, the 18 month maintenance window is insufficient, as the DSCR values are 2 to 3 times the ECAR DSCR criterion.

TABLE B
Critical Availability (before SCR outages)

	Additional Maintenance			
	Base	2 weeks	4 weeks	6 weeks
Retrofit Window	EA Percent	EA Percent	EA Percent	EA Percent
2001				
42 months	79.0	79.2	79.5	na
30 months	79.0	79.3	79.7	80.0
18 months	79.0	79.0	79.0	79.0
2002				
42 months	80.3	80.6	80.9	na
30 months	80.3	80.8	81.2	81.7
18 months	80.3	na	81.6	82.6
2003				
42 months	79.5	79.7	79.9	na
30 months	79.5	79.8	80.1	80.4
18 months	79.5	na	80.4	80.9

Table B displays the Critical Availability for each of the cases listed. The Critical Availability is the minimum equivalent availability that must be met to satisfy the reliability criterion.

The most adverse scenario studied, 18 month outage window with 6 week SCR outages, would require an 82.6% equivalent availability (before SCR outages) to meet the DSCR criterion in 2002. This level of ECAR-wide equivalent availability has been achieved only twice in the past 10 years.

Another approach to understanding the effects of the additional SCR outages is to determine the level of firm capacity purchases required to maintain the 10 negative day criterion. *Table C* displays this level of additional purchases for different installation windows at different SCR outage lengths.

TABLE C
Additional Capacity Needed to Achieve 10 days DSCR

	Additional Maintenance			
	Base	2 weeks	4 weeks	6 weeks
Retrofit Window	Capacity MW	Capacity MW	Capacity MW	Capacity MW
2001				
42 months	0	0	0	na
30 months	0	0	0	0
18 months	0	0	0	0
2002				
42 months	0	320	760	na
30 months	0	380	910	1,520
18 months	0	na	1,430	2,460
2003				
42 months	0	0	0	na
30 months	0	0	0	50
18 months	0	na	30	610

Based on TID.
na = not available, case not run.

OTHER

1. It is recognized that the DSCR criterion is a function of interregional conditions and should be reviewed periodically. Capacity margins forecast for the region and subregion areas adjacent to ECAR have been declining since 1995 (see Appendix - *Figure 2*), date of the most recent review of the DSCR criterion. The decline in capacity margins in these adjacent regions is an indicator that when the ECAR region needs to purchase power from an adjacent region, it may not be as readily available as it has historically been even during non-summer months. Furthermore, the adjacent regions and subregions are summer peaking areas as is ECAR, and they are all affected by these EPA NO_X regulations (except Ontario Hydro).

2. During the summer months, the peak load days are hot, humid days with a large amount of air conditioning load. During a potential shortfall in capacity resources, appeals for voluntary cutbacks on air conditioning, can produce significant load relief during the peak of the day. During the traditional scheduled maintenance periods of spring and fall, there would not be any air conditioning load to provide significant relief during any potential shortfall in capacity resources.

3. This study reviewed the ECAR DSCR results on the basis of Total Internal Demand (TID). ECAR does not believe Net Internal Demand (NID) should be the load basis for evaluating reliability. The interruptible load that is reported for planning purposes is contractually curtailable only by the supplying system itself. In total, the ECAR region could be capacity short without there being a shortage in the companies with interruptible load contracts and DSM programs. No company with interruptible load or DSM is obligated to curtail that load for capacity problems on another ECAR member system, unless the interruptible load has been qualified by the company as part of its required daily Operating Reserves, and those reserves need to be committed. Therefore, the interruptible load contracts and demand side management programs reflected in the difference between TID and NID are considered supplemental resources in the analysis. Excessive use (curtailment) of these supplemental resources will ultimately cause end-users to avoid such contracts, reducing the amount of supplemental resources available for emergency use, and increasing the chances of rolling blackouts.

4. This NO_X study, like the Assessment of *ECAR-Wide Capacity Margins 1999-2008*, does not include the daily Operating Reserve requirement in the calculation of DSCR. The daily Operating Reserve requirement is 4% of the expected daily load. Including the operating reserves in the analysis would reduce the available capacity margin and increase the DSCR.

