ST. CHARLES SINCE 1834	**AGENDA ITEM EXECUTIVE SUMMARY**	
	Title:	Recommendation to Purchase LDC Transformer from CG Power Systems
	Presenter:	Tom Bruhl

Please check appropriate box:

	Government Operations	X	Government Services 11.26.12
	Planning & Development		City Council
	Public Hearing		

Estimated Cost:	$217,600	Budgeted:	YES	X	NO	

If NO, please explain how item will be funded:

Executive Summary:

The City requested formal bids which were opened on November 2. Due to the highly specialized nature of this design, there are a limited number of manufacturers capable and willing to design and build such a unit. Our design is so unique and innovative, that it was recognized earlier this year in a respected trade magazine. The City provided bid documents to a number of potential suppliers, but only received one bid. The bidder that responded, CG Power Systems, is the same supplier that built our first unit.

Attachments: *(please list)*

Bid Tabulation
T & D World Article

Recommendation / Suggested Action *(briefly explain)***:**

Recommend approval to award Purchase Order for (1) – 9,375kVA LDC Transformer to CG Power Systems for $217,600

For office use only:	*Agenda Item Number: 5.a*

Bidder	Price	Lead Time
Howard Transformers	No Bid	
CG Power Systems	$217,600	21-23 weeks
Cooper Power Systems	No Bid	
CARTE Transformers	No Bid	
ABB	No Bid	

T&D World Article

Local Distribution Center or Substation?

The City of St. Charles, Illinois is located approximately 35 miles west of Chicago in northern Illinois. The Fox River flows through the middle of this city of 35,000 which was flagged by Family Circle Magazine as the best place in the United States to raise a family in 2010. St. Charles is home to historic sites such as the Arcada Theater and the Hotel Baker (which hosted a meeting of the NFL owners and players during the spring 2011 negotiations). The "Pride of the Fox" theme carries through the numerous festivals and community events that draw thousands from all over the Chicago area and from neighboring states. St. Charles continues to be a great place to live, work and visit.

The Historic Hotel Baker sits on the west bank of the Fox River in downtown St. Charles, Illinois.

St. Charles also has a municipal electric utility that has served the citizens since 1892. The St. Charles Municipal Electric Utility is the third largest in the state. It serves over 14,000 customers and has a historic peak of about 130 Megawatts. Power is delivered to the city's 6 substations across Commonwealth Edison's (ComEd) 34.5 kV sub-transmission system. There are 9 34.5 kV lines delivering power to the city. Reliability in the city is enhanced by a city owned network of 34.5 kV lines that tie the substations together. This gives the city the ability to restroe power internally when there is an interuption of one of the ComEd lines.

About a year ago, a major publishing company expressed interested in the purchase of a large warehouse facility in the industrial park on the east side of the city. The intent was to convert the space to manufacturing. The total electrical load of the facility was estimated at 7 megawatts with full production. Although the facility is located near a major substation, with adequate reserves, the 12 kV distribution was not in place to handle this level of increased load. Another significant issue was a duct bank coming out of the substation was nearing full thermal capacity without this additional load.

Several years ago the utility purchased a 5 acre parcel when open property was disapperaing. It was understood that there would eventually be a need for additional substation capacity in this area. This site is less than a quarter mile away, but a major substation investment did not seem to be a prudent move at this time since other load in the area is not increasing significantly. So, it was obvious that the St Charles Municipal Electric Utility would need a new plan to serve this additional load.

The building in question is on a major regional connector, Kirk Road. Under Kirk Road is a duct bank that is home to one of the city's 34.5 kV lines. An additional 34.5 kV line runs immediately behing the building. There was interest by the customer to have dual feeds into the facility and a willingness to support efforts to increase reliability. So, as city staff looked at the options it became clear that a direct connection to the 34.5 kV system had considerable merit.

