PJM Uses Geospatial Data Analytics to Improve Situational Awareness

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Keywords

Geospatial Analytics, Dispatch Map, Regional Transmission Organization (RTO), Electricity Generation, Esri ArcGIS, OSIsoft PI System

Overview

PJM Interconnection, operator of the largest electric grid in the US, uses Esri ArcGIS geographical mapping software and the OSIsoft PI System's data capabilities to increase situational awareness for operators and improve business performance.

> PJM uses PI System data combined with Esri geographical mapping software to build interactive geographical maps that give detailed information about the state of its electric grid at any time. Capabilities include the ability to "geofence" an area and understand what is happening in real time and compare forecast to actual generation. These capabilities have helped PJM improve reliability and brought tremendous value to dispatchers.

ARC Advisory Group recently had an opportunity to meet with Ed Kovler, Sr., Lead Business Solutions Architect at PJM Interconnection, to learn more about the company's Dispatch Interactive Map Application (DIMA). As a regional transmission organization (RTO), PJM coordinates the movement of wholesale electricity in all or parts of 13 US states and the District of Columbia within the Eastern Interconnection. PJM has more than 960 member organizations and serves 61 million people in a territory that encompasses 21 percent of the US GDP. PJM's peak load is 165,492 MW.

As we learned, PJM's video wall dispatcher visualization technology supports the company's objective of ensuring electric reliability for people in the region it serves. The video wall for dispatchers utilizes real-time statistical dashboards that display and compare forecast to generation.

The company has three main responsibilities: reliability of grid operations (supply demand balance and transmission monitoring); running energy, capacity, and ancillary services markets; and regional transmission planning. PJM coordinates and dispatches energy in the grid and monitors the

grid to make sure the electricity gets from one point to another. It does not own transmission lines, distribution lines, or equipment, or have field crews.
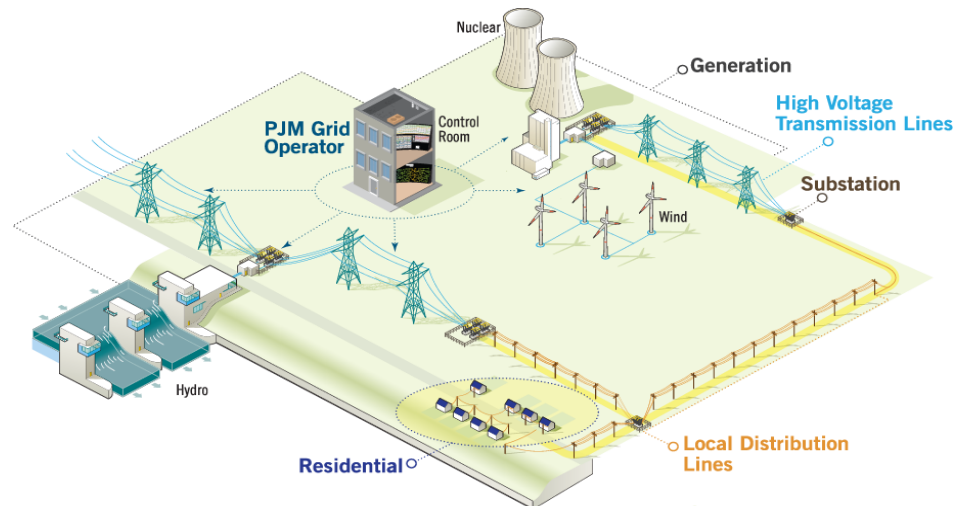
As the RTO, PJM Focuses on Electricity Distribution

Too Much Data, Not Enough Actionable Information

Implementing the DIMA application developed using the interface between the OSIsoft PI System and Esri ArcGIS geographical information system allowed PJM to improve situational awareness for its control center dispatchers, enabling them to make the most informed decisions. While the company could previously tie together the huge volumes of information across this large geographical area from multiple systems using the available tools, this was not an easy task.
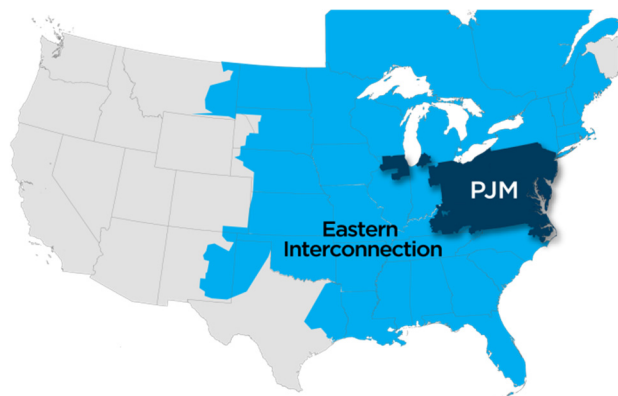

PJM Control Center

The company had previously used Esri ArcGIS information in other applications, but not in DIMA, which was specifically developed to improve situational awareness geospatially for grid operations. PJM wanted to make it easier for dispatchers to use multiple tools and drill down to obtain actionable information from these tools. The company wanted to make it easier for its operators and dispatchers to find the information they needed, and to do so at a glance.

