Technology to meet new challenges faced by utilities
The environment in which vertical utilities (generation, distribution and retail services all under one business) operate has changed dramatically in the last few years.

The introduction of new technology in the extraction of gas and oil has led to the convergence of natural gas and coal prices. In addition, the increasing availability of wind power has brought with it the challenge of integrating variable resources into the grid. These new challenges have been added on top of the traditional problems of transporting power over an aging transmission grid — all while ensuring the quality of service with efficient management of regulation and reserves.

Security-constrained unit commitment (SCUC) benefits
• Plant operators can easily implement the results of SCUC, as SCUC uses detailed physical plant models.
• Savings in annual fuel costs of up to one-half percent, depending on the fuel mix of the user utility. On an annual basis, this can amount to tens of millions of dollars at a large utility.

Advanced techniques for an optimal solution
Siemens utilizes advanced Mixed Integer Programming (MIP) techniques, combined with a separable quadratic interior point method, to obtain the optimal SCUC solution. The MIP-based SCUC represents the next step when compared to the traditional Lagrange relaxation-based SCUC.

Answers for infrastructure and cities.
The Siemens MIP-based SCUC implementation reaches an optimal solution without manual interaction or arbitrary relaxation of constraints, and does so consistently – independent of the operator.

SCUC solves these current problems:
- A physical model of combined cycle plants more precisely models the economics of operations, including startup, shutdown costs, ramp rates and transition costs, enabling more economic operations (see examples below):

![Combined cycle plant with two gas turbines, heat recovery steam generators, and one steam turbine](image)

- Models of dual fuel plants allow optimization of the mixture of gas and oil
- The use of hydro and energy storage allows better deployment of these resources for economic operations

![Gas turbine rotor (using the physical model above)](image)

- The co-optimization of allocation of energy and reserves to a utility fleet promotes both economic and reliable operations
- Full network models allow a utility to plan reliable operations that are secure both in the base case and in the case of contingencies on the transmission grid
- Gas pipeline models allow a utility to plan reliable operations that meet contract obligations (take-or-pay, or long-term limitations) and respect network constraints
- Look-ahead features, including dynamic dispatch and contingency analysis, anticipate and solve problems before they become severe.

SCUC is based on breakthroughs in optimization technology
- It uses the same Market Clearing Engine (MCE) that operates the world’s most advanced energy markets
- The same clearing engine is used in Day-Ahead operations planning and intraday dispatch to ensure consistency in both time frames
- Optimization based on MIP technology used for precise modeling
- Branch and bound methodology delivers breakthroughs in system performance
- Multi-threaded programming architecture further speeds up the solution
- Flexible approach supports easy addition and model upgrades to solve new problems as they arise.

A new SCUC for vertically integrated utilities
SCUC is based on the MCE, which is the core of Spectrum Power Energy Market Management (EMM). For the first time ever, the SCUC does not impose artificial limitations on the solution.

It is now possible to include all relevant production, load and network constraints when clearing the central spot market simultaneously for energy and ancillary services. This solution approach, known as co-optimization of energy and ancillary services, produces the lowest overall clearing prices while meeting all physical constraints and grid security objectives.

How to get SCUC
SCUC is available now. For additional information, please contact your local Siemens representative or visit our website at www.usa.siemens.com/smartgrid.