To the drawing board went the St. Charles engineers. ComEd has been using smaller 34.5 kV to 12 kV transformers around there system for several years that they call a substation in a box. Over a period of about 2 months, with assistance from various vendors, and in consulation with ComEd engineers, St. Charles produced a specification that took the ComEd idea to the next step. The City called this a Local Distribution Center (LDC) to solve the need of this customer. The customer agreed to provide easement space on their property and to do extensive site preparation work, including grading and a retaining wall, in order to expedite the project.

The crew watches as the 34.5 kV to 12.47 kV 10 MVA dead front transformer approaches the precast concrete pad.

The project would consist of 3 major components: the transformer, the 34.5 kV switchgear and the single phase 12 kV regulators. A relay and communications cabinet would be included as part of the switchgear and the 12 kV vacumn breakers would be located inside the transformer cabinet.

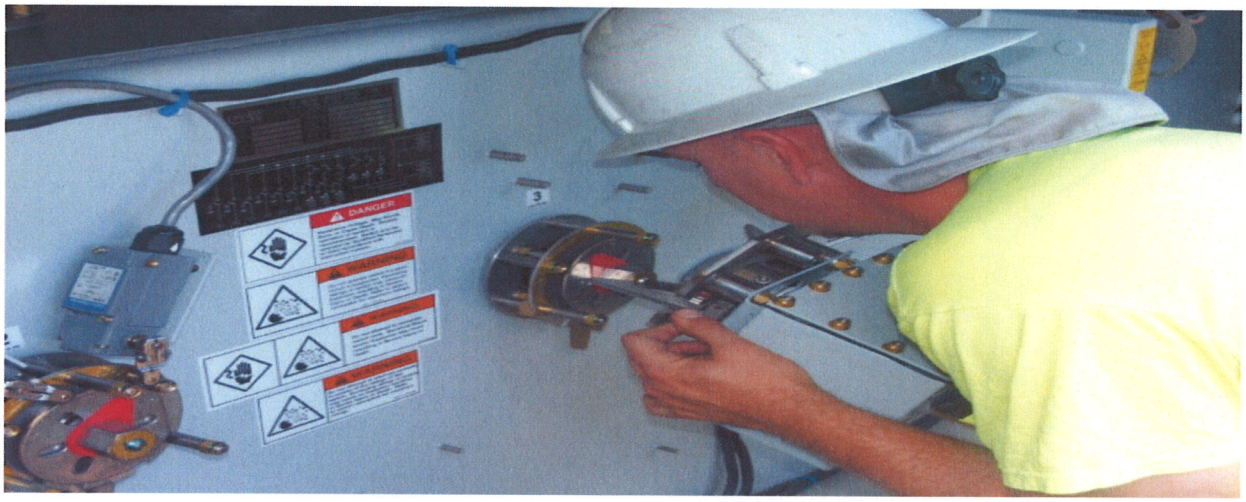
The specifications were sent out with a request for bids on the equipment. The evolutional elements over and above the ComEd design included:

- Dead front design for the 35kV switchgear, the primary and secondary sides of the transformer, the 12kV reclosers within the secondary compartment of the transformer, the 7,200V regulators, and the padmounted 12kV sectionalizing gear
- Upstream 34.5kV gear with a differential relay to provide additional protection for the transformer.
- Precast foundations for the all of the equipment

Safety and reliability are cornerstones of the St. Charles utility so advancing dead front technology to the greatest extent was a goal. The safety related to dead front was obvious, but the reliability was also expected to be improved by a lower probability of bushing flashovers due to contamination or wildlife. Dead front also provides the ability to deploy elbow arrestors at multiple points on the system for increased system protection.

The City challenged transformer bidders to provide a "dead front" option in both the 35kV and 12kV compartments. CG Power Systems from Washington, Missouri accepted the challenge and was the successful bidder for the transformer. CG partnered with G&W Electric to utilize their Viper ST recloser, with dead front terminations, to meet the secondary compartment recloser requirement of the specification.