APPENDIX

The tables and figures in this Appendix contain the detailed data and results referenced throughout this report

TABLE 1

ECAR 1999-2003 Forecast Data

	January MW	February MW	March MW	April MW	May MW	June MW	July MW	August MW	September MW	October MW	November MW	December MW
1999												
TOTAL INTERNAL DEMAND	83,843	79,583	75,379	70,372	75,438	86,520	93,991	92,687	84,030	70,514	75,014	81,908
SALES	726	726	626	626	626	929	979	979	829	676	676	676
PURCHASES	2,381	2,331	1,798	1,785	2,185	3,118	3,869	3,530	2,728	2,088	2,093	2,458
NET CAPACITY	103,687	103,680	103,635	103,352	103,020	103,778	103,392	103,834	104,229	105,484	105,698	106,006
2000												
TOTAL INTERNAL DEMAND	85,445	81,441	76,729	71,500	76,534	89,043	96,761	95,912	85,690	71,733	76,909	83,803
SALES	531	531	531	531	531	531	531	531	531	531	531	531
PURCHASES	1,997	2,002	1,604	1,590	1,792	3,076	3,429	3,409	1,927	1,586	1,590	1,601
NET CAPACITY	106,476	106,471	106,365	106,201	105,814	105,067	104,673	104,632	105,029	106,114	106,324	106,629
2001												
TOTAL INTERNAL DEMAND	87,153	83,587	78,175	73,029	78,133	90,775	98,585	97,691	87,286	73,014	78,253	85,264
SALES	531	531	531	531	531	531	531	531	531	531	531	531
PURCHASES	2,086	2,074	2,057	2,015	2,218	3,294	3,643	3,623	2,349	2,033	2,048	2,098
NET CAPACITY	106,624	106,619	106,503	106,224	105,841	105,227	104,836	104,795	105,235	106,318	106,534	106,838
2002												
TOTAL INTERNAL DEMAND	88,665	85,010	79,658	74,398	79,847	92,476	100,432	99,550	88,978	74,386	79,689	86,852
SALES	531	531	531	531	531	531	531	531	531	531	531	531
PURCHASES	1,990	1,978	1,961	1,919	2,123	3,551	3,895	3,874	2,160	1,842	1,857	1,887
NET CAPACITY	106,829	106,825	106,709	106,498	106,109	105,466	105,066	105,025	105,487	106,582	106,810	107,132
2003												
TOTAL INTERNAL DEMAND	90,082	86,364	80,926	75,590	81,171	94,020	102,108	101,202	90,455	75,588	80,976	88,203
SALES	431	431	431	431	431	431	431	431	431	431	431	431
PURCHASES	2,014	2,002	1,885	1,843	2,048	3,678	4,016	3,994	2,185	1,865	1,880	1,911
NET CAPACITY	107,081	107,056	106,908	109,258	108,694	108,070	107,630	107,658	108,084	109,898	110,149	110,500

TABLE 2

SCR Outages - Additional Scheduled Maintenance w/ 42 Month Outage "Window"

	2000		2001		2002		2003		Total
	Jan-Jun	Jul-Dec	Jan-Jun	Jul-Dec	Jan-Jun	Jul-Dec	Jan-Jun	Jul-Dec	
# of units w/ SCR outages	6	7	11	17	21	19	22	0	103
MW per Outage Season	2413	4257	6479	9022	10518	9727	13210	0	55,626
Annual SCR Outages - MW	6670		15501		20245		13210		55,626
Non-Summer Month Added SCR Maintenance - MW									
2 week extension	342		795		1,038		677		2,853
4 week extension	684		1,590		2,076		1,355		5,705

SCR Outages - Additional Scheduled Maintenance w/ 30 Month Outage "Window"

