# Resource-Must-Run Generation, Locational Installed Capacity And Electric Capacity Markets in New England

***** ALERT *****

**On August 10, 2005, under heavy pressure from the New England congressional delegation, governors and regulators, the Federal Energy Regulatory Commission (FERC) delayed until October 2006 implementation of the Locational Installed Capacity (LICAP) initiative proposed by ISO-NE. We will provide updates to our customers as events change.**

The electric system in New England is a very complex system of electric generators and loads (customers) interconnected by a web of transmission and distribution wires. The system is controlled by a central operator, the Independent System Operator of New England or ISO-NE. The ISO-NE must maintain a precise balance between generators and loads by instructing generation to put exactly as much electricity “on” the grid as customers are taking electricity “off” the grid. This balance is absolutely essential. If electricity is taken off the grid without a corresponding amount put on, the frequency on the grid will slow from the desired 60 Hz. When this happens, the ISO-NE will be forced to lower voltage to maintain frequency, resulting in a voltage reduction or “sag”. If the voltage is reduced beyond a threshold amount, the grid will collapse leading to a blackout. Similarly, if electricity is put on the grid without a corresponding amount taken off, frequency will increase above 60 Hz, forcing the ISO-NE to increase voltage (“spike”). If the voltage spike exceeds threshold limits, the grid will shut down to protect equipment. This, too, will result in a blackout. The ISO-NE preserves frequency in the first instance by matching generation with customer loads. If the ISO-NE is not able to achieve this balance it can also preserve frequency by adjusting voltage, but only within certain limitations.

One way to think about the electric grid, which will help in the discussion about capacity markets to follow, is as a large bathtub. Around the top of the bathtub are spigots that, when turned on, put water into the tub. Some of these spigots release a large amount of water when turned on. These can be thought of as nuclear plants or large coal plants. Other spigots release a small amount of water. These can be thought of as hydro, biomass or other small generators. Still others release only a tiny trickle. These can be thought of as small, distributed generators such as roof-top solar units.

The bottom of the bathtub is full of holes of varying sizes. These holes represent customers taking water out of the tub. As with the spigots, the holes pass varying amounts of volume. Large holes correspond to large industrial and commercial users of electricity such as paper mills, university campuses and manufacturing centers. Smaller holes pass less water – these represent the full range of commercial users from grocery stores to office buildings to box stores to small factories. Finally, the millions of pin-pricks represent all of the residential customers and the smallest commercial customers, as well as things like traffic and street lights.

In order to maintain stability, the ISO-NE must maintain a near-perfectly level amount of water in the bathtub at all times. This feature distinguishes the electric grid from other commodity markets, where the bathtub level varies with additions to and withdrawals from storage or inventory. Electricity cannot be stored economically. Since the ISO-NE cannot control how customers use electricity and since it cannot utilize storage or inventory to maintain a balance between supply and demand, it must maintain a perfectly level amount of water in the bathtub by managing the operation of each of the spigots – something referred to as "generation dispatch". As the ISO-NE senses an increase in the amount of flow out of the tub from below, it must increase the flow out of those spigots that are on or it must turn on a spigot that is currently off. The ISO-NE chooses which spigots to adjust based on the prices associated with each spigot, that is, the bids the owners of generators submit to the ISO-NE to operate. It begins with those that have the lowest price and works its way up the so-called bid stack until it has just the right amount of flow. By choosing in this manner, the ISO-NE ensures that the combination of generators operating at any given time represents the least cost combination of generators and therefore results in the lowest prices to consumers.

