



BACKGROUND ON THE DESIGN AND OPERATION OF NEW ENGLAND'S BULK POWER SYSTEM

The Role of ISO New England in Bulk Power System Operations

ISO New England is responsible for the secure and reliable operation of the region's bulk power generation and transmission system. The ISO's system operators monitor the "real-time" generation and flow of electricity across the region's interstate high voltage transmission system around the clock.

The Electric Power Grid

New England's bulk electric power system is designed and operated to reliably meet the electricity needs of the region in accordance with established industry criteria. The system is comprised of more than 8,000 miles of transmission lines and several hundred generating facilities, of which more than 350 units are under the direct control of ISO New England.

There are also several interconnecting transmission lines to bulk power transmission systems in New York State and the provinces of Quebec and New Brunswick in Canada. The interconnections with neighboring systems allow for both the import and export of electricity between regional power systems. These interconnections are used for reliability purposes as well as for the sale and purchase of electricity between regions.

The bulk power systems operating in the northeastern United States were designed and built to standards developed in response to the Northeast Blackout of 1965 and have evolved over time. The fundamental goal of the system's design and operations is to absolutely minimize the likelihood of experiencing a similar event in the future.

North American Reliability Requirements

To provide uniform design and operating standards for electricity generation and delivery systems, the industry created the North American Electric Reliability Council (NERC), which was given the responsibility to establish electric system reliability and operating performance standards. In turn, NERC coordinates its activities with ten regional reliability councils who provide oversight at the regional level. The New England bulk power system, or grid, is a part of the Northeast Power Coordinating Council (NPCC) region.

The New England Power Pool has established a bulk power supply resource adequacy standard commonly known as the "one day in ten years" criterion. This standard is widely used by the electric industry and requires that the bulk power system be designed in a manner that the likelihood of having to disconnect non-interruptible customers, resulting from a lack of generating resources, occurs on average no more than one day in ten years.

A Summer Peaking System

The New England power grid is a summer peaking system. This means that the highest demand for power during the year typically occurs during the summer season. Peak demand on a normal summer day has typically ranged from 19,000 to 23,000 megawatts (MW).

In winter, peak demand has typically ranged from approximately 17,000 MW to 19,000 MW. Typical spring and fall peak demand ranges from 15,000 MW to 16,000 MW. In August 2002, the region reached an all-time record demand of 25,348 MW. Summer peak (under normal weather conditions) has increased by 20% over the last ten years and is expected to continue to grow by 15% over the next ten years.

Operating Procedures and Guidelines

ISO New England has detailed operating procedures and guidelines that govern the day-to-day operation of the bulk power system. At its Control Center in Holyoke, Massachusetts, operators monitor the “real-time” generation and flow of electricity across the region’s interstate high voltage transmission system 24 hours a day, 365 days a year.

ISO New England uses both verbal and electronic communications to provide centrally located, real-time direction on the electrical output of each of New England’s 350-plus resources. ISO New England also coordinates maintenance activities of the generators and the transmission system to ensure that the flow of electricity is not disrupted by a planned or unexpected outage of a facility.

To assist ISO New England in operating the New England bulk power system, there are four sub-regional control centers, called Satellite Control Centers operated by transmission companies. Like ISO New England, these facilities are staffed 24 hours a day by operators who monitor the real-time production and flow of electricity. The satellite facilities work in conjunction with the ISO to ensure reliable transmission operations within their sub-regions. They also serve as backup to perform certain critical ISO New England functions. The ISO also coordinates its activities with neighboring bulk power system operators to protect the reliability of the interconnected systems.

Operating Reserves

To ensure minute-to-minute reliability of the bulk power system, there are requirements for maintaining an adequate reserve of electricity supply, commonly referred to as the “operating reserve.” This means that the operators simultaneously ensure that there is enough electricity to meet the real-time demand of the New England region and maintain an adequate reserve of resources to be called upon to replace any generating source or transmission line that unexpectedly goes out of service. Electricity is generated on demand since it cannot be stored. Once power is generated, it must flow to a source. So operating reserves can be defined as a specific number of megawatts that could be called upon to generate at any given time.

ISO New England maintains an operating reserve to provide the capability to replace within ten minutes the sudden loss of energy production from the largest source of power and to restore within 30 minutes the ability to withstand a subsequent loss of the second largest source of power.

Typically, the ISO maintains an operating reserve margin of about 1,700 MW. Resources designated to provide operating reserve are identified in advance of the operating day, and the ISO New England operators closely monitor these resources to ensure that they will be able to generate electricity within the prescribed time frames necessary to keep a constant balance between the supply and demand of electricity on the grid.

Due to a variety of circumstances, there are times when the required operating reserve on the system is jeopardized. Circumstances could include having an unusual number of power plants out of service due to mechanical problems or experiencing unexpected high demand due to extreme hot or cold weather. To respond to such conditions, ISO New England has special operating procedures that address a variety of such contingencies. These procedures were developed during the original design of the New England bulk power system to maintain system reliability and have been enhanced over the course of the 31-year existence of the grid.

Operating Procedure No. 4

One of these procedures is **Operating Procedure No. 4 (OP-4)**, Actions During a Capacity Deficiency. This procedure is invoked when a deficiency of required operating reserves has occurred or is imminent. The procedure includes 16 steps that the operators can take to either increase the available supply of electricity for the region or reduce the actual real-time demand for electricity. These steps can be implemented in any order depending on the circumstances of the capacity deficiency. In addition, some of the steps can be implemented in advance of an anticipated capacity deficiency situation. The potential load relief resulting from implementing all 16 steps of the procedure is between 2,600 MW and 3,600 MW.

It is important to note that OP-4 is an implicit part of the reliability design of the bulk power system in New England. It was envisioned that there would be instances when required operating reserves could not be maintained and that appropriate contingency measures needed to be in place. In 2002, OP-4 was initiated six times over the course of the summer.

Public Notifications

For the seventh straight year, ISO New England will use a public notification system when the OP-4 action requires the ISO to ask customers to conserve electricity. Modeled after advisories used by the National Weather Service, the ISO New England public notification system has two levels of appeals, **Power Watch** and **Power Warning**.

A **Power Watch** is a request to all customers to voluntarily reduce electricity usage and is issued when the region's electricity supplies are expected to be tight.

A **Power Warning** is a more urgent appeal and will be issued when electricity supplies are—or are expected to be—extremely tight and there is concern that electric companies may have to disconnect certain customers as a means of reducing demand on the grid.

A follow-up notification will be issued to the public once the **Power Watch** or **Power Warning** has been lifted. ISO New England will issue a notice that power supplies and operating reserves have returned to normal levels and that regular electricity usage can resume.

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*For more information, please contact ISO New England's
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