TRANSACTIONS

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IN THIS ISSUE

TRANSACTIONS is a service of GDS Associates, Inc., a multi-service consulting and engineering firm formed in 1986.

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BLACKOUT 2003:
Where Did the Reliability Go?

My flight departed Detroit - Wayne County at 4:10 p.m. on August 14, 2003. Little did I realize I was leaving 50 million people without electricity in my wake. The media frenzy was evident at the baggage claim carousel at Atlanta-Hartsfield when local news stations scrambled to interview passengers arriving from the land of darkness. The usually sedate electricity industry had just suffered its worst debacle since the blackout of 1965 when 30 million residents of New York, New England, and Canada were plunged into darkness. The August 14 blackout stretched from the lower peninsula of Michigan, through parts of the Ohio River Valley, and into New York and the Canadian Provinces of Ontario and Quebec. It culminated in the loss of nearly 62,000 megawatts of electrical load. Nine nuclear power plants and numerous fossil-fueled power plants were forced off-line[1] when a "cascading" failure of the electrical transmission system appears to have begun with a trip of First Energy Corporation's Eastlake, Ohio power plant and two of its 345kV transmission lines.[2]

The resulting media attention and political grandstanding was almost unbearable. The lights were not even back on in Times Square when politicians were on the networks demanding that Congress take immediate action to legislate grid modernization. Manufacturers of everything from generators fueled by cow manure to exotic fuel cell technology were hawking their wares and scrambling for venture capital on the cable financial news channels. The reality is that a long-term detailed analysis will be needed to determine the root cause of the blackout. Michehl Gent, President of the North American Electric Reliability Council, testified to Congress on September 3, 2003 that "Understanding exactly what happened and why is an enormously complex task requiring a methodical investigation by experts from many disciplines." The U.S.-Canada Joint Task Force has been established to conduct a fact-finding investigation and make recommendations to prevent events like that of August 14 from occurring again. A staggering amount of data will be reviewed from sources such as disturbance recording devices, control center data, taped phone calls from utility operators, maintenance records, weather reports, and utility personnel interviews.

Many, including members of Congress, have asked if rules and regulations are in place today to prevent blackouts like this from occurring again. The answer is yes; NERC and its ten Regional Reliability Councils have extensive planning and operating procedures in place along with compliance monitoring functions. The one obvious flaw in this system, pointed out by Mr. Gent in his September 3 testimony, is that NERC is a voluntary organization; it

continued on Page 2

has no statutory authority to levy fines or sanctions upon utilities that do not comply with the rules. It is still too early in the investigation to tell whether any of the NERC procedures were violated but initial indications are that rules governing communication between grid operators probably were.

In addition to statutory authority for NERC, many regulators, including FERC's Chairman Pat Wood, are requesting that energy legislation be enacted mandating reliability through the oversight of Regional Transmission Organizations (RTOs). According to Chairman Wood, RTOs will also provide economic incentives for new transmission development in the form of incentive rates, accelerated depreciation, and special tax treatment for transferring facilities. The proposed energy legislation would provide FERC backstop siting authority for certain needed transmission lines that are rejected or delayed at the state level. Due to regulatory uncertainty, construction of new transmission lines has been at low ebb in the past decade. From 1988 to 1997, transmission investment declined by 0.8 percent annually. Expenditures for maintenance of transmission facilities, including tree-trimming and equipment maintenance, declined by a staggering 3.3 percent annually. During this same period, energy usage increased at an annual rate of 2.4 percent.[3]

One of the possible contributing factors to the blackout that is easily overlooked is the utilities' lack of experienced operating personnel. The Energy Policy Act of 1992 and FERC Order 888 set the stage for the opening of the competitive electricity market. In the push to become lean and mean, many utilities have reduced workforces through layoffs and hiring freezes. Since 1990, the number of employees in the electric utility industry has fallen by 24 percent, a loss of over 100,000 jobs.[4] Arguably, much of the decline in employment has been the result of utility mergers and consolidations and could indicate gains in efficiencies. It is conceivable, though not confirmed, that many of these lost jobs were retirements of experienced operations and maintenance personnel.

