Synapse
Energy Economics, Inc.

Wholesale Natural Gas Prices in New England

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1. Executive Summary

This report presents a short discussion of trends in wholesale natural gas prices in New England as of June 2008, and of the implications of those trends for wholesale electricity prices and retail electricity prices in Massachusetts. Synapse Energy Economics (Synapse) prepared this report for the Office of Attorney General for the Commonwealth of Massachusetts under its umbrella contract for consulting services.

The report begins by presenting trends in wholesale natural gas prices in New England, both in the short-term and the long-term, and discussing the factors driving those trends. (We consider the short-term to encompass the last few years and the next two to three years; while the long-term covers the past three to ten years and the future three to ten years). The report then discusses the impacts of these trends in wholesale natural gas prices on wholesale electricity prices in New England and concludes by discussing the impacts of these trends on retail electricity prices in Massachusetts.

The wholesale price of gas in New England can be represented as the Henry Hub price plus a "basis" differential. The basis differential is relatively stable, high in winter and low in summer. The average basis differential to New England in 2007 was about $1.30 MMBtu.

The Henry Hub price is the largest and most volatile component of the wholesale price of gas in New England. In 2007 the Henry Hub price averaged approximately $7/MMBtu. In recent months that price has risen to the $10/MMBtu to $12/MMBtu range, and is expected to remain at that range through at least 2010. The increase in Henry Hub price, relative to 2007 levels, is attributed to distribution utilities acquiring more gas to refill storage, electric generators using more gas to produce electricity, a decline in imports, and higher oil product prices.

In the long-term the average annual price of gas at the Henry Hub is projected to stabilize somewhere between $7 to $8/MMBtu on the low end and $10 to $12/MMBtu on the high end. These price expectations are driven primarily by projected declines in traditional sources of natural gas supply and increased reliance upon gas from onshore unconventional sources, Alaska, and LNG imports. If generators use much more gas to generate electricity than the EIA is projecting in AEO 2008, future consumption will be materially greater, supplies tighter and Henry Hub prices potentially higher. More detail on the structure and operation of the natural gas market in New England, and the factors driving prices in the long-term, can be found in *Avoided Energy Supply Costs in New England 2007 Final Report,* (AESC 2007) completed in August 2007 by a project team led by Synapse.[1] The most recent long-term national and regional projections by the Energy Information Administration (EIA) can be found in Annual Energy Outlook 2008 (AEO 2008).[2]

Wholesale natural gas prices drive, and are expected to continue to drive, wholesale electricity prices in New England because of the region's dependence on natural gas for

[1] Available in PDF format at http://www.synapse-energy.com/Downloads/SynapseReport.2007-08.AESC.Avoided-Energy-Supply-Costs-2007.07-019.pdf

[2] available in PDF format at http://www.eia.doe.gov/oiaf/aeo/index.html

electricity supply. In turn, wholesale electricity prices in New England drive retail electricity prices in Massachusetts. Our analyses indicate that a $1/MMBtu increase in wholesale natural gas prices typically lead to a $0.77 cents/kWh increase in wholesale electric energy prices. Based upon that relationship, and the residential load shaping premium reflected in the generation service component of residential retail rates, a $1/MMBtu change in wholesale natural gas prices would lead to an approximate $0.85 cents/kWh change in residential retail rates in Massachusetts. However, it is important to note that changes in wholesale natural gas prices do not lead to immediate changes in residential retail rates because of the multi-month procurement process followed to acquire supply for generation service.

2. Trends in New England Wholesale Natural Gas Prices

Background

Wholesale natural gas prices in New England consist of two components. First, and largest, is the wholesale commodity price of gas in the North American market. This component is typically reported as the "Henry Hub" price. Second, and smaller, is the "basis" or differential between the wholesale price of gas at the Henry Hub and the wholesale price of gas in New England.

Henry Hub Price. Unlike the wholesale market for electricity in New England, which is regional in scope, the wholesale market for natural gas is North American in scope. Wholesale prices at each major producing area and market area in the United States, Canada, and Mexico are highly correlated. In particular, prices at most, if not all, of these locations can be linked to prices at the Henry Hub. The Henry Hub, located in Louisiana, is the intersection of more than a dozen interstate pipelines. It is the most liquid trading hub in North America and has the longest history of public trading on the New York Mercantile Exchange ("NYMEX").

Basis Differential. Market prices of gas in other regions reflect Henry Hub prices with an adjustment for their location, referred to as a basis differential. A basis differential is defined as the natural gas price in a market location minus the gas price at the Henry Hub.