Most of the time and for most of the regions of New England, this dispatch method works very well. However, there are certain instances in which it is simply not possible to regulate flow as needed by following the lowest cost approach. For example, consider a situation in which there are many large users of electricity located in a relatively small geographic area. These would be represented by many holes in one location on the bottom of the bathtub. If these users all drain water from the tub simultaneously, the effect on the surface of the tub will be a whirlpool, resulting in a depression in the level of water in the bathtub above these holes. It may not be possible to neutralize this whirlpool by turning on a spigot on the other side of the tub. In fact, if the spigot on the other side of the tub is large and there are no offsetting holes in the vicinity of the spigot, turning it on might create a mounding of water on that side rather than an equilibrating of water across the entire surface of the tub.[1]

This effect translates in the electric grid to a drop in frequency and a resulting voltage sag in the vicinity of the users and a rise in frequency and a resulting voltage spike in the vicinity of the large spigot. In order to correct the problem of localized load, it may be necessary to have localized generation that can be cycled in response to changes in the load, even though doing so might not be the most economic way to operate the grid. Furthermore, since the ISO-NE cannot control how or when the users decide to use electricity, it might be necessary to have such localized generators available at all times. These generators are called Reliability Must Run ("RMR") generators.

[1] One option, of course, is to attach a hose to the spigot and run the hose to that part of the bathtub where the holes are so that the water from the spigot flows to exactly where it is needed. This is precisely what occurs on the electric grid when transmission lines are built – the transmission lines move the electricity from the location where it is being generated to a location where it is being used by consumers.

The RMR designation may not be a problem for many generators, since most generators are always ready to produce more electricity if called upon. For some generators, however, the RMR designation could become a problem if it is expensive for these generators to maintain themselves in a "ready state", and they are not able to cover these costs from normal operations. Absent some intervention by the ISO-NE, such generators may shutdown, leaving the ISO-NE unable to meet the demands on the grid. This would leave the grid vulnerable to voltage sags that could lead to cascading blackouts. The method that has been developed by the ISO-NE for dealing with this problem is to permit those generators that are designated as RMR Generators and that are uneconomic to operate to receive a subsidy for maintaining themselves in a ready state. These payments are called RMR Payments.

When a generator is designated an RMR Generator by the ISO-NE, it becomes eligible for RMR Payments, but in return must give up the opportunity to make a profit on the sale of electricity it generates. The RMR payments are intended to cover the fixed operating costs of the unit. These include property tax payments, wages and salaries, interest on inventory, but do not include any return to equity or the owners. In return, whenever an RMR Generator is called upon to operate, it is paid its marginal operating costs not the market clearing price. Thus, if the market clearing price is $85/MWh, but the RMR Generator's marginal operating costs are only $63/MWh, the RMR Generator receives only the $63/MWh for the electricity it generates.

Since the designation of a generator as an RMR Generator is specific to a region, the ISO-NE methodology assigns the obligation for recovering all RMR payments to RMR Generators in each region to consumers in that region.[2] To date, there have only been RMR Generators designated in the SW Connecticut and NEMA regions. For each of the other three regions, there is enough in-region generation and/or transmission capacity into the region to meet load obligations without the need to have any specific units operating. Thus, only consumers in SW Connecticut and NEMA have seen RMR payment obligations reflected in the prices they are charged for electricity.

All of this is about to change. The excess generating capacity in New England that has resulted from the building spree of new natural gas combined-cycle generating plants has been a boon to consumers but a bust for the generators. As with any market, the surplus capacity has depressed prices, which, in turn, has put many generators in New England in serious financial difficulty. These generators are now threatening to shutdown their facilities unless they receive RMR designation from the ISO-NE. In fact, the ISO-NE now estimates that as much as 50% of all generating units in New England will seek RMR status over the next few years if economic conditions in the energy market do not change. This will mean that all

[2] There are five RMR regions – Maine, Northeast Massachusetts (NEMA), which includes Boston and the north shore, SW Connecticut, the Rest of Connecticut and the remainder of New England known simply as Rest of Pool.

consumers, even those in regions with a surplus of capacity such as Maine, will begin to see RMR add-ons to the price of electricity[3].