	2001		2002		2003		Total
	Jan-Jun	Jul-Dec	Jan-Jun	Jul-Dec	Jan-Jun	Jul-Dec	
# of units w/ SCR outages	15	17	22	22	27	0	103
MW per Outage Season	7870	9022	11228	12133	15373	0	55,626
Annual SCR Outages - MW	16892		23361		15373		55,626
Non-Summer Month Added SCR Maintenance - MW							
2 week extension	866		1,198		788		2,853
4 week extension	1,733		2,396		1,577		5,705
6 week extension	2,599		3,594		2,365		8,558

SCR Outages - Additional Scheduled Maintenance w/ 18 Month Outage "Window"

	2002		2003		Total
	Jan-Jun	Jul-Dec	Jan-Jun	Jul-Dec	
# of units w/ SCR outages	31	33	39	0	103
MW per Outage Season	15888	17349	22389	0	55,626
Annual SCR Outages - MW	33237		22389		55,626
Non-Summer Month Added SCR Maintenance - MW					
4 week extension	3,409		2,296		5,705
6 week extension	5,113		3,444		8,558

TABLE 3

2002 w/ 30 month SCR "Window"

		JAN MW	FEB MW	MAR MW	APR MW	MAY MW	JUN MW	JUL MW	AUG MW	SEP MW	OCT MW	NOV MW	DEC MW	
SCHEDULED MAINTENANCE	Regional	6,772	10,415	15,750	21,076	15,831	2,419	-	-	6,922	21,196	15,908	8,775	125,064
SCHEDULED MAINTENANCE	Company	8,388	11,161	15,862	20,407	14,871	2,419	-	-	6,760	20,041	15,503	9,652	125,064
Difference		1,616	746	112	(669)	(960)	-	-	-	(162)	(1,155)	(405)	877	

TABLE 4

Actual Equivalent Availability

Base Case without SCR outages = 80.3% in all years

42 Months

SCR outage SCR Window	2 weeks	4 weeks	6 weeks
2000	80.1%	79.9%	
2001	79.8%	79.3%	
2002	79.6%	79.0%	
2003	79.9%	79.5%	

30 Months

SCR outage SCR Window	2 weeks	4 weeks	6 weeks
2000			
2001	79.7%	79.2%	78.6%
2002	79.5%	78.8%	78.0%
2003	79.8%	79.3%	78.8%

18 Months

SCR outage SCR Window	2 weeks	4 weeks	6 weeks
2000			
2001			
2002		78.1%	77.0%
2003		78.9%	78.2%

