BASE LOAD SUPPLY:

THE FOUNDATION OF THE ELECTRICITY GRID

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The energy industry terms "base load power" and "base load supply" are widely used, yet often misunderstood. But "base load" power and supply are critical to meeting the day to day demand of electricity consumers and for stabilizing electricity prices. Base load supply is literally the foundation of every electricity grid.

The Massachusetts Affordable Reliable Electricity Alliance (Mass AREA) has prepared the following issue brief to provide an overview of base load supply and the importance of these resources in the Commonwealth.

WHAT IS BASE LOAD SUPPLY?

Base load is the minimum level of demand on an electrical supply system over 24-hours: the load that exists 24 hours a day. Base load energy sources meet this demand by generating a steady quantity of power regardless of demand fluctuations. Base load power plants are generally large-scale hydro-electric, coal, natural gas and nuclear power plants, and except for scheduled maintenance or repairs, these facilities operate 24 hours per day, year round. Renewable sources of power, such as wind and solar, are not considered base load because they generate power intermittently.

Base load power plants are efficient and have comparatively low-cost electricity generation.

Typically base load power plants generate enough output to provide most of the power used by a grid. Most base load power plants (especially coal and nuclear power plants), are slow to start up and shut down. Thus, they are more effective when used continuously to cover the base load (or minimum) amount of power required by the grid.

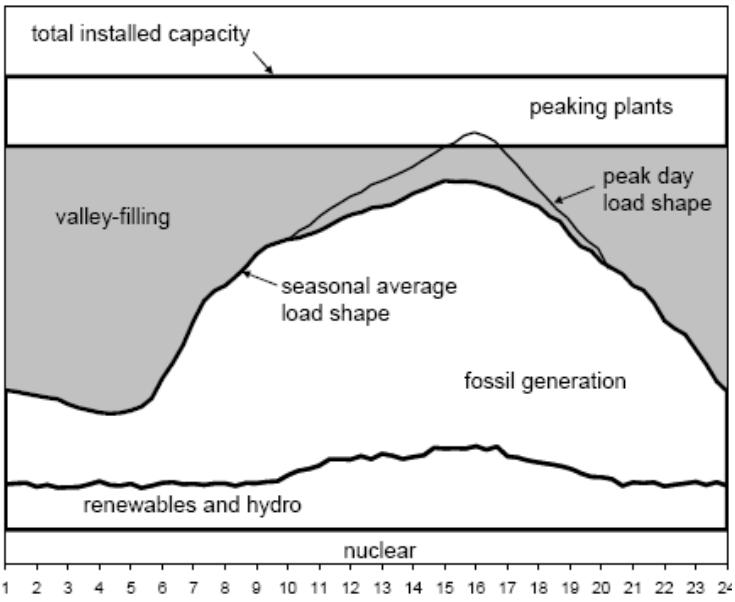
PEAK AND INTERMEDIATE SOURCES

Electricity demand fluctuates over the course of the day, throughout the week and seasonally. Demand also varies from location to location, depending on the climate, demand mix and other factors. Policy initiatives and long-term changes in electricity use also affect demand. Examples include electrification of public and private transportation, incentives for off-peak electricity use, and the increasing use of small-scale renewable sources of energy, among others.

To meet demand differences and fluctuations, there are two other types of power plants: peak and intermediate.

Peak load plants have smaller outputs and are usually oil- or natural-gas fired. These fuel sources allow plants to be easily turned on and generate electricity quickly. Peak load facilities must be capable of being brought on line and shut down quickly throughout the day to meet the higher "peak" demand periods. Typically, peak periods occur during the afternoons of hot summer days when air conditioners put excessive strain on the power grid. Without these

"peaker" plants, transformer blowouts and rolling blackouts could occur as demand outstrips supply. The chart below demonstrates the "load shape" over the course of 24 hours.