For the power transformer manufacturer, the main challenge was integrating the recloser and its associated controls in a very small space using off-the-shelf deadfront connectors. The transformer also had to contain less than 1,320 gallons of mineral oil in order to eliminate the need for spill containment at the site. A 7,200/120V single phase potential transformer (to provide power to the recloser controller) was included above the transformer's low voltage bushings and connected to the transformer's secondary using fused deadfront elbow connectors.



The 35 kV switchgear has a remote switch mechanism to allow the operator to switch from up to 50' away from the gear. Lineman Merrill Colby attaches the mechanism to the gear.

An upstream 34.5kV switchgear was needed to tap the existing transmission feed line and to provide an interrupter with a differential relay to protect the transformer. The custom switchgear needed to also

contain a separate communications area so that all status and analog values would be available for the city's SCADA system.

After a thorough investigation, G&W Electric was selected to supply the dead front switchgear because they offered a custom solution and agreed to work with the utility on the specific requirements. The particular switch supplied was a 35kV, 4-way, TNI style padmount switch.

Ways 1 and 2 were 600A source ways, incorporating an integral ground position operable through the external operating handle. The source ways had provisions for mounting a portable motor actuator permitting remote operation if required. Auxiliary switches were mounted to each open and close position to monitor contact status to a remote SCADA master.

Way 3 was connected to the transformer and included overcurrent protection provided by a three phase vacuum interrupter in the switch. A motor actuator was installed on the external operating mechanism permitting the vacuum interrupter to be reset remotely. Auxiliary switches were included for remote monitoring of contact position.

Way 4 was connected to two 1.5 KVA potential transformers mounted inside the switch tank to supply 120VAC power to the control devices and to measure voltage. The PTs were protected through a manually resettable vacuum interrupter. Both Ways 3 and 4 were equipped with 500:1 current transformers mounted inside the switch tank for monitoring current.

St Charles Substation Engineer, Erika Drennen, uses a laptop to program the relays in the control enclosure attached to the 35 kV gear.

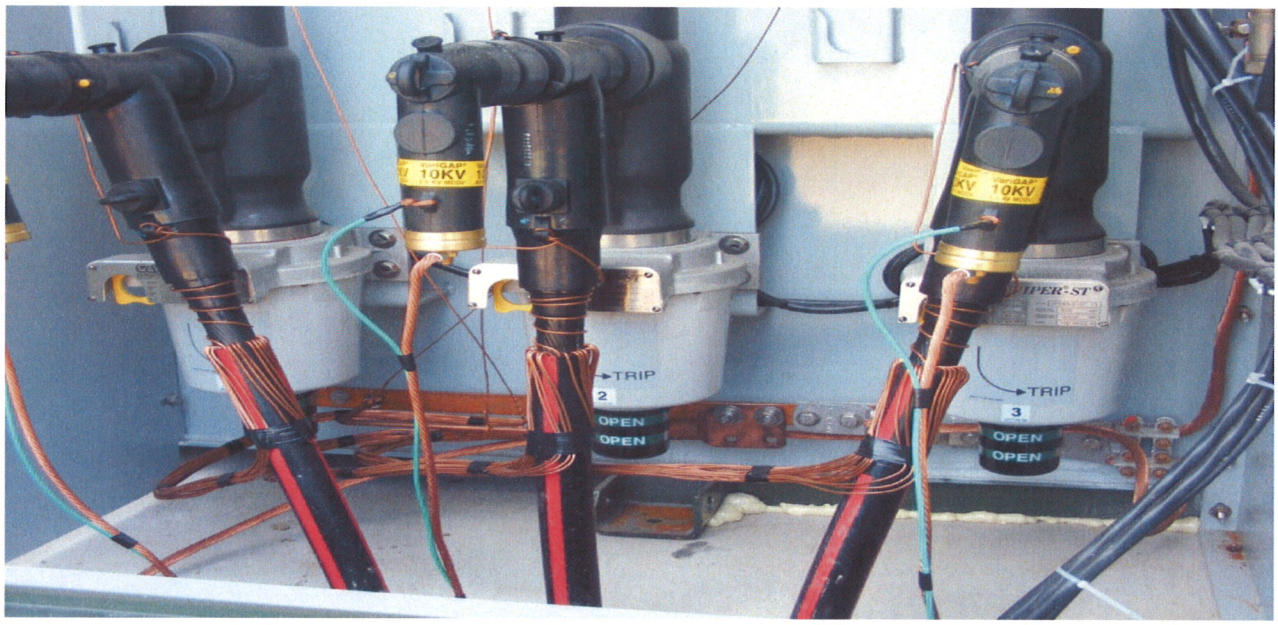
The switch was equipped with a control enclosure that included one SEL 787 relay, one SEL 751A relay, and one SEL 8300 (Radio Ranger) communication device. The SEL 787 provided motor control and current differential relay protection for the transformer on Way 3. The SEL 751A provided overcurrent control to the PTs on Way 4. G&W provided the relays, auxiliary power supply, and all control wiring. Also included was a communications rack for the city SCADA switches.