FIGURE 1
ECAR
July Capacity Margin
Projections

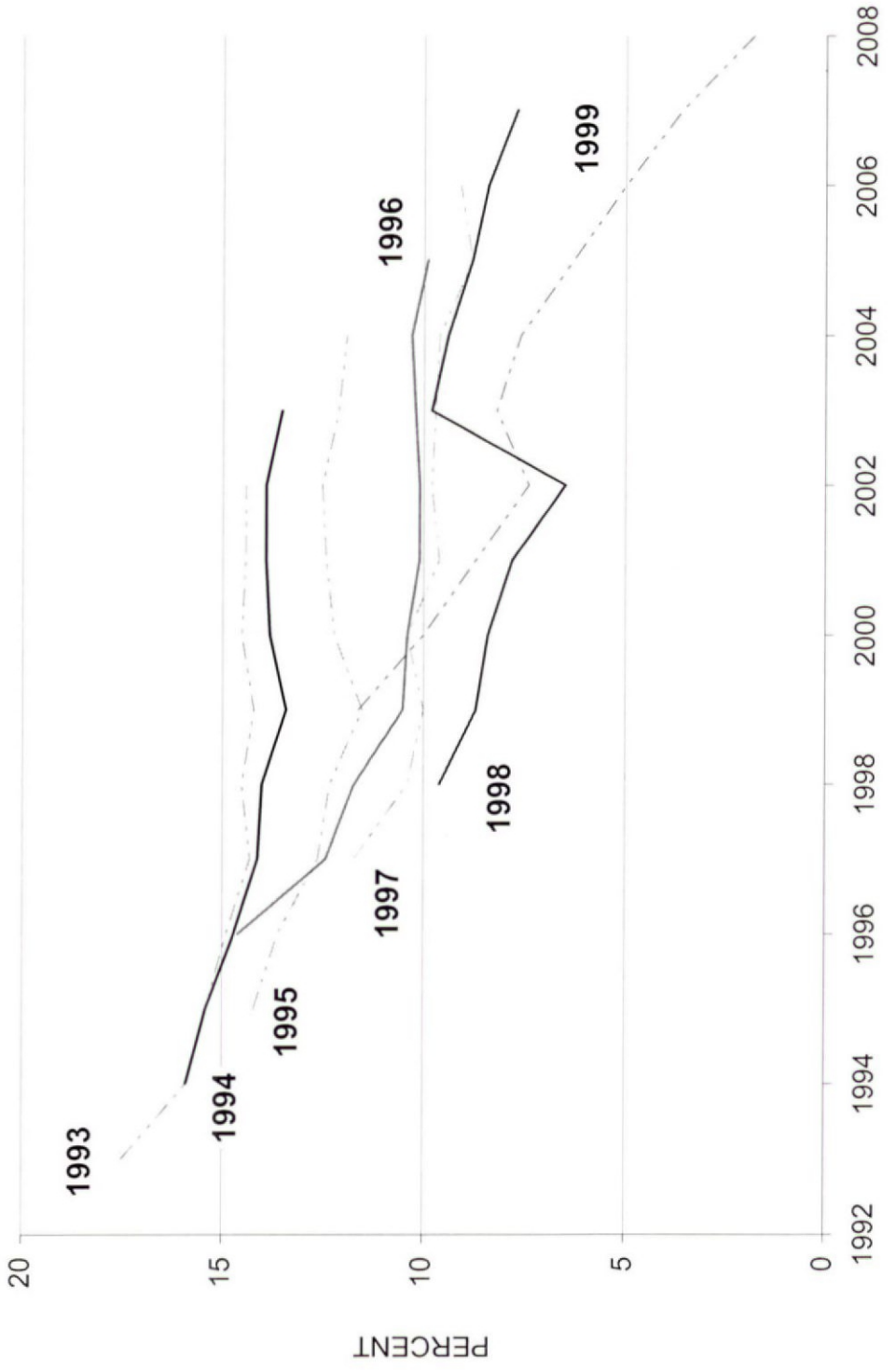

TABLE 5

ECAR 1999-2003 Forecast Data

	January MW	February MW	March MW	April MW	May MW	June MW	July MW	August MW	September MW	October MW	November MW	December MW
1999												
NET CAPACITY RESOURCES	105,342	105,285	104,807	104,511	104,579	105,967	106,282	106,385	106,128	106,896	107,115	107,788
TOTAL INTERNAL DEMAND	83,843	79,583	75,379	70,372	75,438	86,520	93,991	92,687	84,030	70,514	75,014	81,908
CAPACITY MARGINS - MW	21,499	25,702	29,428	34,139	29,141	19,447	12,291	13,698	22,098	36,382	32,101	25,880
SCHEDULED MAINTENANCE	3,618	7,828	11,599	16,593	11,983	2,061	-	-	5,784	18,993	14,498	7,989
MARGINS - MW	17,881	17,874	17,829	17,546	17,158	17,386	12,291	13,698	16,314	17,389	17,603	17,891
MARGINS - %	17.0%	17.0%	17.0%	16.8%	16.4%	16.4%	11.6%	12.9%	15.4%	16.3%	16.4%	16.6%
2000												
NET CAPACITY RESOURCES	107,942	107,942	107,438	107,260	107,075	107,612	107,571	107,510	106,425	107,169	107,383	107,699
TOTAL INTERNAL DEMAND	85,445	81,441	76,729	71,500	76,534	89,043	96,761	95,912	85,690	71,733	76,909	83,803
CAPACITY MARGINS - MW	22,497	26,501	30,709	35,760	30,541	18,569	10,810	11,598	20,735	35,436	30,474	23,896
SCHEDULED MAINTENANCE	4,776	8,785	13,099	18,463	13,631	2,406	-	-	4,610	18,226	13,054	6,171
MARGINS - MW	17,721	17,716	17,610	17,297	16,910	16,163	10,810	11,598	16,125	17,210	17,420	17,725
MARGINS - %	16.4%	16.4%	16.4%	16.1%	15.8%	15.0%	10.0%	10.8%	15.2%	16.1%	16.2%	16.5%
2001												
NET CAPACITY RESOURCES	108,179	108,162	108,029	107,708	107,528	107,990	107,948	107,887	107,053	107,820	108,051	108,405