Source: Pacific Northwest National Laboratory, 2007

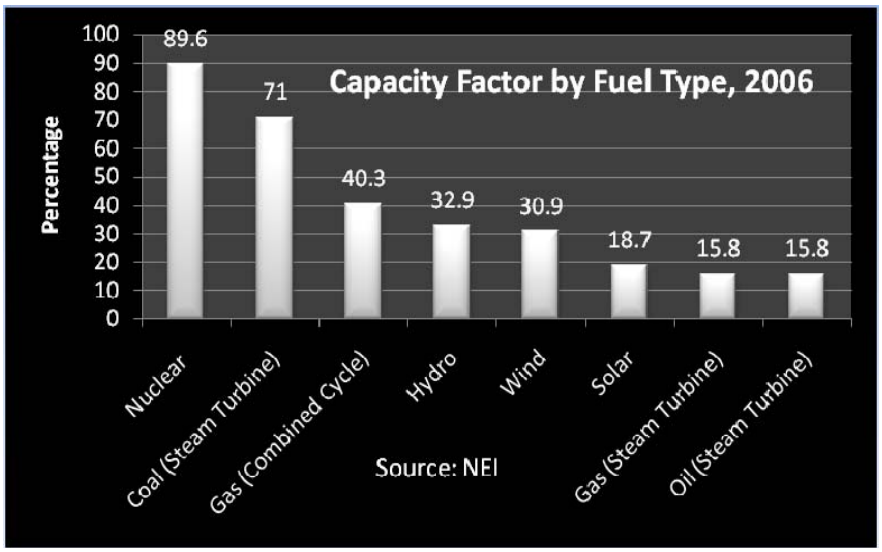
Up front capital costs of building peak load plants are usually low compared to base load plants, but the fuel costs per unit of power generated is relatively high. Depending on type, size, and location, hydro-electric sources can also meet peak and intermediate load periods in addition to providing base load power.

Intermediate load generating units are used during the transition between base and peak load requirements. Intermediate load units typically use the same fuels that peak load plants do, but have a higher-capacity output. Wind and solar energy sources fall in the intermediate category. As wind and solar are intermittent by nature and outputs fluctuate with the weather, they cannot be depended on to meet peak demand periods, but are effective in helping to reduce the need for the fossil-fuel power.

THE CAPACITY FACTOR

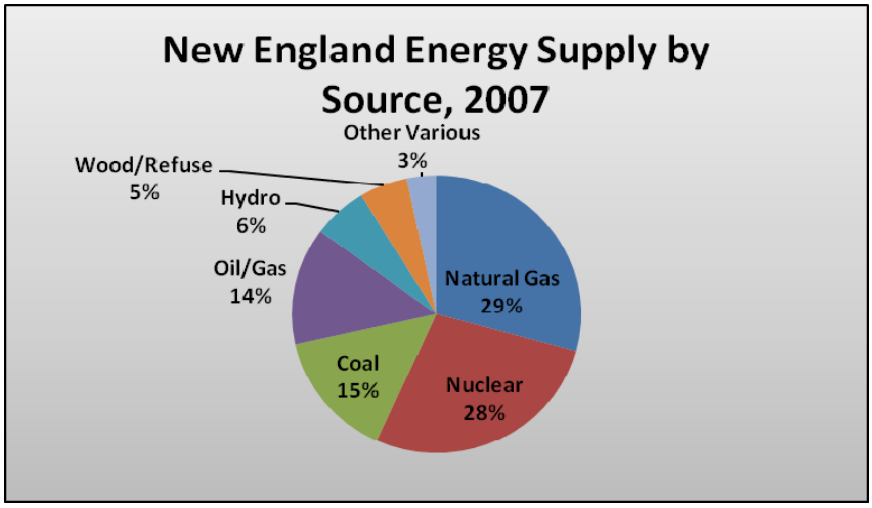
Because it is economical to run base load power plants constantly and at the highest output possible, base load power facilities have by far the highest capacity factor of any power source. Capacity factor is measured by the potential vs. the actual output of a power source over a given period of time. For example, at full capacity the 130-turbine Cape Wind farm off Nantucket Sound would be capable of generating 420 megawatts (MW) of electricity. However, the average output is estimated to be 170 MW, giving Cape Wind a capacity factor of approximately 40 percent.

The following chart from the Nuclear Energy Institute shows average capacity factor by fuel type.