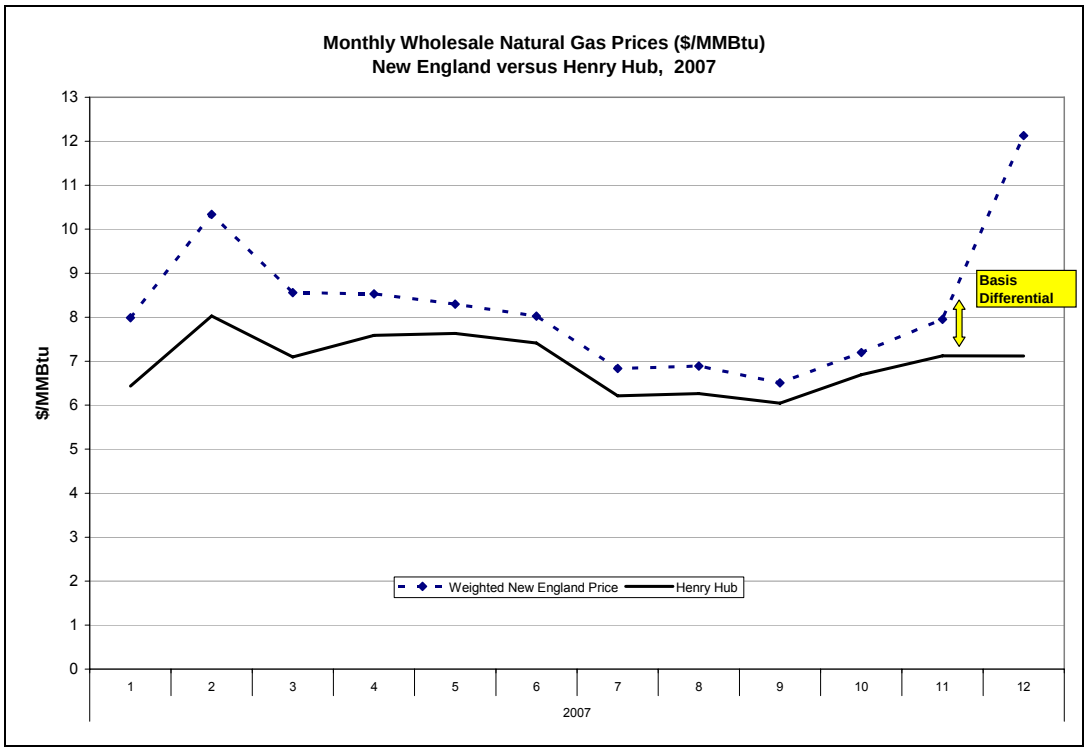
Figure 1 presents the relative magnitude and variation of each component by month in 2007. The average annual Henry Hub price[3] was approximately $7.00/MMBtu during 2007. The monthly Henry Hub price varied relatively little by month, in the order of +/- 10% of the annual average or less. In contrast, the average annual basis differential to New England was only about $1.30/MMBtu in 2007. However, that differential varied substantially between winter months and summer months. In winter months,[4] the basis

[3] Prices in this chart are monthly averages of daily prices reported by Intercontinental Exchange (ICE).

[4] In the gas industry winter months are typically defined as November through March.

differential is quite high, reflecting the market value of natural gas in New England when demand is high relative to pipeline capacity. In contrast, the basis differential is much lower in the summer months, usually reflecting the variable pipeline transportation costs to deliver natural gas to the region.

Figure 1. Monthly Wholesale Natural Gas Prices



The balance of this report focuses on trends in Henry Hub prices in both the short-term and long-term. We do not expect the New England basis differential to change materially in the short-term or long-term for the reasons presented on pages 2-15 to 2-19 of AESC 2007.

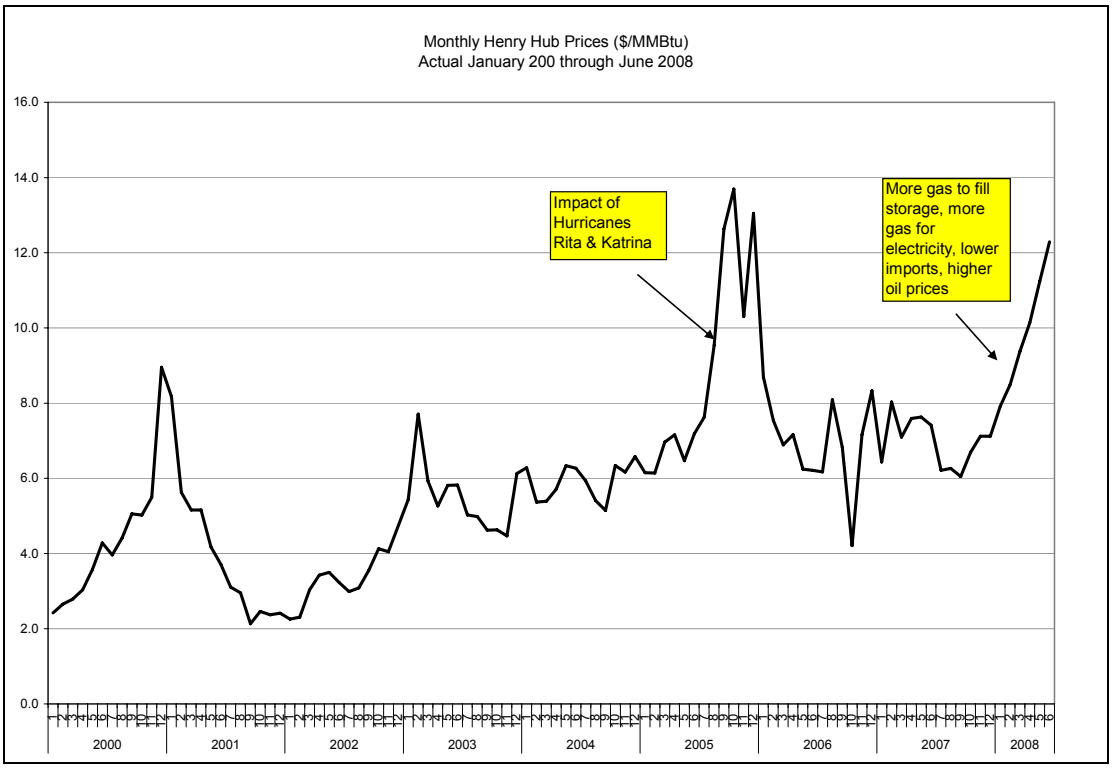
Short-Term Trends in Wholesale Natural Gas Prices and Underlying Factors

