

NGReal-time: processing and analysis tool for natural gas delivery systems

Opportunity

In 2006, the United States relied on natural gas to meet about 22% of its energy needs. Therefore, assuring efficient delivery and receipt of this fuel is essential to the nation's economy.

Every day, natural gas is transported from production fields and import points to consumers nationwide. Thousands of delivery and receipt points along interstate high-pressure pipeline systems make gas accessible to millions of people. In a natural or man-made pipeline disruption emergency, it would be crucial for emergency responders and disaster monitoring organizations to know—in “real time”—which regions are facing a shortage of natural gas and the scale of the shortage. Daily updates of the recovery rates for each affected region, that is, whether the natural gas shortfall is short term or long term, are also important information.

Argonne Solution

Argonne's new data mining and analysis tool—NGReal-time—can provide this essential information. The tool extracts and processes real-time data from Web-based electronic bulletin boards posted by interstate pipeline companies (Figure 1). Because most interstate natural gas companies post their confirmed real-time gas volume nominations on their respective Web sites, it is possible to ‘mine’ the receipt and delivery point flows, analyze them, and display the results on screen. NGReal-time takes this information and uses it to assess, on an hourly basis, the impacts on natural gas components from an emergency disruption, such as a hurricane.

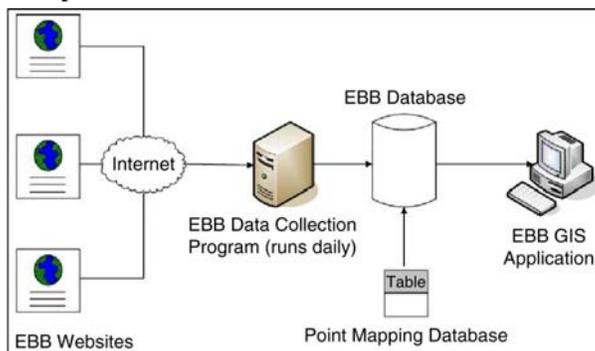


Figure 1 – NGReal-time model architecture

NGReal-time can generate and display natural gas use profiles before, during, and after a disruption for each delivery and receipt point of interest. This capability allows the model to highlight potential impacts. Moreover, using NGReal-time lets analysts see real-time utilization rates of natural-gas-fired electric power plants, natural gas processing plants, and other industrial customers, along with the changes in the utilization rates as disruptive events progress (Figure 2).

The model also generates reports and graphics to help researchers analyze recovery rates in specific regions of interest. In addition, a graphical user interface (GUI) operates in standard “point, click, or drag” mode, making it easy to use.

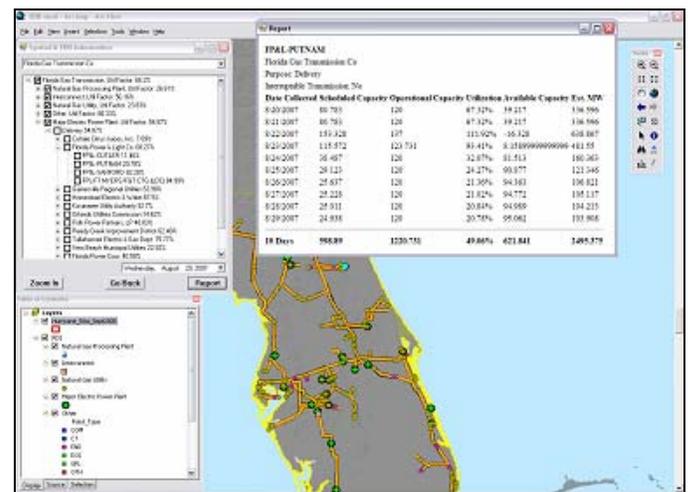


Figure 2 – Example of NGReal-time's GUI, showing real-time and historic utilization factor values for the Putnam Power Plant, owned by Florida Power and Light, over a period of several days

Capabilities

NGReal-time can:

