

Integrating Realtime Weather Into Outage Management

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Weather is an important variable that impacts energy companies. Distribution engineers monitor radar and lightning to manage field crews. As storms move into the service area, dispatchers need to know where to be prepared to send repair crews and whether or not to pull them off jobs or put off-duty crews on standby. By overlaying realtime storm and lightning data with transmission and distribution assets in a GIS, engineers can better determine the cause and location of system failures and dispatch service crews more efficiently. Our paper reviews and contrasts the benefits of weather-enabling ArcMap and ArcReader for outage management.

INTRODUCTION

The most important variable that impacts a utility is the amount of demand for energy. Utilities must be prepared to increase or decrease the production of energy or gas to keep up with existing demand. Over-producing or under-producing can cost a utility millions of dollars. On the other hand, a utility's primary responsibility is to ensure the delivery of energy or gas to their customers and to control or reduce the number of interruptions in service.

The primary driving factor of demand is, quite simply, the weather. During summer, the hotter it is above normal, the more electricity is demanded for cooling and the less natural gas is needed for heating by the utility customer. Conversely, during winter, the cooler it is that trend is reversed. To the uninitiated, this seems like an easy formula to manage. That couldn't be farther from the truth. Weather can be as unpredictable as the Stock Market. That is why utilities depend on many advanced technologies to monitor and forecast the weather. In fact, larger utilities are beginning to employ their own staff of meteorologists.

HOW WEATHER IMPACTS A UTILITY

Weather affects the various areas of a utility differently. The effect that weather can have on service interruptions and the ability of an electric utility to consistently deliver energy to its customers is well known. The generation group is mostly concerned with forecast weather conditions. Their requirement is to know how hot or cold it's going to be today and tomorrow in order to efficiently manage the production and generation of energy. The non-regulated marketers also monitor forecast weather so they are prepared to buy and sell power due to fluctuating demand, often driven by weather conditions. Meanwhile, transmission operations are on the lookout for adverse weather conditions such as lightning, severe storms and winds. If there is weather-related damage, or potential for damage, the transmission engineer must be prepared to re-route energy or dispatch repair crews to return the grid to full operation. Finally, the distribution operations group monitors weather information, such as radar and lightning data, to manage field crews. As storms move into the service area, dispatchers need to know where to be prepared to direct repair crews and whether or not to pull them off jobs or put off-duty crews on standby. New storm tracking technology introduces the ability for an electric utility to monitor dynamically developing severe weather storm cells for much improved and more efficient decision-making.

BENEFITS OF GIS

With more precision comes more efficiency, and with more efficiency comes decreased operational costs. In a nutshell, that is precisely the reason why so many utilities are currently or migrating toward managing their assets in an enterprise

GIS. The enterprise GIS enables different organizational units within the utility to access, analyze and distribute shared information about their assets. Further, data ownership can still be maintained and enforced locally by individual organizations.