The monthly price of gas at the Henry Hub in the short-term tends to be more volatile and more difficult to forecast than the annual price of gas at the Henry Hub in the long-term.

Both sets of prices are driven by demand and supply, but the monthly price is driven by short-term changes in demand and supply in addition to the long-term trends in demand and supply driving long-term annual prices.

The impacts of short-term changes in demand and supply on monthly prices can be seen as price spikes in Figure 2. This figure, which shows monthly prices at the Henry Hub from January 2000 through June 2008, exhibits at least three periods of major spikes in monthly prices. The first spike occurred in Fall 2000/Spring 2001. It was driven, in part, by an unexpectedly large increase in gas use for electricity generation, particularly on the U.S. West Coast. The second spike, in Fall 2005/Spring 2006, was driven by a large reduction in gas production due to the impacts of Hurricanes Rita and Katrina. The third spike started in early 2008 and is expected to continue for several months.

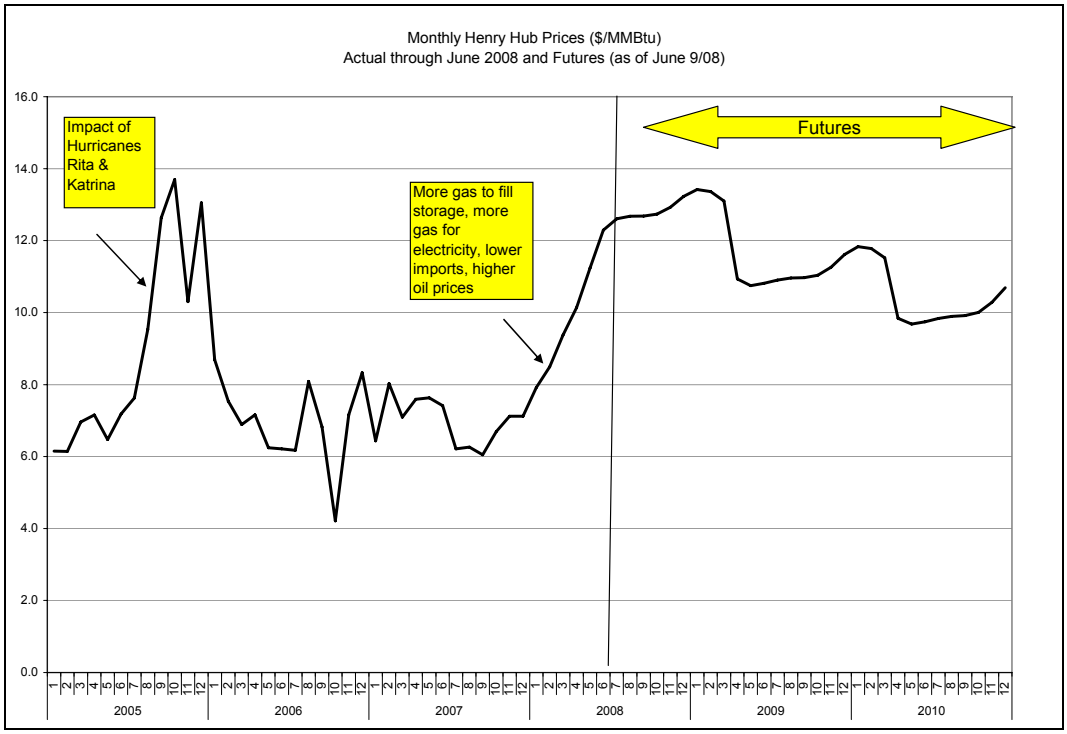
Figure 2. Monthly Henry Hub Prices January 2000 through June 2008