Improving Situational Awareness with GIS

PJM integrated data from the PI System with the Esri ArcGIS for geographic intelligence using OSIsoft's PI Integrator for Esri ArcGIS product and HTML 5 for the user interface. It also integrates data from other databases (weather data, SCADA systems, spreadsheets, etc.) into the PI System. Once integrated, the data were geographically displayed for the entire territory - from North Carolina to New Jersey, and from the District of Columbia to Illinois. This display provides the operators and dispatchers with a better understanding of the state of the grid in each area at any time in real time, improving their situational awareness.

**PJM Is the Largest RTO in the Eastern Interconnection**

The geographical dispatch interactive map of PJM's territory enables dispatchers to see at a glance what is going on. The dispatchers can bring up DIMA on their web browser to see locations and transmission lines, and drill down, zoom in and out, and pan to see substations.

Using Weather Forecasts to Improve Reliability

In the northeastern US, extreme hot and cold days can wreak havoc on the grid because the excessive demands for electricity can impact reliability. As a result, PJM monitors the weather by integrating data from an external weather provider, including both temperatures and radar. The company also integrates national weather service information, including lightning strikes and storm patterns. If the forecast pattern indicates that a significant storm is approaching, the dispatcher can use this information to help alleviate the stress on the system, predict loads, and plan and allocate resources.

Mr. Kovler demonstrated the capabilities of the DIMA solution showing geographical areas with different colored power transmission lines. He showed how dispatchers can determine which lines are in or out of service and find ways to re-route electricity flows. The real-time data is from the OSIsoft System. The line colors represent different KV. For example, he pointed out that the pink lines indicated 765 KV and the yellow lines indicated 500KV, and white lines indicated out of service lines. Mr. Kovler stated that the "information is invaluable," and that the new displays re-

ceived a lot of positive feedback from the dispatchers and operations workers.
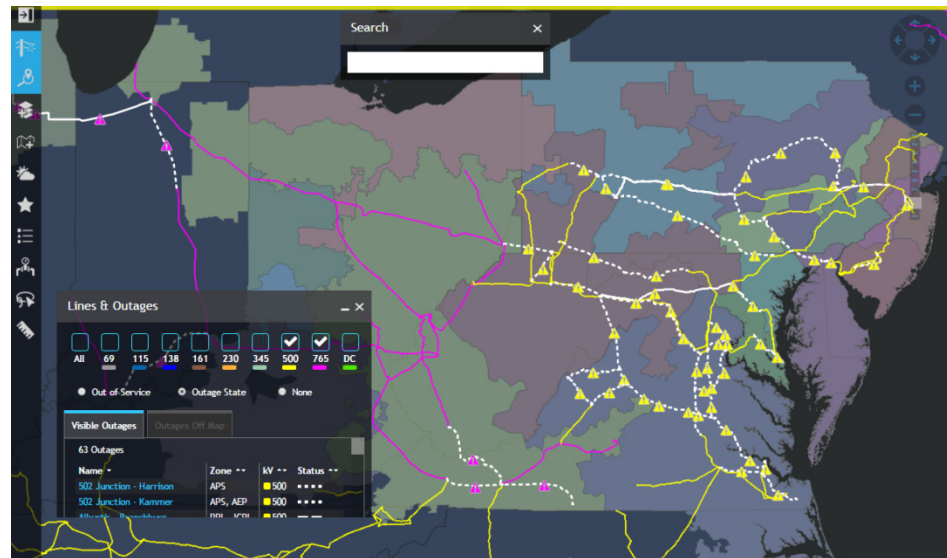
PJM's Dispatch Interactive Map Application (DIMA)

Using Esri ArcGIS, Mr. Kovler demonstrated how the company can look at an area of concern and, using the mouse or other device, can "lasso" this area of concern (called geofencing) and organize the information to better understand the electricity response availability which they are able to understand by color code at a glance. Here's a link to the presentation.

Future Plans

Based on the success of its DIMA application, the company plans to enable additional features for dispatchers using the real-time data from the OSIsoft PI System combined with the Esri ArcGIS data. These include the capability to search for substations and their locations for automatic repositioning when necessary, such as when there is a change in demand during a storm or other extreme weather conditions.   The plan is to include notifications and additional intelligence to speed decision making. Although some of this information is currently available to the operators in the energy management system, the newer geographical format would make it much quicker and easier to identify.

Other plans include integrating more generation information, including demand response-related information, and the ability to filter by generation types: coal, gas, hydro, nuclear, oil, wind, etc.

Recommendations

As we learned in this real-world case study and in numerous discussions with other end users, in geographically dispersed operations (electric transmission & distribution, oil and gas pipelines, upstream production, water and sewage systems, etc.), combining real-time operational and environmental data with geographical information often helps improve situational awareness for operators. This enables them to make better decisions, faster, with a better understanding of the situation which can help them improve reliability and safety, and reduce costs.

ARC recommends that owner-operators carefully consider their own operational requirements and the decision-support tools available to their operators to determine whether they could benefit from this type of solution.

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