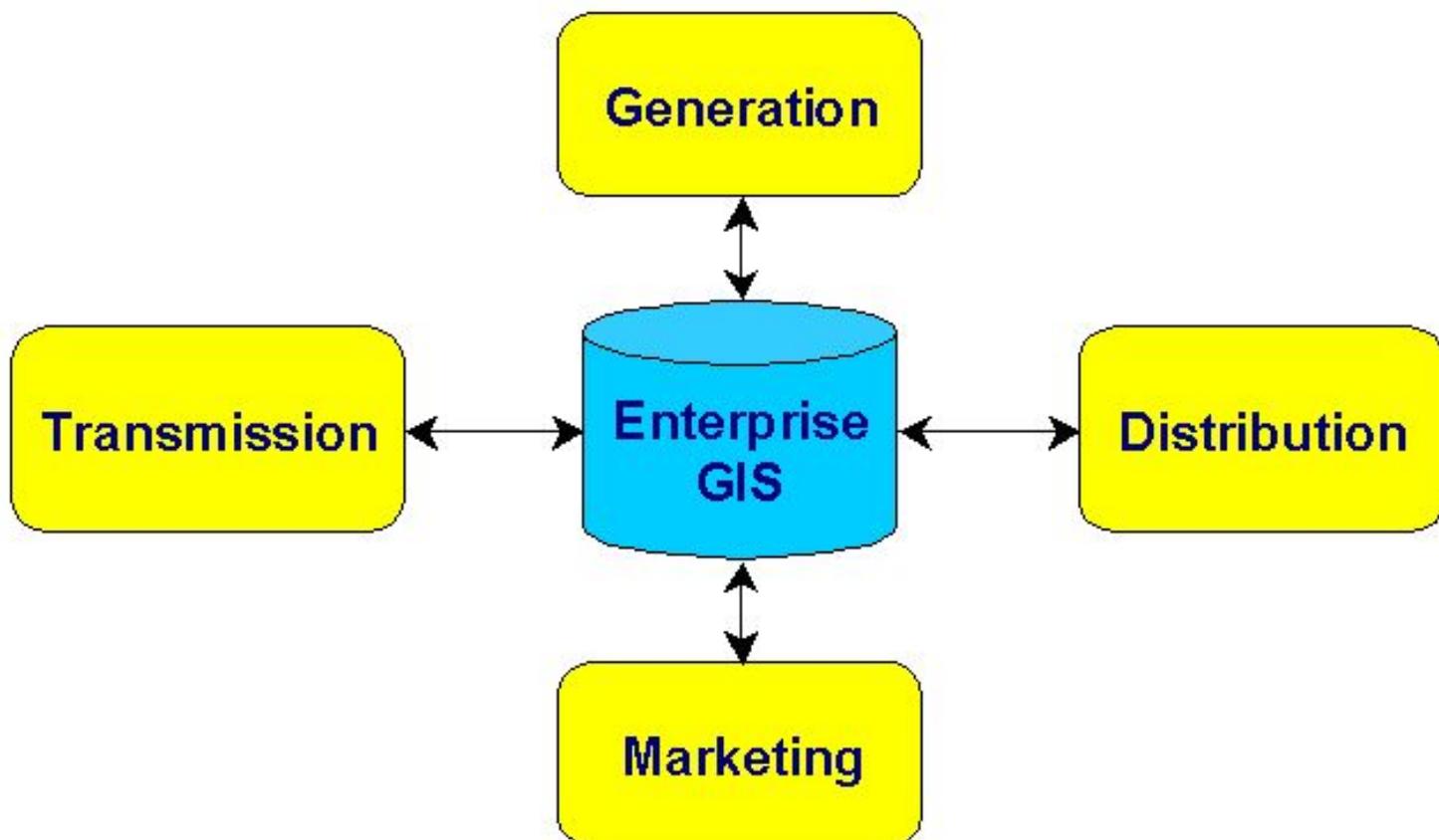


Figure 1. Different organizational units in a utility collect, share, and analyze information through an enterprise GIS.

INTEGRATING WEATHER DATA WITH GIS

By bringing weather into the GIS enterprise, utilities now have the ability to more quickly make better decisions that can reduce losses. A weather-enabled GIS offers much more than a typical "display" of weather graphics; it provides the capability of combining the weather data itself with virtually any other geographically based data layer. In addition, GIS spatial analysis tools make it possible to calculate meaningful results to solve more complex business problems.

The combination of utility assets (generation units, substations, transmission lines), customer information, and weather in a single GIS create a synergy that can greatly enhance the ability to look at data simultaneously and make more accurate decisions, thereby adding value for customers and employees, as well as adding to the corporate bottom line.

Power Outages

A weather occurrence that negatively impacts the ability to deliver uninterrupted service is severe thunderstorms, with damaging winds and lightning strikes. Bringing this information into the GIS enables outage management to track positions of severe storms in real time and correlate that information with outage reports in order to determine conclusively the cause of a particular outage. This knowledge allows the utility to determine if the affected area can be reenergized remotely, or if a crew will need to be deployed to fix the problem on-site.

Storm tracking, merged into a GIS enhances value by integrating the geographical locations of the storm information with energy infrastructure assets. Service area infrastructure (generation units, transmission lines, substations) can be mapped into the GIS and merged with real-time weather information. Every line, pole and substation can be easily monitored and managed through the use of GIS. With the use of GIS, engineers can pinpoint the exact location where service is required. Smaller-scale weather events, such as storm cells and their corresponding meteorological characteristics including speed and direction of movement, intensity, presence and size of hail, and presence of possible developing tornadic activity, can also be incorporated into a GIS and treated as just another data layer. With a weather-enabled GIS, engineers can pinpoint the exact location where weather-related service is required. This also introduces interesting prospects for spatial analysis that can generate automated alerts when threatening weather approaches strategic company assets.