The current spike or run-up in monthly prices is illustrated in Figure 3, which shows actual monthly prices through June 2008 and "futures" prices for natural gas from NYMEX as of June 9, 2008. Analysts at FERC[5] and elsewhere[6] attribute this increase to four changes relative to last summer:

- distribution utilities used more gas from storage this past winter than the winter of 2006/2007, and therefore will need to acquire more gas to refill storage this summer as compared to 2007;
- electric utilities are expected to use more gas to produce electricity this summer as compared to 2007;
- imports are less this year than last year, particularly by pipeline from Canada and by LNG tanker from elsewhere;
- oil prices are almost 100 percent higher, providing a lot of "head room" for gas prices relative to distillate prices in the space heating market.

Figure 3. Monthly Henry Hub Prices through June 2008 and Futures



[5] FERC, *Summer Market and Reliability Assessment,* presentation to Commission, May 15, 2008.

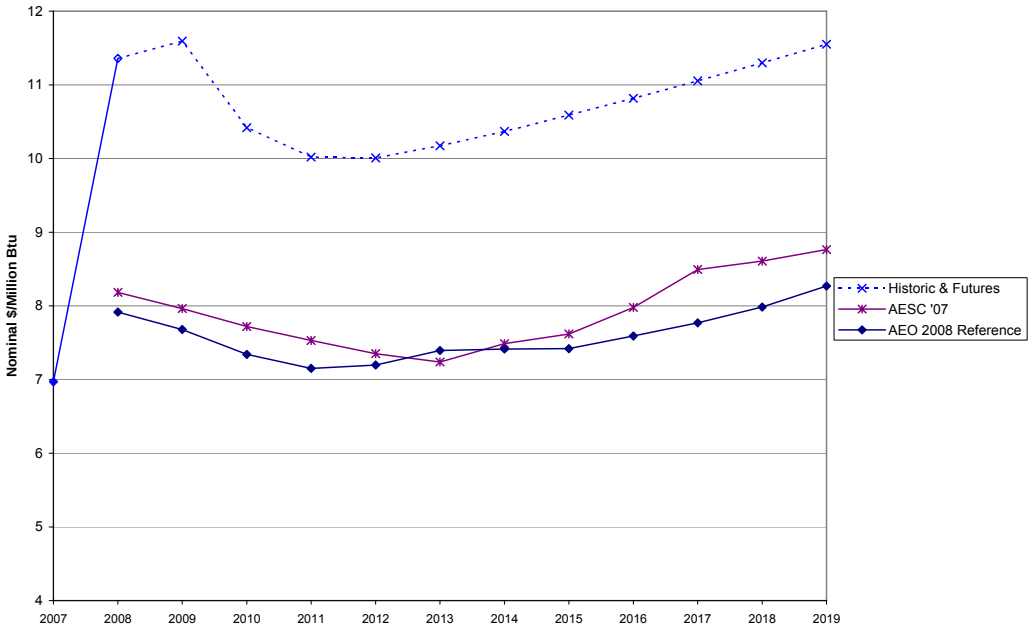
[6] Ron Denhardt, Strategic Energy & Economic Research Inc., as reported in Foster Natural Gas Report, May 16, 2008, page 26.

As indicated in Figure 3, market participants currently expect Henry Hub prices to remain in the range of $10/MMBtu to $12/MMBtu through at least 2010. In comparison, the Henry Hub price in 2007 was approximately $7/MMBtu.

Long-Term Trends in Wholesale Natural Gas Prices and Underlying Factors

Futures prices on NYMEX beyond 2010 indicate that market participants currently expect Henry Hub prices to remain in the $10/MMBtu range through 2019. However, one cannot place a lot of confidence in futures prices beyond a few years, since the volumes traded drop off substantially after about three years. Other estimates of long-term prices are in the $7 to $8/MMBtu range, as shown in Figure 4.

