A rural electric utility's GIS asset inventory

Information from Magellan

Combining teamwork and rugged data was the answer for East Central Energy (ECE) when it came to conducting a GIS inventory of its many assets.

Like many large utilities, (ECE), a member-owned electric cooperative serving more than 57 000 homes, farms and businesses in rural east central Minnesota and northwestern Wisconsin, is an amalgam of merged distribution cooperatives. In recent years, ECE has gone through multiple software upgrades and conversions, which have affected the integrity of their mapping, outage management system, and property records. The time appeared right for ECE to examine the need for a full GIS inventory of its hundreds of thousands of assets. Before fully committing to the project, ECE staff collected and analysed cost data from cooperatives within a surrounding five-state area.

After averaging the costs on a per-point basis and estimating points for the ECE system, the value of the inventory and GIS modelling endeavour became more clearly established. It was determined that improved accounting management, knowledge of underground assets for underground utility location requests, and system age and location for improved maintenance were additional reasons to do a full field asset inventory and GIS model.

A request for proposal (RFP) to collect and map asset information for the entire system was drawn up and released.

The project: getting started

To ensure the highest quality data, the asset inventory called for the tagging and collection of precise map coordinates for each pole and/or pad-mounted device, each member's meter location coordinates, and underground distribution line coordinates (see Fig. 1 and 2). The RFP called for an aggressive one-year timetable (later extended to 18 months), including an up-front pilot project to tune the process and work out the bugs and to find and map the estimated 211 000 points. It was expected that between three and seven flip-pages of attributes would need to be logged for each point.

After all bids were analysed, ECE decided on a team approach. The effort would be led by Hance Utility Services, which would do the actual field data collection, and the Sidwell Company, which would build and implement the GIS model. Hance, a Minnesota-based utility services company, in addition to being a low bidder, was a trusted contractor that

Fig. 1: Hance Utility Services field technician collects data at a customer meter.

Fig. 2: GPS/GIS data collection in the field.

Fig. 3: Working individually circuit by circuit, Hance field technicians collect data at a substation.

had worked for ECE for 25 years locating underground primary faults and underground cables prior to excavation and performing equipment inspection. When it came to boots on the ground and understanding ECE utility systems well, Hance was proven as a candidate to perform the field collection. For the engineering services side of the package, Hance partnered with the Sidwell Company, a Chicago-based firm specialising in engineering services and building geographic information systems, using data, and hardware, software and implementation services.

Sidwell used ESRI's ArcPad and ArcPad Application Builder. The Magellan MobileMapper CE was chosen for field GPS/GIS data collection for its accuracy, toughness in the expected harsh field conditions, and its open platform that could run ArcPad. It was also robust enough to handle the large amounts of software that would be loaded and the massive amounts of data that would be collected. Sidwell created and loaded customised forms on the Magellan MobileMapper CEs, which the Hance technicians would use for recording data. Additionally, Sidwell trained Hance field personnel on using GPS/ArcPad field collection and installation and on the use of ESRI's ArcReader. After collecting data by day, Hance technicians saved the data internally in its raw form, and once a circuit was complete, uploaded to a Sidwell-configured enterprise ESRI geodatabase for warehousing the data.

Using software tools written by their technical staff, Sidwell provided management of all GPS-collected data – including generating line and point features to represent different utility lines and overhead assemblies. In addition, Sidwell published GPS data in an ArcIMS map service to allow both Hance and ECE to view the progress of data collection via ArcReader. In short, Hance technicians gathered the raw field data and Sidwell produced the final product.

Field collection: good equipment counts

Hance employed ten technicians in the field, each working individually circuit by circuit with a MobileMapper CE (see Fig. 3). Sidwell traveled to Minnesota and provided on-site training to the technicians at Hance, who although not surveyors, reported that they found the new mobile mapping GIS device from Magellan very easy to use. "MobileMapper was easy to learn and incredibly simple to operate," said Christopher Koch, consultant and special project manager with Hance. "If a field technician had a problem, Sidwell provided support by phone or overnight express if we needed to remedy the problem."

Field techs moved circuit by circuit through 133 circuits, each containing 10 to 2500 collecting points. After data from each circuit was collected, the information would be downloaded to the Sidwell office where it would be placed in an ArcGIS geodatabase and reviewed.

A total of more than 200 000 base points, including support structures (poles), service structures, transformers, fuse boxes and switches on the ground were captured. Each pole might have as many as 15 attributes. And, if the pole had an overhead, another point connected to it, such as a transformer, that attribute would become its own point which could then have another six to eight possible attributes. There could be ten possible types of assemblies on the poles. Each tech typically recorded about 90 points a day, with seven flip screens of attributes, usually a minimum of three pages.

"Our field personnel were working seven to twelve hours a day year-round," said Koch. "We paid them by the point. We had guys who more than doubled the 90 points, some close to 200 points in a day. We beat the heck out of our MobileMappers and they just kept going. This is out in the rural Minnesota countryside, moving along in off-road utility vehicles (UTVs) on dusty roads, in rain, snow, in sub-zero temperatures down to minus 7°C, banging down the ditches and mowing down weeds. We worked the units pretty hard, touching stylus to screen maybe a 1000 times a day. They didn't behave like an instrument that needed to be taken care of. They also got dropped pretty regularly; one guy left his on the hood of a pickup truck and drove away. The MobileMapper CE bounced 5 m down the road, and he went back to pick it up and kept on working. They preformed amazingly given what we asked those instruments to do."

The overall completed project had all the team members smiling. The team approach, allowed specialised contractors to perform the tasks they knew best while the rugged GPS units and minimal training enabled the field technicians to operate like professional surveyors. All of which played a big role in keeping the project on schedule.

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