- Assess normal or pre-disruption status (in terms of utilization factors and flow information) of receipt and delivery points for those pipelines most likely to be affected by an impending hurricane, disaster, or incident
- Monitor during and post-disruption status of receipt and delivery points for pipeline(s) of interest

- Monitor recovery rates of local distribution companies (LDCs), natural gas processing plants, and electric power plants affected by natural disasters and other disruptive events
- Project possible impact (customer and LDC-levels) of impending disasters on the basis of information from previous similar incidents (Figure 3)
 - Display historic information for specified time frame
 - Print hard-copy reports for documentation for further analysis
- Assess system-wide performance of pipelines
- Port output data to NGfast model to facilitate examination of long-term impacts and possible mitigation measures

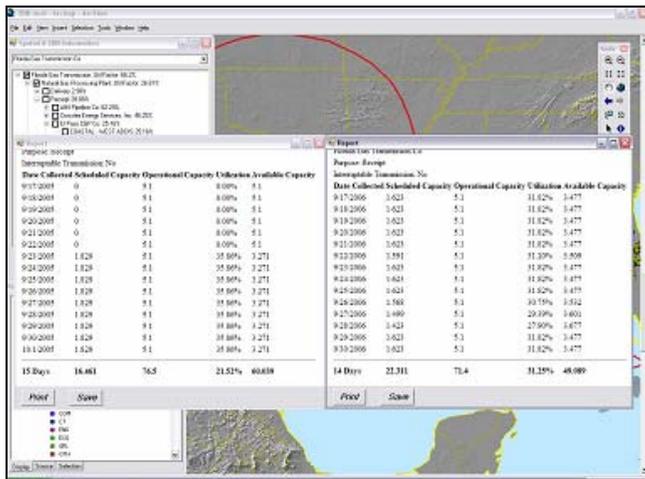


Figure 3 – Impact of Hurricane Rita on an El Paso processing plant in 2005 compared with the plant’s 2006 flow profile under normal conditions (Predictions of possible impact by natural disasters can be developed by using past data recorded under similar circumstances.)

NGReal-time is currently in “prototype status” with limited coverage and functionalities, sufficient only for demonstration purposes (Figure 4).

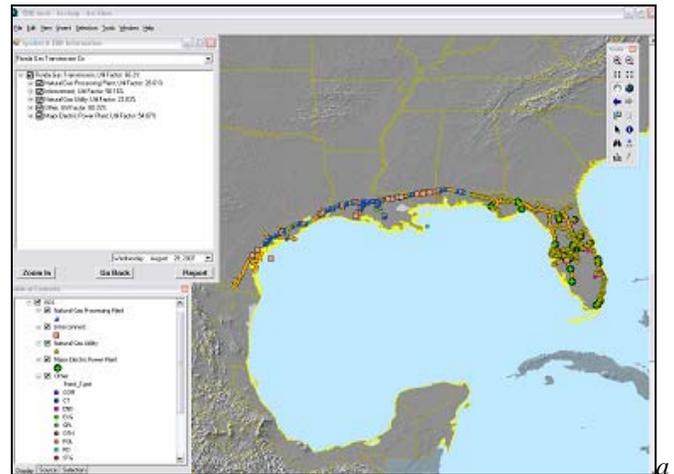


Figure 4 – NGReal-time can now display all types of receipt and delivery points associated only with Florida Gas Transmission Company

Future Developments

Argonne plans to further improve the model by including the following features:

- Enhance database to include historic data as far back as feasible to cover timeframes in which previous hurricanes or disasters occurred and to include all interstate pipelines
- Display data and calculated results in terms of charts and graphs rather than tables
- Calculate real-time and historic state-border flows for all states traversed by the pipeline of interest
- Calculate real-time and historic total in-state deliveries for all states traversed by the pipeline of interest
- Spatially select an LDC or state for detailed assessment
- Display calculated values (e.g., utilization factor) on the GUI map
- Implement a more user-friendly, intuition-driven GUI
- Display real-time and historic prices (transportation and hub prices)

Learn more about NGReal-time and other Argonne-developed models at:

<http://www.dis.anl.gov/>

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