Figure 4. Annual Henry Hub Prices ($MMBtu) Futures (6/9/08), AESC 2007, AEO 2008



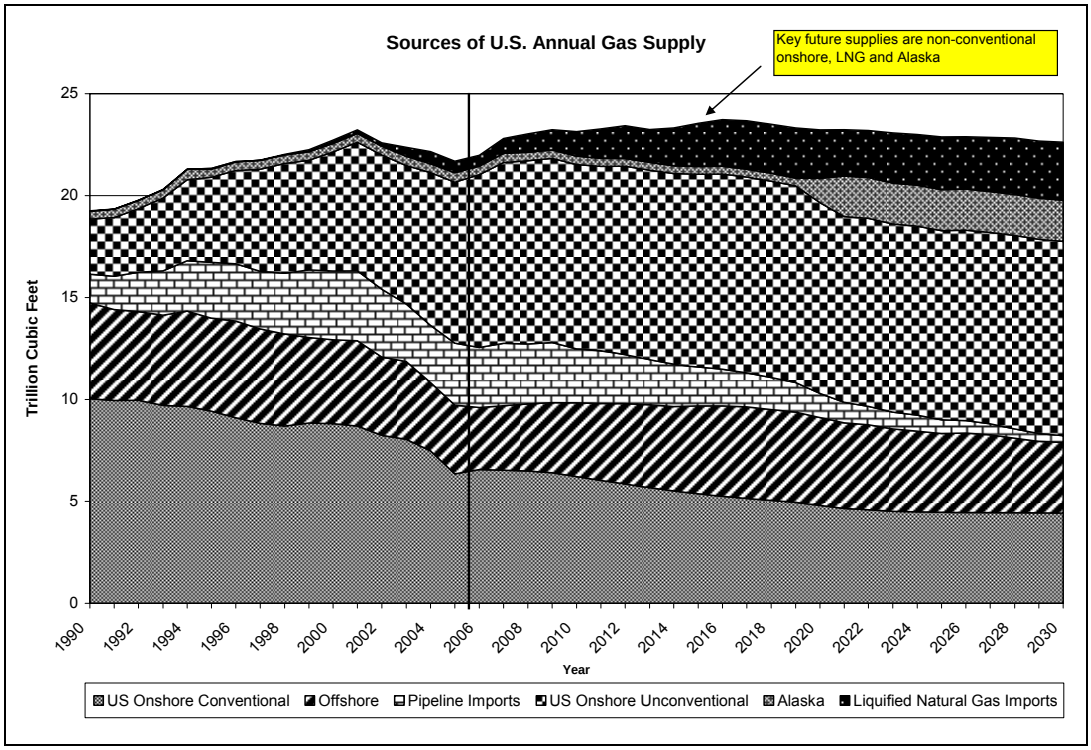
These projections indicate that, in the long-term, the price of gas at the Henry Hub is expected to stabilize somewhere between the record high levels seen over the past several years and an even higher level. These price expectations are driven primarily by concerns regarding the availability and cost of natural gas supplies in the future.

Annual gas consumption in the United States is met by supplies from six major sources. These are:

- onshore natural gas fields, referred to as "onshore conventional;"
- offshore natural gas fields;
- imports by pipeline, the vast majority of which are from Canada;[7]
- onshore supplies from "non-conventional" sources such as coalbed methane, gas shales and tight sandstone;
- gas produced in Alaska;
- and imports via LNG.

Supply from the first three of these sources has been declining as reserves deplete and is projected to continue to decline. Thus, in order to meet current levels of annual consumption, additional gas will have to come from onshore unconventional sources, Alaska, and LNG imports. Gas from each of these three sources will be more expensive than gas from the first three sources. The changes in the mix of annual gas supply to meet annual U.S. gas consumption is presented in Figure 5. This projection is drawn from data in EIA AEO 2008.[8]

Figure 5. Sources of U.S. Annual Gas Supply



[7] Other sources of pipeline imports are gas produced in Mexico and regasified LNG by pipeline from the Bahamas.

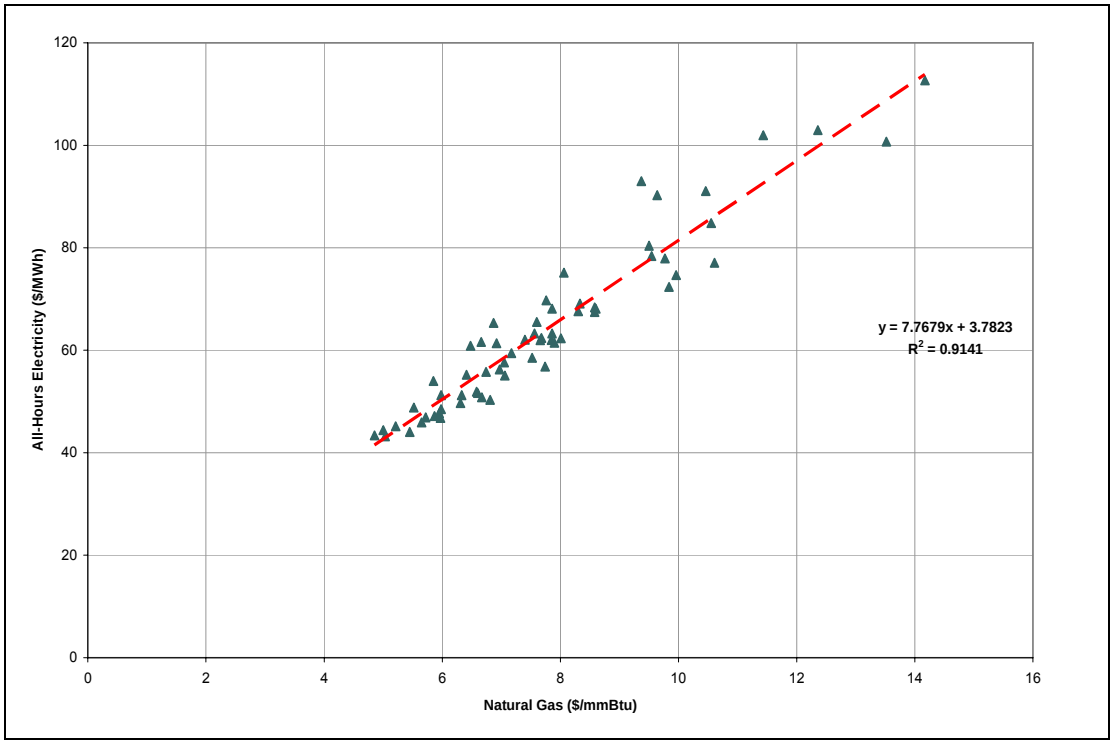
[8] Other references to supply constraints can be found at Committee on Global Oil and Gas, "Facing the Hard Truths about Energy", National Petroleum Council, July 2007, p.137 and at Natural Gas Division, "Canadian Natural Gas Review of 2006 & Outlook to 2010", Natural Resources Canada, December 2007, pp. 2-3.