TOTAL INTERNAL DEMAND	87,153	83,587	78,175	73,029	78,133	90,775	98,585	97,691	87,286	73,014	78,253	85,264
CAPACITY MARGINS - MW	21,026	24,575	29,854	34,679	29,395	17,215	9,363	10,196	19,767	34,806	29,798	23,141
SCHEDULED MAINTENANCE	4,409	7,963	13,358	18,462	13,561	2,182	-	-	4,726	18,682	13,458	6,497
MARGINS - MW	16,617	16,612	16,496	16,217	15,834	15,033	9,363	10,196	15,041	16,124	16,340	16,644
MARGINS - %	15.4%	15.4%	15.3%	15.1%	14.7%	13.9%	8.7%	9.5%	14.1%	15.0%	15.1%	15.4%
2002												
NET CAPACITY RESOURCES	108,288	108,272	108,139	107,886	107,701	108,486	108,430	108,368	107,116	107,893	108,136	108,488
TOTAL INTERNAL DEMAND	88,665	85,010	79,658	74,398	79,847	92,476	100,432	99,550	88,978	74,386	79,689	86,852
CAPACITY MARGINS - MW	19,623	23,262	28,481	33,488	27,854	16,010	7,998	8,818	18,138	33,507	28,447	21,636
SCHEDULED MAINTENANCE	4,365	8,008	13,343	18,669	13,424	2,408	-	-	4,515	18,789	13,501	6,368
MARGINS - MW	15,258	15,254	15,138	14,819	14,430	13,602	7,998	8,818	13,623	14,718	14,946	15,268
MARGINS - %	14.1%	14.1%	14.0%	13.7%	13.4%	12.5%	7.4%	8.1%	12.7%	13.6%	13.8%	14.1%
2003												
NET CAPACITY RESOURCES	108,664	108,627	108,362	110,670	110,311	111,317	111,215	111,221	109,838	111,332	111,598	111,980
TOTAL INTERNAL DEMAND	90,082	86,364	80,926	75,590	81,171	94,020	102,108	101,202	90,455	75,588	80,976	88,203
CAPACITY MARGINS - MW	18,582	22,263	27,436	35,080	29,140	17,297	9,107	10,019	19,383	35,744	30,622	23,777
SCHEDULED MAINTENANCE	2,010	5,716	11,037	19,473	14,097	3,158	-	-	5,230	19,777	14,404	7,208
MARGINS - MW	16,572	16,547	16,399	15,607	15,043	14,139	9,107	10,019	14,153	15,967	16,218	16,569
MARGINS - %	15.3%	15.2%	15.1%	14.1%	13.6%	12.7%	8.2%	9.0%	12.9%	14.3%	14.5%	14.8%