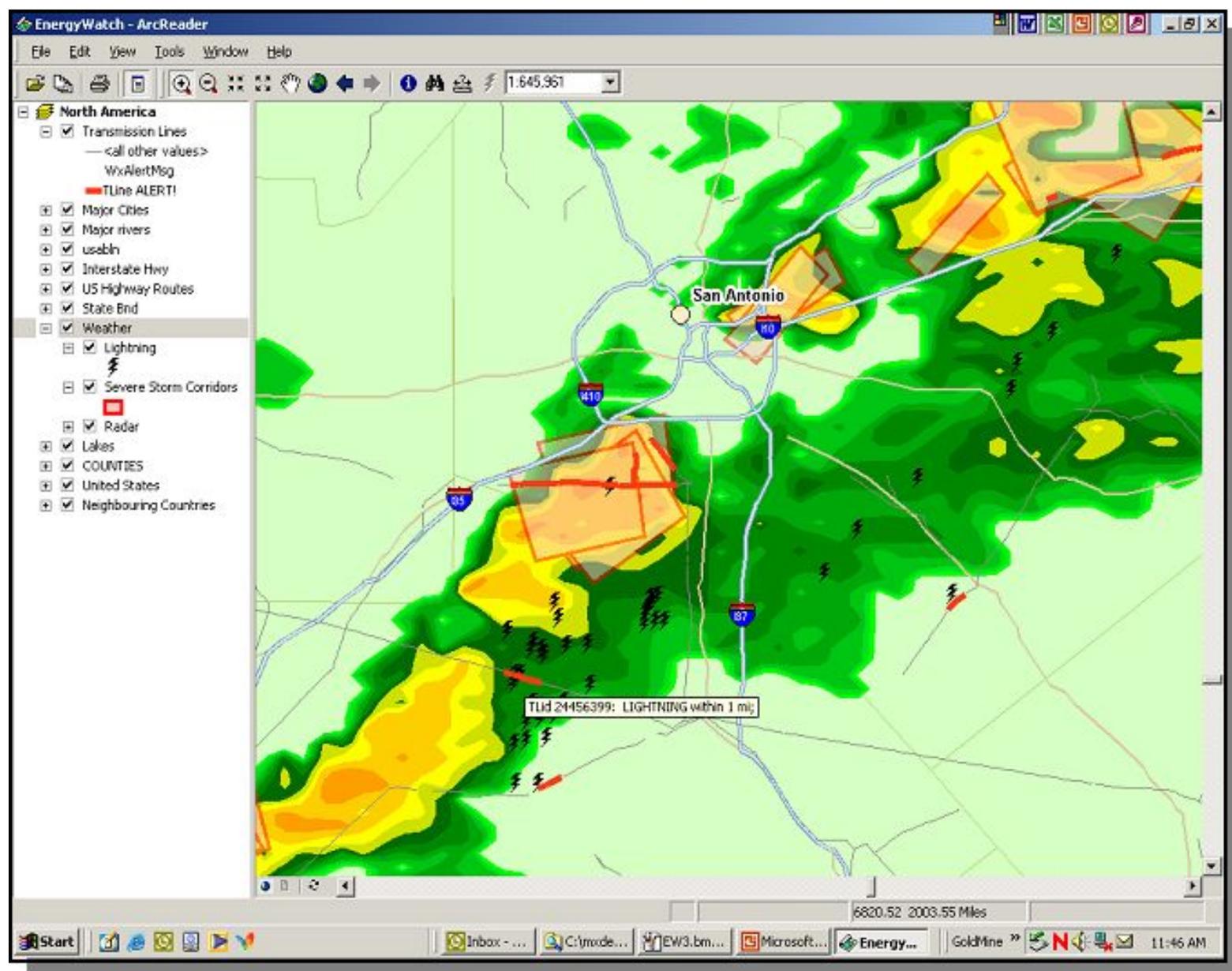


Figure 2. Doppler weather radar and storm tracking information can be brought into the GIS to determine spatial correlation with power outages.

Crew Management

Having the appropriate number of technicians on hand to restore power is critical to maintaining high customer service

standards, as well as managing the budget. It is essential to efficiently manage crew numbers, yet provide the prompt, quality service that customers expect. Correlating utility assets and weather through GIS allows the utility to pre-position crews precisely in a tactical manner, saving time, customers headaches, and expense for the utility.