One of the major uncertainties regarding projections of the future price of natural gas arises from the impending implementation of carbon emission regulation, and the strategies the electricity sector will follow to comply with those regulations. In theory, it is possible that natural gas consumption could be higher under a particular CO2 emission regulation compliance strategy than it would be under the EIA AEO 2008 Reference case and, as a result, natural gas prices might be expected to be higher under that compliance strategy than they would be under the AEO 2008 Reference Case. However, the future consumption, supply and price of natural gas will depend on a number of factors, some of which will tend to increase annual natural gas use and some of which will tend to decrease that use. These factors include the incremental quantity of electricity produced from natural gas generating units as a result of the higher coal-plant operating costs due to CO2 emission allowance prices, the additional energy efficiency and renewable alternatives that become economic and are added to the U.S. system, the incremental quantities of natural gas imports and world prices for LNG. In fact, current uncertainty around projections of future prices of natural gas under the AEO 2008 Reference Case, as indicated in Figure 4, far exceed the uncertainty regarding the incremental impact on natural gas prices of incremental gas consumption under a particular carbon regulation compliance strategy according to our analyses of published forecasts.

3. Impact of Wholesale Natural Gas Prices on Wholesale Electricity Prices in New England

There is a strong correlation between the prices of wholesale natural gas and wholesale electricity in New England. That correlation, which is a function of the region's dependence on natural gas for electricity supply, is presented in Figure 6.[9]

Figure 6. Correlation between Wholesale Electricity and Natural Gas Prices in New England

