Understanding Base Load Power

What it is and Why it Matters

October 7, 2008

Published by Dr. Matthew Cordaro in conjunction with New York Affordable Reliable Electricity Alliance (New York AREA)
Overview
New York State and the country as a whole are being challenged to make decisions about sources of electric power for today and for the future. This issue brief discusses the role and limitations that base load, intermediate, and peak power plants have in an electricity portfolio and the power sources typically suited to each application.

Understanding Base Load Supply
Base load requirement (also baseload) is the minimum level of demand on an electrical supply system over 24 hours. Base load power sources are those plants which can generate dependable power to consistently meet demand. They are the foundation of a sound electrical system.

Power demand typically follows a bell curve on a day to day basis with the peak demands changing based on the season. During the late evening and early morning demand for power is relatively low, but never below a certain ‘base.’ This is the base load which must always be accounted for by grid operators.

Daily Base Load Power Variations by Season

The graphic above illustrates the three different types of demand – base load, intermediate, and peak – and the daily and seasonal variations. Every electric grid system must have base load power plants, intermediate power plants, and peak power plants to operate reliably and efficiently.

Base load power plants produce continuous, reliable and efficient power at low cost. They often take a long time to start up and are relatively inefficient at less than full output. Base load plants run at all times through the year except in the case of repairs or scheduled maintenance. Their reliability to provide the base demand (i.e., to continuously supply electricity to customers) helps keep their operation costs low and offers stable, attractive pricing through long-term agreements.

Each base load power plant on a grid competes for a specific amount of base load power demand to provide. For a typical power system, the rule of thumb is that base load power is usually 35–40 percent of the maximum load during the year. Demand spikes are handled by
intermediate or peak power plants which must be smaller and more responsive to changes in demand.

Base load power plants include coal and nuclear facilities because of the low fuel costs and the steady state of power they produce. Geothermal and hydro can also be used as base load power depending on their regional availability. These are the two most reliable forms of renewable energy available to most grids.

**Peak and Intermediate Sources**

Electricity demand fluctuates over the course of a day, throughout the week, and seasonally. Demand is also impacted by location, population and climate. Regions with high population typically have higher demands and often have large public transportation systems which rely on electricity. To meet the changing demand for power, peak and intermediate power plants are coordinated into the system.

Peak load power plants (commonly referred to as peakers) provide power during peak system demand periods. They are highly responsive to changes in electrical demand and can be started up relatively quickly and vary the quantity of electrical output by the minute.

Barring undue stress on a grid system, peak load plants typically operate 10 to 15 percent of the time and are smaller than base load plants. Peaker plants are very expensive to operate, relative to the amount of power they produce and the cost of fuel to power them. Due to their size, however, they are less expensive and easier to build. Peaker plants are most often natural gas combustion turbine plants but some do run on light oil.

Intermediate load plants fill the gap between base load and peaker plants. From a cost and flexibility standpoint, they typically operate between 30 and 60 percent of the time. Intermediate plants are larger than peaker plants so their construction costs are higher, but they also run more efficiently.

Both wind and solar can be considered intermediate power sources. Both are intermittent by nature, as output fluctuates with weather patterns. Wind and solar cannot be relied upon to meet constant supply needs, nor can they be immediately called upon to meet peak demands. They are, however, effective as intermediate sources and can help to reduce the need for fossil fuel intermediate plants or overuse of peaker plants during heavy demand days.

**Base Load Supply in New York**

New York’s total energy consumption is among the highest in the United States. New York also has minor resources of oil and gas but the state’s geography gives it an ample supply of renewable hydroelectric power. In fact, New York produces more hydro power than any state east of the Rocky Mountains.

With New York’s ample hydropower and nuclear capacity, the state’s current base load power portfolio is extremely clean and efficient. But the demand for electricity continues to increase. New York has also entered into the Regional Greenhouse Gas Initiative (RGGI) in efforts to reduce the emission of greenhouse gases which have been linked to climate change. This has resulted in several coal plants being phased out and strong resistance to the construction of new...
conventional coal plants. New York’s hydro power potential is built out to capacity, and offers little in the form of new generation.

![Net Electricity Capacity for New York State](image)

For New Yorkers, this makes the existing base load supply increasingly important and presents distinct challenges for building new base load power. The expected growing demand for hybrid and plug-in electric vehicles, new technologies that will require ample amounts of power, and the growth of the mass transportation system will further strain New York’s grid, particularly the base load supply. Building out our renewable intermediate sources like wind will help decrease the need to use fossil fuel peaker plants, but cannot replace base load supply. Clean base load supply is vital to keeping electric bills stable, improving regional air quality, and reducing the state’s carbon emissions.

**About the Author:** Dr. Matthew Cordaro is a seasoned electricity industry executive who formerly served as President and CEO of the Midwest Independent System Operator, the not-for-profit operator of the region’s transmission grid, and CEO of Nashville Electric, one of the 10 largest public utilities in the US. He currently serves as a professor at Long Island University specializing in energy research and policy development.

**About New York AREA:** Founded in November 2003, the New York Affordable Reliable Electricity Alliance (New York AREA) is a diverse group of more than 125 business, labor, and community groups whose mission and purpose is to ensure that New York has an ample and reliable electricity supply, and economic prosperity for years to come. New York AREA helps to educate policy makers, businesses, and the general public regarding the necessity and importance of safe, low-cost and reliable electricity. For additional information visit: www.area-alliance.org.
Additional Information

Renewable Energy World

Energy Information Association
www.eia.doe.gov
http://www.eia.doe.gov/neic/brochure/electricity/electricity.html
http://www.eia.doe.gov/conf_pdfs/Tuesday/JOSKOW.pdf

World Nuclear Association
www.world-nuclear.org
http://www.world-nuclear.org/info/electricity_cars_inf120.html?terms=base+load
http://www.world-nuclear.org/info/inf10.html

New York Independent System Operators
www.nyiso.com

The Public Service Commission of Wisconsin
http://psc.wi.gov/thelibrary/publications/electric/electric04.pdf