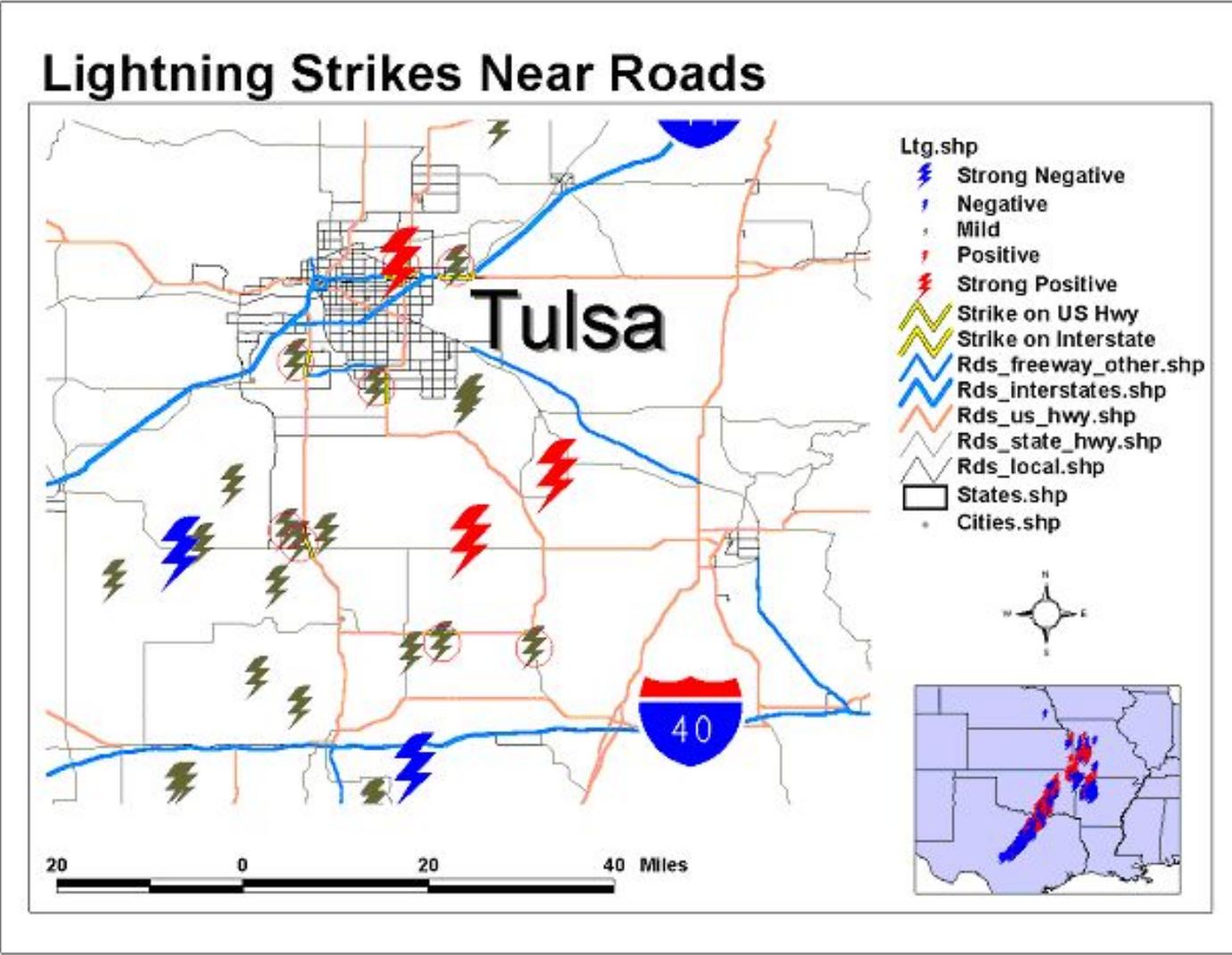


Figure 3. Proximity and timing of lightning strikes can be used to determine if a crew needs to be deployed to a problem area.

Load Forecasting

Improved knowledge of future weather conditions, both in time and space, can help enormously with managing energy loads, allowing the utility to more accurately quantify load requirements. Better decisions can be made in order to avoid buying on the open market at a premium price, or having to fire up auxiliary generators.