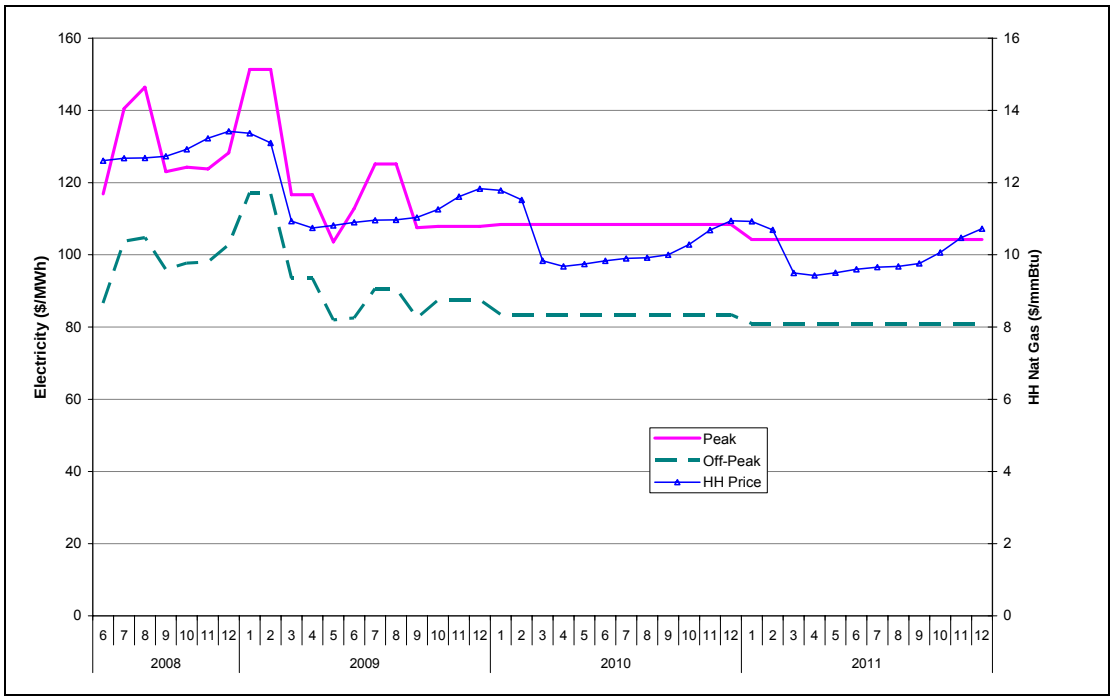


The region's dependence on natural gas for electricity supply drives wholesale electricity prices because wholesale electricity prices in New England are set in each hour by the cost of electricity from the last, or marginal, unit dispatched in that hour to meet the last unit of energy load in that hour. In New England, natural gas units are "on the margin" in the vast majority of the hours each year.[10] Scenario analyses prepared by ISO-New England indicate that the region's high dependence on natural gas-fired units will most likely continue for at least another decade.

[9] Monthly wholesale electricity prices at the New England Hub from ISO-NE and natural gas prices for electric generation in Massachusetts from EIA Electric Power Monthly for the period March 2003 through May 2008.

[10] ISO-NE "2007 Annual Markets Report" section 2.4.2.1 indicates that natural gas and oil accounted for ~80% of the marginal resources during 2007.

Figure 7. NYMEX Futures for Wholesale Electricity and Henry Hub Gas (6/9/08)[11]



Wholesale natural gas prices drive, and are expected to continue to drive, wholesale electricity prices in New England because of the region's dependence on natural gas for electricity supply. The futures anticipate all-hours electricity prices of $105/MWh in 2009 and $95/MWh in 2010. For comparison, wholesale electricity prices averaged $60.50/MWh in 2006 and $67.60/MWh in 2007.

4. Impact of Wholesale Natural Gas Prices on Retail Electricity Prices in New England

Composition of Retail Electricity Prices in Massachusetts

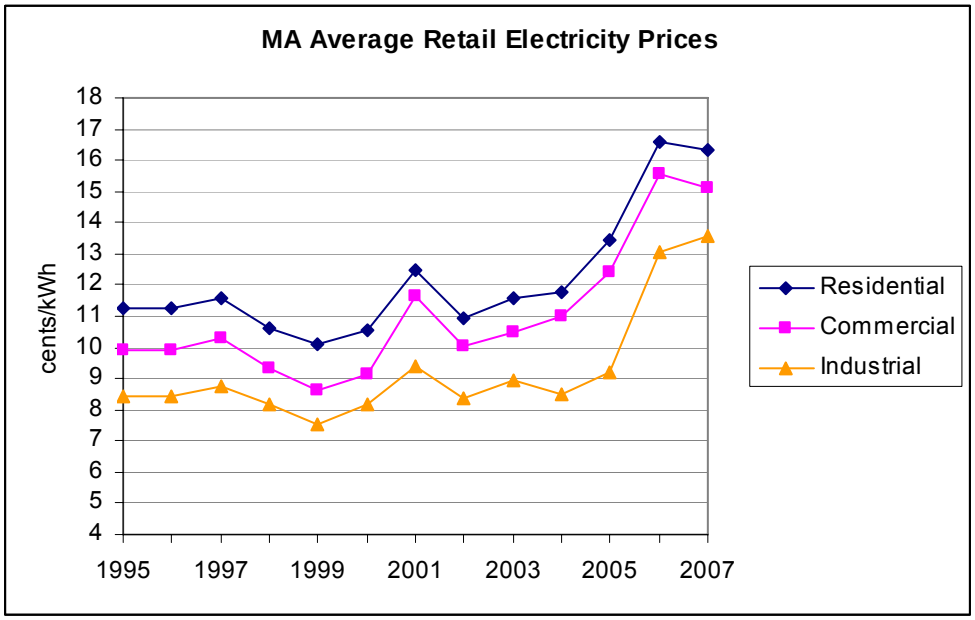
Retail electricity prices differ by customer class. These prices recover the costs of two basic services, Generation and Transmission + Distribution (T&D). When the retail market in Massachusetts was restructured in 1998, generation service was "unbundled" from T&D service. The costs of generation service include wholesale electric energy costs, ancillary service costs, capacity costs, risk management costs and supplier profit margins. The costs for T&D services include transmission, distribution, transition, utility management and conservation program costs.

After restructuring, customers were allowed to "shop" for a generation service provider at market prices. In contrast, T&D services remained as regulated services provided at cost-of-service based rates.

[11] Future electricity prices represent swaps at the ISO-NE Hub.

Figure 8 shows annual average retail electricity prices by rate class in Massachusetts from 1995 through 2007. Those average prices remained relatively stable from 1995 to 2005 and then increased sharply in 2006.

