

# PROJECT facts

Strategic Center  
for Natural Gas

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U.S. DEPARTMENT OF ENERGY  
OFFICE OF FOSSIL ENERGY  
NATIONAL ENERGY TECHNOLOGY LABORATORY



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## THE GAS SYSTEMS ANALYSIS MODEL (GSAM)

### *Full Market Assessment from Borehole to Burnertip*

## Description

The Gas Systems Analysis Model (GSAM) is a fully integrated model of the North American natural gas system that was originally developed to assist in planning, research and development (R&D), and policy development. The system employs a variety of modeling schemes ranging from the use of type curves in the reservoir performance module to a node-based representation of the natural gas transportation system. GSAM consists of a series of linked modules, which collectively:

- describe the North American natural gas resource base
- evaluate reservoir performance
- incorporate exploration and production (E&P) operations and strategies
- compute pro forma cash flows
- incorporate natural gas storage availability, use, and costs
- analyze inter-regional transmission options and deliverability
- integrate demand with supply, by region and by end-use sectors
- compute equilibrium market prices and volumes subject to myriad constraints.



*GSAM: A robust model capable of tracing impacts of E&P alternatives through to individual demand sectors.*

# THE GAS SYSTEMS ANALYSIS MODEL (GSAM)

## *Full Market Assessment from Borehole to Burnertip*

### Description (continued)

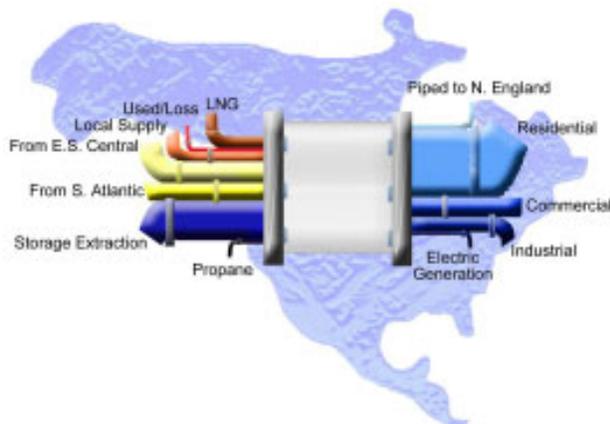
GSAM evaluates and quantifies the direct impacts of advanced technologies, including unique combinations of enhanced reservoir performance; decreased investment and operating costs; and reduced E&P risk for individual reservoirs nationwide. The microcomputer model is routinely used to simulate a variety of diverse policy alternatives, including specific tax, environmental, and regulatory structures — directly assessing their economic implications for securing future domestic natural gas supplies. Beyond these traditional applications and with minor enhancements, GSAM could also be used to more fully understand and plan for natural gas service disruptions - whether accidental or intentional. Multiple response scenarios could be generated with the system allowing for more informed decisions with respect to service restoration.

### Development History

In 1992, the National Energy Technology Laboratory (NETL) sponsored a project to develop GSAM. This effort resulted in a prototype model late in 1993 followed by additional system development and enhancements including an environmental module. The model underwent myriad upgrades and peer review during the mid-90's. Since that time, GSAM has been used in a variety of applications in support of multiple agencies. Currently, GSAM and Total Oil Recovery Information System models are being combined into a single comprehensive Oil and Gas Analysis model.

### Model Applications and Value

Broadly, GSAM's resource databases, market characterizations, and computer models are used to quantify various aspects of DOE's natural gas R&D program as well as evaluate supply/demand impacts associated with regulatory, fiscal, and other policy options. R&D metrics are regularly developed in order to focus and coordinate public and private R&D and to prioritize funding within Fossil Energy's technology portfolio. In terms of policy, GSAM has been used to evaluate the supply and price impacts of increased access to resources underlying federal lands. The EPA, Bureau of Land Management, and other DOE offices have all benefited from GSAM application. GSAM has also been used to optimize operational strategies (and capital investment), as when natural gas storage, LNG, or propane/air are weighed against pipeline expansions and associated costs.



*Illustration of gas balancing at a GSAM demand node.*

Since the tragic events of September 11<sup>th</sup>, industry and government have gained a heightened appreciation of the Nation's energy infrastructure as well as its vulnerabilities. As a result of this recognition, many exercises are underway to assess threats, limit impacts, and expedite recovery. With minor modifications, GSAM could be used to support critical infrastructure assurance programs most notably in the area of response and recovery - identifying optimum gas supplies and delivery routes for service resumption. Given the extensive use of the system for R&D portfolio management, it clear that GSAM could also be used to plan and guide infrastructure assurance technology development efforts.

### Potential Future Enhancements

Several system enhancements are currently being considered. These enhancements are in direct response to market dynamics, especially the significant growth in gas-fired power generation and critical infrastructure protection needs. Contemplated model additions focus on natural gas storage and transportation. In particular, high deliverability natural gas storage concepts, such as salt caverns, lined rock caverns, and chilled mine storage, are of interest.