The LDC concept is based on the transformer and recloser being packaged together in a single padmount enclosure while still providing dead front construction. This required a custom solution from both the transformer and recloser manufacturer.

G&W provided a solution incorporating their Viper-ST solid dielectric recloser. The modular construction of the recloser permitted the unit to be reconfigured from a conventional overhead design to a dead front padmount construction providing single side access and elbow style connections to the transformer. The enclosure incorporated a side compartment which housed an SEL 651R recloser control. The recloser provided 12.5kA symmetrical fault current protection of the system.

The City utilized dead front regulators and the T-Op II products from Cooper. Elbow arrestors were deployed on the 35kV switchgear, the high side of the transformer, the low side of the transformer, and at the 12kV padmounted sectionalizer downstream of the regulators. Fault indicators were liberally applied using the test point on the T-Op II.

On the civil side, construction of a substation on approximately 30' x 80' of significant sloping terrain required a 9' tall retaining wall and detailed ground grid design. Jacob and Hefner and Electrical Design Systems Corp. developed the civil plans. Power Systems Engineering provided the ground grid study and design.



Viper ST reclosers, adapted for dead front, are in the 12 kV side of the transformer encloser. Elbow arresters are connected to the T Ops.

The equipment foundations were another element that differentiated the "LDC" from the Exelon design. The customer schedule was aggressive with a service date of June 20, 2011 and civil work not starting until the spring of 2011. Thirty days of concrete cure time created significant scheduling challenges for

the general contractor, Pepper Construction. Therefore, a precast foundation seemed to be the way to go.

The 50,000 lb transformer pad was set just minutes before the transformenr.

EDS contracted with Utility Concrete Products to precast the foundations for the transformer and regulators. A Concast fibercrete custom foundation with trough was designed for the 35kV switchgear. Precasting the foundations allowed all five foundations and all five pieces of equipment (35kV switchgear, transformer, and three regulators) to be set by a single crane in a single day. The pipe work had to be very precise in the X, Y, and Z planes for the pads to be square to each other and in line. The EDS conduit work on site also needed to be coordinated with a manhole installation and pipe work installed by Meade Electric.

The LDC concept is a complete substation package that has emerged as a potential way for the City to provide for long range planning initiatives without having to upgrade existing substation facilities. Local Distribution Centers are advantageous with respect to the expense and logistics of substation expansion, along with the cost to bring feeders from the station to the load. By altering the ComEd design to dead front, safety and reliability are enhanced.

LDC-1 with the 35 kV gear, the 35 kV to 12 kV dead front transformer and the single phase regulators from right to left above.

Footnote: The City of St. Charles would also like to recognize Tom Callsen and Marty Rave for collaborating on design basics.