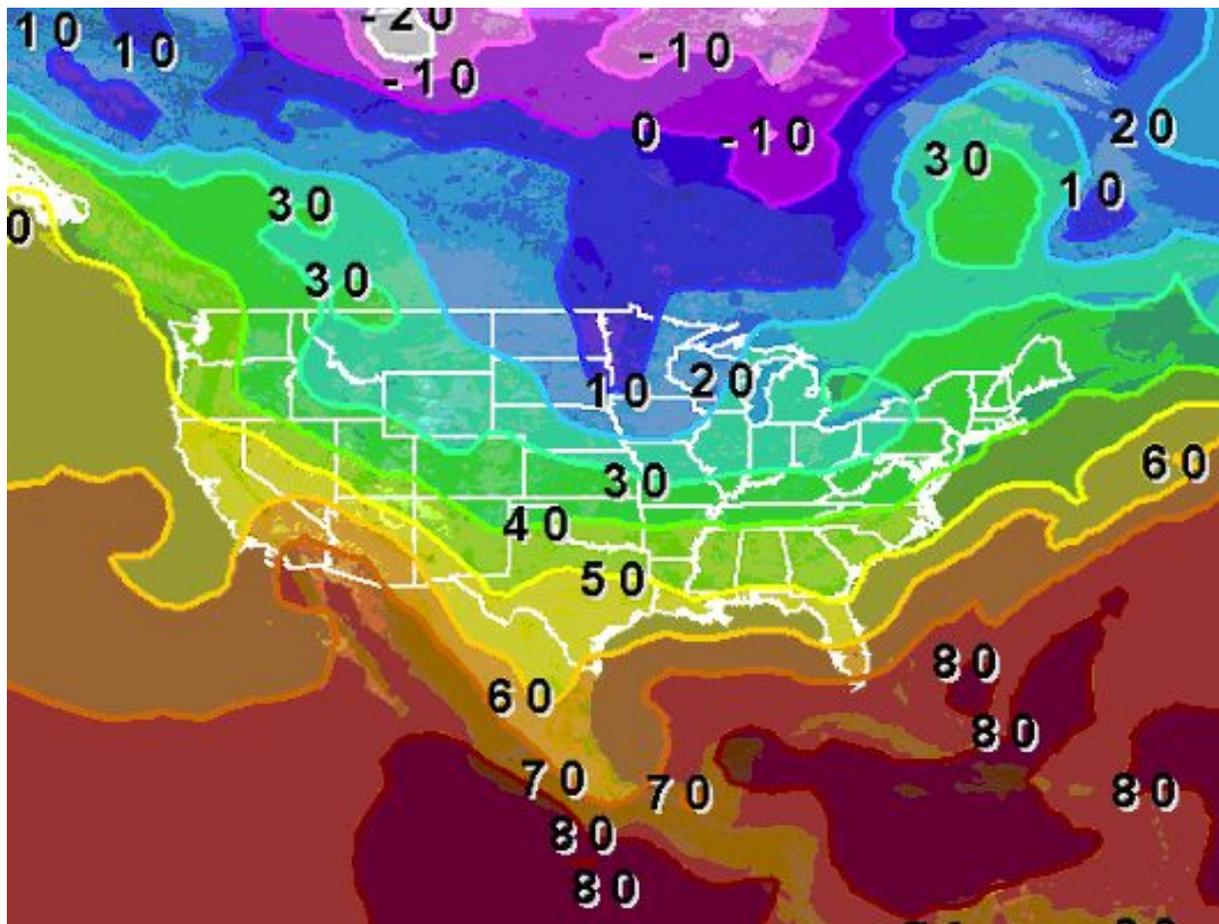


Figure 4. Forecast temperatures can be overlaid with populations to determine a weighted load forecast.

For example, forecast temperature information derived from state of the art numerical weather prediction models at the National Center for Environmental Prediction in Washington D.C. are now available in polygon shapefile format. One potential use of this type of data would be the generation of population and industry density-weighted calculations of energy load versus forecast temperature for a potentially more realistic energy load forecast. Improved energy load forecasts help avoid power shortages and allow the utility to be more competitive when buying/selling excess power on the national grid.

CONCLUSIONS

Combining realtime and forecast weather information with GIS has significant potential for improving weather related decision support systems. With the availability of weather information for a GIS, utilities now have a powerful tool to use in managing load production and power transmission and distribution, while maximizing the value of their GIS. This synergy can greatly enhance a utility's ability to track data simultaneously and make more accurate decisions, thereby adding value for customers and employees, as well as adding to the corporate bottom line.

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