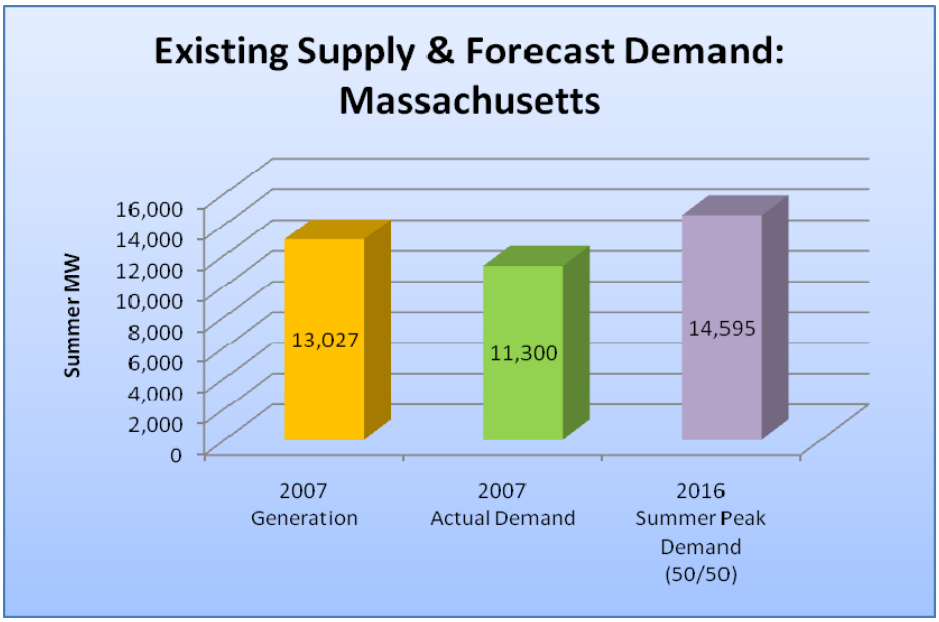
THE ROLE OF BASE LOAD SUPPLY IN MASSACHUSETTS

Massachusetts is heavily dependent on fossil fuels for electricity generation. Indeed, more than 40 percent of the Bay State's electricity supply is generated by natural gas alone. When combined, oil, coal, and gas combined make up well over half of the state's energy supply. The following chart created with figures available from ISO (Independent System Operator) - New England, the regional transmission organization, shows New England's 2007 energy supply by source.



Source: ISO-NE

According to ISO-New England, Massachusetts' demand for energy is growing by one percent each year and summertime peak demand is growing by nearly two percent annually, adding additional strain to the state's electricity grid. The chart below demonstrates Massachusetts' existing summertime supply and forecast demand.



Source: ISO-NE

A Growing Need

As demand continues to grow, increasing base load supply will be critical. Other factors are also contributing to the growing need for new base load energy sources. During the next 30 years, some, if not many of the older base load power plants will need to be retired or completely overhauled due to their age; some are approaching 60 years of operation.

The growth in demand for hybrid, plug-in vehicles, increasing demand in new industries such as biotech and the manufacturing and development of renewable energy technology equipment will also add to the strain placed on Massachusetts' power grid.

Growing concern about greenhouse gases, global warming, and air pollution from fossil fuel sources has added to the need for new sources of "clean" power especially high-capacity base load sources. According to a recent study by Boston-based Polestar Applied Technology, Inc., New England will be unable to reduce carbon dioxide emissions in conjunction with the Regional Greenhouse Gas Initiative (RGGI) goals without the ongoing operation of the region's five nuclear power plants.

In addition, under a low-growth electricity demand scenario the region would also need to prematurely shut down half of the coal and oil fired plants, construct eight 500 megawatt natural gas plants and ten 400 megawatt wind farms (the same size as Cape Wind). This is all in addition to implementing aggressive energy efficiency measures.

However, the complexity of siting and developing new generation is stagnating new power growth. Unfortunately, all sources of power meet opposition for various reasons, as has been seen with the Cape Wind project and the natural gas fired plant proposals in Billerica, Brockton and Walpole, Massachusetts.

Clearly, demand-side energy efficiency and conservation programs can help reduce demand and must continue to be supported and implemented. However, a no-growth energy policy is unsustainable for the Commonwealth, both in the short- and long-term. To meet the state's environmental and economic goals, Massachusetts will need new sources of clean, base load power.

CONCLUSION

There is no silver bullet solution to the Commonwealth's energy needs. A combination of maintaining current base load energy sources, developing new base load and renewable energy supplies, continuing improvements to the transmission infrastructure, and promoting energy efficiency and conservation programs are key to meeting Massachusetts' energy and environmental goals and keeping the state's economy growing.

Mass AREA strongly encourages legislators, policy-makers, and business leaders to develop and implement a long-term energy plan to secure affordable energy for the Commonwealth. By working together and promoting realistic and cost-effective programs and policies to provide low-cost, reliable energy to each and every resident and business in Massachusetts, we can make sure the Bay State remains a great place to live and work – for all.