Energy Security on a Barrier Island

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Abstract

On September 12, 2008, Hurricane Ike reached Galveston Island with 110 mph winds and wide-scale flooding, causing the immediate failure of all facility systems and utilities at the University of Texas Medical Branch (UTMB).

Hurricane Ike, a Category 2 hurricane with a storm surge above normal high tide levels, moved across the Louisiana and Texas gulf coasts on September 13, 2008. Maximum sustained winds at landfall were estimated at 85 miles per hour (mph) and on Galveston Island winds reached 110 mph with gusts of 125 mph. The largest storm surge was estimated at 17 feet and possibly 20 feet in some Galveston Island areas. Hurricane Ike was the third most expensive disaster in FEMA history, behind Katrina and Andrew, and resulted in the largest evacuation of Texans in the state's history. President Bush declared a major disaster for the State of Texas due to damages from Hurricane Ike and signed a disaster declaration on September 13, 2008, authorizing FEMA to provide federal assistance in designated areas of Texas.

Over the course of the following weeks, UTMB's current District Heating and Cooling System essential to all UTMB operations, remained submerged in salt water, sustaining extensive permanent damage before mechanical pumping efforts could even begin.

During the efforts to restart the system by UTMB after the storm, the steam and condensate piping installed below grade exhibited the presence of saltwater within the outer steel jacket that surrounds the carrier piping. Saltwater was validated boiling out of the jacket vents and drains as the steam and condensate carrier piping was brought back online. This jacket and an external cathodic protection system provided initial corrosion protection for the buried piping. With the jacket compromised by saltwater and the cathodic protection system damaged by the storm, there was no longer any corrosion protection for the carrier piping. The initial damage evaluation by UTMB of the steam and condensate system was that of a complete loss of the underground steam and condensate piping.

The existing District Heating and Cooling System is a system of interdependent individual components linked in operation, like a chain. The failure of any individual component will cause the failure of the entire system. While addressing risks to single components provides isolated value, it is only by providing similar protection to all the links in the "chain" that repeated failure of the entire system can be prevented. Affiliated Engineers (AEI), working closely with UTMB, developed a **Three Step Solution** to ensure UTMB would remain resilient during a similar event:

Step One: Go Away from Buried Steam Pipe;
Step Two: Elevate or Protect the Boilers and Chillers;
Step Three: Produce On-Site Electricity via Combined Heat and Power.

Combined heat and power, is the production of electricity and heat from a single fuel source. Considered highly efficient, co-generation captures heat lost during the production of electricity and converts it into useful thermal energy, usually in the form of steam or hot water. Co-generation systems are typically 60-80 percent efficient which is significantly more efficient than the traditional power plant efficiency of approximately 30 percent.

These efficiency gains also result in cost savings, reduced air pollution and greenhouse gas emissions, increased power reliability and quality, reduced grid congestion and avoided distribution losses.