TABLE 6
NO_x Study Cases

No_x Study Data 42 month outage "window"	January	February	March	April	May	June	July	August	September	October	November	December
						2000						
NET CAPACITY RESOURCES	107,942	107,942	107,438	107,260	107,075	107,612	107,571	107,510	106,425	107,169	107,383	107,699
TOTAL INTERNAL DEMAND	85,445	81,441	76,729	71,500	76,534	89,043	96,761	95,912	85,690	71,733	76,909	83,803
CAPACITY MARGINS - MW	22,497	26,501	30,709	35,760	30,541	18,569	10,810	11,598	20,735	35,436	30,474	23,896
SCHEDULED MAINTENANCE	5,460	9,469	13,783	19,147	14,315	2,406	-	-	5,294	18,910	13,738	6,855
MARGINS - MW	17,037	17,032	16,926	16,613	16,226	16,163	10,810	11,598	15,441	16,526	16,736	17,041
MARGINS - %	15.8%	15.8%	15.8%	15.5%	15.2%	15.0%	10.0%	10.8%	14.5%	15.4%	15.6%	15.8%
						2001						
NET CAPACITY RESOURCES	108,179	108,162	108,029	107,708	107,528	107,990	107,948	107,887	107,053	107,820	108,051	108,405
TOTAL INTERNAL DEMAND	87,153	83,587	78,175	73,029	78,133	90,775	98,585	97,691	87,286	73,014	78,253	85,264
CAPACITY MARGINS - MW	21,026	24,575	29,854	34,679	29,395	17,215	9,363	10,196	19,767	34,806	29,798	23,141
SCHEDULED MAINTENANCE	5,904	9,458	14,853	20,093	15,192	2,223	-	-	6,357	20,313	15,089	8,128
MARGINS - MW	15,122	15,117	15,001	14,586	14,203	14,992	9,363	10,196	13,410	14,493	14,709	15,013
MARGINS - %	14.0%	14.0%	13.9%	13.5%	13.2%	13.9%	8.7%	9.5%	12.5%	13.4%	13.6%	13.8%
						2002						
NET CAPACITY RESOURCES	108,288	108,272	108,139	107,886	107,701	108,486	108,430	108,368	107,116	107,893	108,136	108,488
TOTAL INTERNAL DEMAND	88,665	85,010	79,658	74,398	79,847	92,476	100,432	99,550	88,978	74,386	79,689	86,852
CAPACITY MARGINS - MW	19,623	23,262	28,481	33,488	27,854	16,010	7,998	8,818	18,138	33,507	28,447	21,636
SCHEDULED MAINTENANCE	6,452	10,095	15,430	20,756	15,511	2,419	-	-	6,602	20,876	15,588	8,455
MARGINS - MW	13,171	13,167	13,051	12,732	12,343	13,591	7,998	8,818	11,536	12,631	12,859	13,181
MARGINS - %	12.2%	12.2%	12.1%	11.8%	11.5%	12.5%	7.4%	8.1%	10.8%	11.7%	11.9%	12.1%
						2003						
NET CAPACITY RESOURCES	108,664	108,627	108,362	110,670	110,311	111,317	111,215	111,221	109,838	111,332	111,598	111,980
TOTAL INTERNAL DEMAND	90,082	86,364	80,926	75,590	81,171	94,020	102,108	101,202	90,455	75,588	80,976	88,203
CAPACITY MARGINS - MW	18,582	22,263	27,436	35,080	29,140	17,297	9,107	10,019	19,383	35,744	30,622	23,777
SCHEDULED MAINTENANCE	3,375	7,081	12,402	20,838	15,462	3,168	-	-	6,595	21,142	15,769	8,573
MARGINS - MW	15,207	15,182	15,034	14,242	13,678	14,129	9,107	10,019	12,788	14,602	14,853	15,204
MARGINS - %	14.0%	14.0%	13.9%	12.9%	12.4%	12.7%	8.2%	9.0%	11.6%	13.1%	13.3%	13.6%