As if this were not bad enough, the ISO-NE foresees an even bigger problem in the relatively near future. The same excess capacity problem means that no new generation is being proposed for New England. Of course, this is how markets are supposed to work – when supply exceeds demand, prices fall and no new companies enter the market. The problem is that electric load in New England continues to grow each year, and this increase in load growth is absorbing the excess generating capacity. This problem has already become acute in SW Connecticut and is beginning to become a concern in the NEMA region. Based on current forecasts, the surplus situation will turn to shortage as early as 2009 for the rest of New England unless load growth is curtailed or new generation is built.

And herein lies the problem. No one will build new generation given current prices in the market. Further, banks or other investors will not loan money to developers to build new generation in expectation of future high prices, since those same high prices will cause others to build generation, which will replicate the current surplus conditions and lead to financial difficulties and bankruptcies. The generators and their bankers are following the old adage – "once burned, twice shy".

The ISO-NE is concerned that this is setting the stage in New England for a possible repeat of the energy market catastrophe that occurred in California in 2000. There, a shortage of generation created an opportunity for generators to capitalize on the shortage conditions and raise prices for all consumers, causing billions of dollars to flow from consumers to generators. This is something the ISO-NE desperately seeks to avoid; however, it can only be avoided by increasing the amount of generating capacity in the New England and especially in those regions that face the most serious shortage potentials.

The fundamental problem can be best stated as how to maintain an electricity market that has simultaneously excess generating capacity (needed to ensure system stability and reliability) and a price for that capacity that is large enough to provide the financial incentive for new capacity to be developed to meet load growth. Those who have taken even the most fundamental courses in economics will recognize immediately the inherent contradiction in this objective – a true competitive market cannot have excess capacity as well as a price high enough to support new entry.[4]

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[3] Because these changes have occurred during a period of rapidly rising natural gas prices (in part caused by the building spree of the 1990s), the benefit to consumers of low capacity costs has been masked by rising energy prices.

[4] As noted earlier, in most commodity markets, capacity shortages and excesses are buffered by storage and inventory – an option that is simply not available in electricity markets. In addition, consumers are much less responsive to price signals in the electricity market than they are to price signals in other commodity markets, given the essential nature of electricity consumption.

To finesse this contradiction, the ISO-NE has proposed to create an artificial market for capacity in which the price of capacity is regulated based on the amount of excess capacity or shortage of capacity that exists each year. This artificial market is known as Locational Installed Capability or LICAP

LICAP works as follows. First, the ISO-NE determines what the installed cost of adding new capacity is in each of the regions in New England. (Recall that the regions are Maine, NEMA, SW Connecticut, Rest of Connecticut and Rest of Pool.) This cost is then expressed in terms of $/kW month. Second, the ISO-NE determines the required amount of generation necessary to meet load in each of the regions and the actual amount of generation available in each region. The point at which the required and actual amounts of generation are in balance is the equilibrium point, and the ISO-NE sets the price for LICAP in the region equal to the cost of new entry. As the actual amount of generation increases above the required amount, the ISO-NE lowers the price of LICAP below the cost of new entry until the price reaches zero at the point where there is 15% excess capacity in the market. Similarly, as the actual amount of generation falls below the required amount, the ISO-NE raises the price of LICAP up to a point where the price is equal to twice the cost of new entry.

The ISO-NE will set the price each month as described above. Each consumer will have a LICAP obligation based on a formula that relates its usage to the total usage in the region during peak demand hours. Consumers will be able to satisfy their obligations through bilateral LICAP contracts with generators or by purchases of LICAP from the ISO-NE at the established prices in each region.[5]

The ISO-NE believes that LICAP will have a number of beneficial consequences for the electric grid in New England. First, LICAP will provide a price signal to generator developers that will stimulate new generator construction when a shortage begins to emerge. Second, LICAP will provide developers – and more importantly, their bankers and investors – with more certainty that they will be compensated for building generation, even if the market has some excess capacity.[6] This will also act as a stimulus for new generation development to prevent potential shortage situations. And third, LICAP will replace most (although probably not all) RMR Payments. Since the price of LICAP will be highest where capacity shortages exist, payments to generators in these regions, including RMR Generators, will be higher. These LICAP payments should be adequate to keep most RMR Generators operational; further, by having higher LICAP prices in regions with more RMR Generators, the market will respond by targeting new generation in these regions.