It may be some time before the root cause or causes of the August 14 blackout can be identified. Once all the political rhetoric dies down, the utility industry can focus on what's important-- insuring that the nation's transmission grid is the most reliable it can be through additional expenditures in new technologies and facilities, invigorating maintenance programs, enforcement of reliability rules or a combination of all these. **The blackout of 2003 may be over, but the spot light on utilities' reliability practices is just coming on.**

For more information or to comment on this article, contact Seth Brown, P.E. at 770.425.8100 or email: seth.brown@gdsassociates.com

[1]NERC Power Outages Update. August 15, 2003 6:00 a.m.

[2]*Power Firm Points Finger at Rival.* Washington Post, August 23, 2003; Page A08.

[3]Summary of Testimony of Pat Wood, III before the House Committee on Energy and Commerce, September 3, 2003.

[4]*Regulatory reform and labor outcomes in the U.S. electricity sector.* M. Scott Niederjohn, Monthly Labor Review, May 2003, Bureau of Labor Statistics.

Reduced Power Costs

Although considerable debate continues regarding the advantages and disadvantages of deregulation in the electric power industry, one clear opportunity that has arisen for some electric cooperatives in the deregulated wholesale power market is the flexibility to buy or sell power on a daily basis. Shrewd cooperatives are successfully taking full advantage of such market opportunities.

Some cooperatives have power supply contracts that allow them to displace energy that would otherwise be purchased from their primary power supplier with economy energy purchases available in the market. On days when the price of economy energy is less than their supplier's average energy rate, the cooperative estimates what their power needs will be and schedules a portion of that need to be met with economy energy, resulting in reduced power costs. The key unknown in optimizing this process is the forecast of their hourly load for the next day.

In need of a reliable method to project short-term demand and energy requirements, GDS Associates has assisted clients in developing load forecasting systems that can be incorporated into their daily load scheduling process. GDS has developed forecasting systems that produce "day-ahead" load forecasts by hour. Regression techniques are employed in developing the models, which quantify the relationship between energy requirements and factors impacting energy consumption on a short-term basis, such as temperature, hour of the day, and day of the week. The models are housed electronically and provide a convenient platform for co-op staff to generate forecasts each day.

Are Just A Day-Ahead...

Daily load forecasting systems provide cooperative management with a valuable planning tool capable of forecasting hourly loads accurately on a day-ahead basis. Furthermore, while many co-ops do not employ a load forecasting expert, user-friendly systems can be designed that are easily administered by co-op staff on a daily basis.

The benefits of a short-term load forecasting system can be significant. Once implemented, a cooperative can effectively schedule power purchases on a daily basis and take advantage of current market opportunities.

Central Virginia Electric Cooperative is a prime example. Gary Wood, Vice President, indicates that the cooperative has **reduced** its annual power costs **substantially** over the past three years by using their daily load forecasting system.

So, think a day-ahead…reduced power costs could be in your future.

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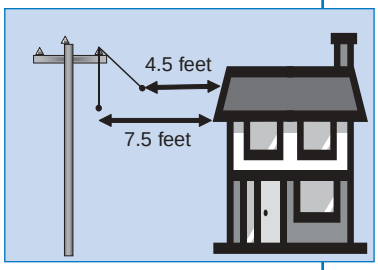
CODE CORNER

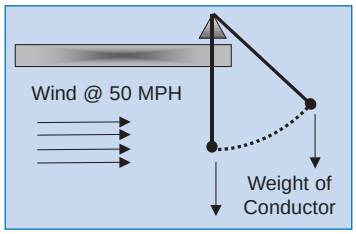
Horizontal Displacement Near Buildings (Rule 234A2)

When a power line passes by, but is not attached to a building or sign, the National Electrical Safety Code (NESC) provides rules as to how close the line can be from the building or sign. The general goal of these rules is to provide a safe working environment around the building to allow for routine maintenance that is occasionally needed.



The NESC in Table 234-1 requires a clearance of 7.5 feet from a primary conductor to a building or a sign. There is a small footnote which also requires that there be 4.5 feet of separation between the building and the primary wire with a 50 mile per hour wind blowing on the conductor. The NESC Rule 234A2 defines the wind loads in terms of 6 pounds per square foot of pressure which is the same as a 50 mile per hour wind.