TABLE 7
NO_x Study Cases

NO_x Study Data 30 month outage "window"	January	February	March	April	May	June	July	August	September	October	November	December
						2001						
NET CAPACITY RESOURCES	108,179	108,162	108,029	107,708	107,528	107,990	107,948	107,887	107,053	107,820	108,051	108,405
TOTAL INTERNAL DEMAND	87,153	83,587	78,175	73,029	78,133	90,775	98,585	97,691	87,286	73,014	78,253	85,264
CAPACITY MARGINS - MW	21,026	24,575	29,854	34,679	29,395	17,215	9,363	10,196	19,767	34,806	29,798	23,141
SCHEDULED MAINTENANCE	6,047	9,601	14,996	20,236	15,335	2,223	-	-	6,500	20,456	15,232	8,271
MARGINS - MW	14,979	14,974	14,858	14,443	14,060	14,992	9,363	10,196	13,267	14,350	14,566	14,870
MARGINS - %	13.8%	13.8%	13.8%	13.4%	13.1%	13.9%	8.7%	9.5%	12.4%	13.3%	13.5%	13.7%
						2002						
NET CAPACITY RESOURCES	108,288	108,272	108,139	107,886	107,701	108,486	108,430	108,368	107,116	107,893	108,136	108,488
TOTAL INTERNAL DEMAND	88,665	85,010	79,658	74,398	79,847	92,476	100,432	99,550	88,978	74,386	79,689	86,852
CAPACITY MARGINS - MW	19,623	23,262	28,481	33,488	27,854	16,010	7,998	8,818	18,138	33,507	28,447	21,636
SCHEDULED MAINTENANCE	6,772	10,415	15,750	21,076	15,831	2,419	-	-	6,922	21,196	15,908	8,775
MARGINS - MW	12,851	12,847	12,731	12,412	12,023	13,591	7,998	8,818	11,216	12,311	12,539	12,861
MARGINS - %	11.9%	11.9%	11.8%	11.5%	11.2%	12.5%	7.4%	8.1%	10.5%	11.4%	11.6%	11.9%
						2003						
NET CAPACITY RESOURCES	108,664	108,627	108,362	110,670	110,311	111,317	111,215	111,221	109,838	111,332	111,598	111,980
TOTAL INTERNAL DEMAND	90,082	86,364	80,926	75,590	81,171	94,020	102,108	101,202	90,455	75,588	80,976	88,203
CAPACITY MARGINS - MW	18,582	22,263	27,436	35,080	29,140	17,297	9,107	10,019	19,383	35,744	30,622	23,777
SCHEDULED MAINTENANCE	3,597	7,303	12,624	21,060	15,684	3,168	-	-	6,817	21,364	15,991	8,795
MARGINS - MW	14,985	14,960	14,812	14,020	13,456	14,129	9,107	10,019	12,566	14,380	14,631	14,982
MARGINS - %	13.8%	13.8%	13.7%	12.7%	12.2%	12.7%	8.2%	9.0%	11.4%	12.9%	13.1%	13.4%

TABLE 8
NO_x Study Cases

NO_x Study Data 18 month outage "window"	January	February	March	April	May	June	July	August	September	October	November	December
						2002						
NET CAPACITY RESOURCES	108,288	108,272	108,139	107,886	107,701	108,486	108,430	108,368	107,116	107,893	108,136	108,488
TOTAL INTERNAL DEMAND	88,665	85,010	79,658	74,398	79,847	92,476	100,432	99,550	88,978	74,386	79,689	86,852
CAPACITY MARGINS - MW	19,623	23,262	28,481	33,488	27,854	16,010	7,998	8,818	18,138	33,507	28,447	21,636
SCHEDULED MAINTENANCE	7,785	11,428	16,763	22,089	16,844	2,419	-	-	7,935	22,209	16,921	9,788
MARGINS - MW	11,838	11,834	11,718	11,399	11,010	13,591	7,998	8,818	10,203	11,298	11,526	11,848
MARGINS - %	10.9%	10.9%	10.8%	10.6%	10.2%	12.5%	7.4%	8.1%	9.5%	10.5%	10.7%	10.9%
						2003						
NET CAPACITY RESOURCES	108,664	108,627	108,362	110,670	110,311	111,317	111,215	111,221	109,838	111,332	111,598	111,980
TOTAL INTERNAL DEMAND	90,082	86,364	80,926	75,590	81,171	94,020	102,108	101,202	90,455	75,588	80,976	88,203
CAPACITY MARGINS - MW	18,582	22,263	27,436	35,080	29,140	17,297	9,107	10,019	19,383	35,744	30,622	23,777
SCHEDULED MAINTENANCE	4,316	8,022	13,343	21,779	16,403	3,168	-	-	7,536	22,083	16,710	9,514
MARGINS - MW	14,266	14,241	14,093	13,301	12,737	14,129	9,107	10,019	11,847	13,661	13,912	14,263
MARGINS - %	13.1%	13.1%	13.0%	12.0%	11.5%	12.7%	8.2%	9.0%	10.8%	12.3%	12.5%	12.7%

FIGURE 2
Projected Capacity Margins for the NERC Regions or Subregions Interconnected to ECAR