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[5] The LICAP obligations for most consumers will be met by their competitive electricity suppliers with the cost either embedded in the price of electricity or treated as a pass-through cost to the consumer.

[6] Of course, if there is a lot of excess capacity (in excess of 15% of target levels), the LICAP price will be zero.

Now that we have discussed RMR Payments and LICAP in general, let's turn to what each of these systems is costing and, more importantly, what each system is projected to cost consumers throughout New England.[7]

We turn first to RMR Payments. By mid-2004, the ISO-NE had identified only a handful of generators as RMR Generators and had entered into RMR Contracts with these generators totaling $172 million a year. By the end of 2004, the total value of RMR Contracts that had been approved or that were pending had risen to $367 million a year. The RMR Generators included in these contracts were in NEMA (Salem, New Boston and Kendall generating stations – totaling 1,248 MW of capacity) and Connecticut (New Haven Harbor, Bridgeport Harbor, Milford, Devon 11-14, Middletown and Montville generating stations – totaling 2,449 MW). In addition, the ISO-NE has new requests for RMR designation for more than 2,400 MW, and expects that over the next 4-5 years, assuming that there is no LICAP market implemented, the total amount of RMR Generator capacity will approach 15,000 MW or almost 50% of all generation capacity in New England. These will include units in Maine.

As is shown on the table below titled ISO-NE – Projections – RMR Costs by Region, the costs to consumers for these RMR Contracts will become increasingly expensive and will exceed $1 billion a year by 2009. The bulk of this cost is initially confined to NEMA and SW Connecticut where the more severe capacity shortages first emerge, but ultimately, over the 5 year period, all regions are projected to incur RMR cost obligations. The RMR costs shown in this table are for the "Mid-Case Scenario". If there is higher load growth in the region or if certain projected transmission and generation projects are not completed, the costs to consumers could be even higher.

[7] The final structure of LICAP has not yet been approved by the Federal Energy Regulatory Commission ("FERC"). Accordingly, no definitive estimates of LICAP costs can be made until FERC issues its final order implementing LICAP. In the meantime, we are able to report only those estimates of LICAP costs that have been made by the ISO-NE based on implementation of the LICAP market as its has proposed. We believe that FERC is likely to accept most of the definitions and structure of LICAP as has been proposed by the ISO-NE, and therefore, we believe that the ISO-NE estimates are good estimates of LICAP costs.

## ISO-NE
## Projections - RMR Costs by Region
## Mid Case Scenario

| | 2005/6 | 2006/7 | 2007/8 | 2008/9 | 2009/10 |
|---|---|---|---|---|---|
| SWCT | $168 | $225 | $282 | $339 | $339 |
| Rest of CT | $72 | $115 | $158 | $200 | $200 |
| NEMA | $128 | $224 | $320 | $415 | $415 |
| Rest of Pool | $0 | $118 | $236 | $354 | $354 |
| Maine | $0 | $20 | $39 | $59 | $59 |
| TOTAL - NEPOOL | $368 | $702 | $1,035 | $1,367 | $1,367 |

Note: Figures are in million of dollars

The ISO-NE projections for LICAP costs are higher than those for RMR Contracts, as shown in the table below. This table includes a column titled "Base – Incl. 2004 RMR plus Market". This is the amount of capacity related costs that are being collected under the current system, which includes the RMR payments noted above plus very small capacity payments under the existing system. Maine consumers, for example, paid approximately $16 million during 2004 in capacity payments to generators under the current market structure. Since Maine made no RMR Payments in 2004, the $16 million is a measure of the current value of capacity in the Maine region today.