Determining how far the conductor moves during a heavy wind is a function of the conductor weight, diameter of the conductor, and the sag of the wire. As shown in the diagram, the weight of the wire acts in a vertical direction while the wind acts in a horizontal direction. The wire can only move in a circular direction, so when wind blows on the wire, it moves over and up. The weight of the wire resists this upward movement.



The following equation is used to determine the horizontal displacement, which is the horizontal distance that a conductor moves from its position at rest to its wind-induced deflected point.

$$H_D = Sag \bullet \sin\left[\tan^{-1}\left(\frac{Wind\left(Dia/12\right)}{W_C}\right)\right]$$

H_D = Horizontal displacement
W_C = weight per foot
Dia = diameter in inches
Wind = 6 psf (50 MPH)
Sag = sag @ 60F with 6 psf (50 MPH)

It is important to know the sag of the wire at 60 F with a wind pressure of 6 pounds per square foot. Wind pushing on the conductor actually causes the conductor to elongate. Thus, the sag at 60F is less than the sag caused by the 6 pounds per square feet at 60F.

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GDS Associates, Inc.
Engineers and Consultants

Mission Statement:

To help our clients succeed by anticipating and understanding their needs, and by efficiently delivering quality services with confidence and integrity.

GDS Associates, Inc. is a multi-service consulting and engineering firm formed in 1986 and now employs a staff of over 100 in five locations across the U.S. Our broad range of expertise focuses on clients associated with, or affected by, electric, gas, and water utilities. In addition, we offer information technology, market research, and statistical services to a diverse client base. The size and depth of our firm permits us to offer clients multiple sources of assistance, ensuring complete, competent, and timely service. Some of the consulting areas in which GDS has specialized skills are:

1. Power Supply Planning Services
2. Financial Analysis and Rate Services
3. Generation Services
4. Regulatory and Restructuring Services
5. Renewable Energy Resources, Distributed Generation, and Combined Heat and Power Services
6. Energy Efficiency and Demand-Side Management Services
7. Electric Planning and Design Services (Hi-Line Engineering, LLC)
8. Environmental Management Services (GreenLine Environmental)
9. Deregulation and Retail Energy Procurement Services
10. Utility Privatization Services
11. Water and Wastewater Utility Consulting Services
12. Natural Gas Consulting Services
13. Statistics and Market Research Services
14. Information Technology Services

GDS consultants are recognized leaders in their respective fields, dedicated to their clients, innovative in their approach to meeting unique challenges, and known for consistently being available when needed. GDS strives to develop long-term client relationships. Our goal is to be a wise investment in consulting services for our clients.

Hi-Line Engineering, LLC is a wholly owned subsidiary of GDS Associates, Inc. Hi-Line specializes in providing safe, reliable, and efficient planning and design for electric cooperatives, investor owned utilities, municipal electric systems, and the military in all types of terrain and all three NESC loading districts. Hi-Line's areas of expertise include:

1. Overhead Distribution Line Design and Staking
2. Underground Distribution System Design
3. Inspection and Inventory
4. Contract Administration
5. System Planning and Analysis
6. Right-of-Way Vegetation Management
7. GIS/GPS Mapping and Inventory
8. Training Services
9. Specialized Design Services

Hi-Line uses the latest technology to increase efficiency and accuracy. Our commitment to client satisfaction and diversity of expertise ensures that we provide the highest quality of service.

GreenLine Environmental, a division of Hi-Line Engineering, LLC, provides environmental services specially geared to the electric utility industry. GreenLine's staff is composed of registered foresters and ISA certified arborists. Our experience in both power line design and operation complement our expertise in vegetation management on right-of-ways. GreenLine offers the following services to utilities, municipals, developers, industry, and the military:

1. Right-of-Way Vegetation Management
2. GIS/GPS Mapping and Inventory
3. Environmental Assessments
4. Urban Forestry Consulting

Our goal is to use our technology and experience to provide efficient long-term control of trees and brush in harmony with the biological ecosystem.

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