## ISO-NE
## Projections - LICAP Costs by Region
## Mid Case Scenario

| | Base - Incl. 2004 RMR plus Market | 2005/6 | 2006 | 2007 | 2008 | 2009 | 2010 |
|---|---|---|---|---|---|---|---|
| SWCT | $70 | $176 | $230 | $279 | $323 | $225 | $280 |
| Rest of CT | $122 | $112 | $163 | $260 | $300 | $209 | $260 |
| NEMA | $79 | $116 | $194 | $317 | $324 | $317 | $394 |
| Rest of Pool | $96 | $227 | $404 | $730 | $744 | $728 | $906 |
| Maine | $16 | $38 | $67 | $121 | $124 | $121 | $151 |
| TOTAL - NEPOOL | $383 | $669 | $1,058 | $1,707 | $1,815 | $1,600 | $1,991 |

Note: Figures are in million of dollars

Under the LICAP system, Maine consumers will see their capacity cost obligations increase by a factor of four in 2006, then almost double again in 2007. To put this 2007 figure in perspective, on a cents per kWh basis it translates into an average cost increase of 1.1 cents per kWh or about $55 per year for the average Maine residential consumer. By 2010, this amount has increased to about 1.4 cents per kWh or about $70 a year.

The table below shows the prices for LICAP in each of the zones for each of the next 5 years that are forecasted by the ISO-NE based on its mid case estimates of load growth and changes in generation capacity in New England during this same period. These prices are expressed in the standard unit for this product, which is $/kW/Month. The way to convert these figures to the more commonly understood unit of $/kWh is to multiply the figure in the table by the consumer's maximum demand for a month, then divide this by the total kWhs used that month. Thus, for a commercial customer that has a demand equal to 225 kW and a monthly usage of 82,500 kWhs, the price in Maine in 2008 would be computed as follows:

($5.11 x 225 kW) / 82,500 kWhs = $0.0139/kWh or 1.39 cents/kWh

**ISO-NE**
**Projections - LICAP Costs by Region**
**Mid Case Scenario**

| | 2006 | 2007 | 2008 | 2009 | 2020 |
|---|---|---|---|---|---|
| **SWCT** | $6.53 | $6.58 | $7.67 | $4.95 | $6.03 |
| **Rest of CT** | $4.35 | $6.58 | $7.68 | $4.95 | $6.02 |
| **NEMA** | $3.56 | $5.07 | $5.11 | $4.94 | $6.02 |
| **Rest of Pool** | $3.01 | $5.07 | $5.10 | $4.94 | $6.02 |
| **Maine** | $3.01 | $5.07 | $5.11 | $4.94 | $6.03 |

Note: Figures are $/kW/Month

As the capacity market tightens in New England and each region begins to approach an equilibrium level where the amount of generating capacity available in the region is equal to the required amount necessary to maintain stability and reliability on the electric grid, the price for LICAP will increase to around $8.00/kW/Month. For the same customer noted above, this translates into about 2.18 cents per kWh.

**Final Thoughts**

We need to stress that, until LICAP is approved by the FERC and implemented by the ISO-NE, the figures presented in this paper must remain estimates only. As of this date, FERC has bowed to political pressure from New England Senators, Congressmen, Governors and Regulators and voted to postpone the implementation date from January 1, 2006 to October 1, 2006 in order to give the LICAP proposal additional scrutiny.

Changes in the proposed structure of LICAP or in key parameters that effect how the amount of existing generation capacity is measured, for example, will change the cost estimates presented in the tables above. However, while the cost estimates may change, the fundamental concern about capacity adequacy in New England and the long-term stability and reliability of the electric grid and the requirement that consumers bear the costs of ensuring this stability and reliability will not change.

We will update this report as necessary to reflect the best information we are able to obtain regarding changes in capacity markets and the impacts these changes are likely to have on consumers throughout all regions in New England.

We hope that you find this report useful. We welcome your comments about how we can make it more useful to you.