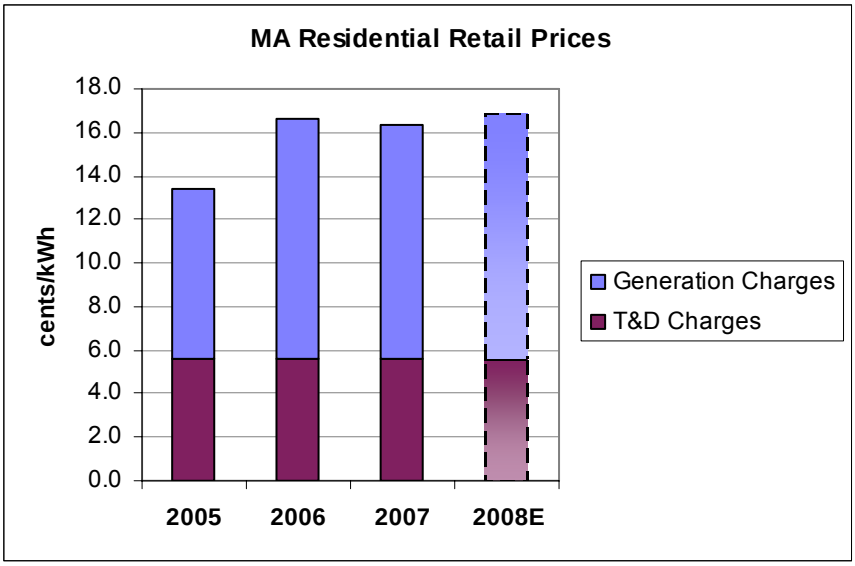
Figure 8. Average Annual Retail Electricity Prices in Massachusetts, 1995-2007



Between 1998 and 2005 customers who did not "shop" acquired service through "Standard Offer Service" (SOS). The generation component of SOS prices was set administratively and capped. In 2006, SOS was terminated and customers still on that service, e.g., most residential customers, were transferred to Default Service. The generation component of Default Service prices is no longer capped, and hence reflects the full cost of acquiring generation service from the wholesale electricity market. Thus 2006 was the first year that customers who had been on SOS, including most residential customers, were fully exposed to the market prices for generation service.

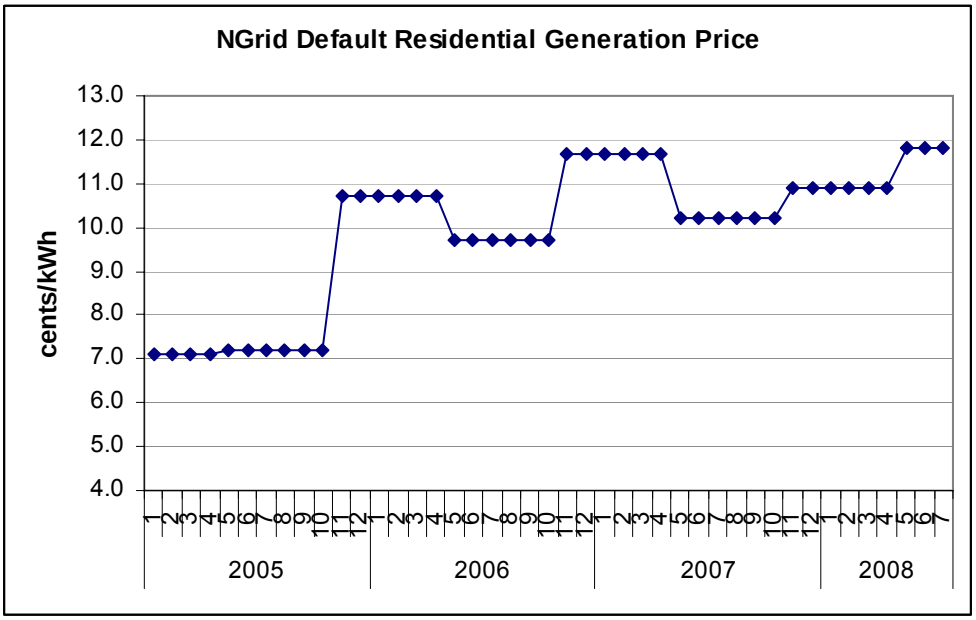
The move from capped prices to market prices for the generation service component of retail prices led to large increases in average retail prices from 2005 to 2006. For example, Figure 9 illustrates the composition of Massachusetts residential retail prices since 2005. Since the move to market prices, charges for generation service represent two-thirds of average residential retail prices. T&D service charges represent the remaining one-third.

Figure 9. Average Annual Retail Electricity Prices in Massachusetts by Component, 2005-2008



This generation component of Default Service prices varies slightly from one distribution company to another. In Figure 10 we plot data for NGRID to show the considerable increase in the generation service charge since 2005. In 2005, the average generation charge was 7.76 cents/kWh. By 2007, this charge had increased to 10.81 cents/kWh. The overall increase was 3.06 cents/kWh. This increase in NGRID rates closely corresponds to the change in average retail prices for Massachusetts over that period.

Figure 10. Generation Component of Residential Default Service, NGRID, 2005-2008



Retail Electricity Prices versus Wholesale Natural Gas Prices

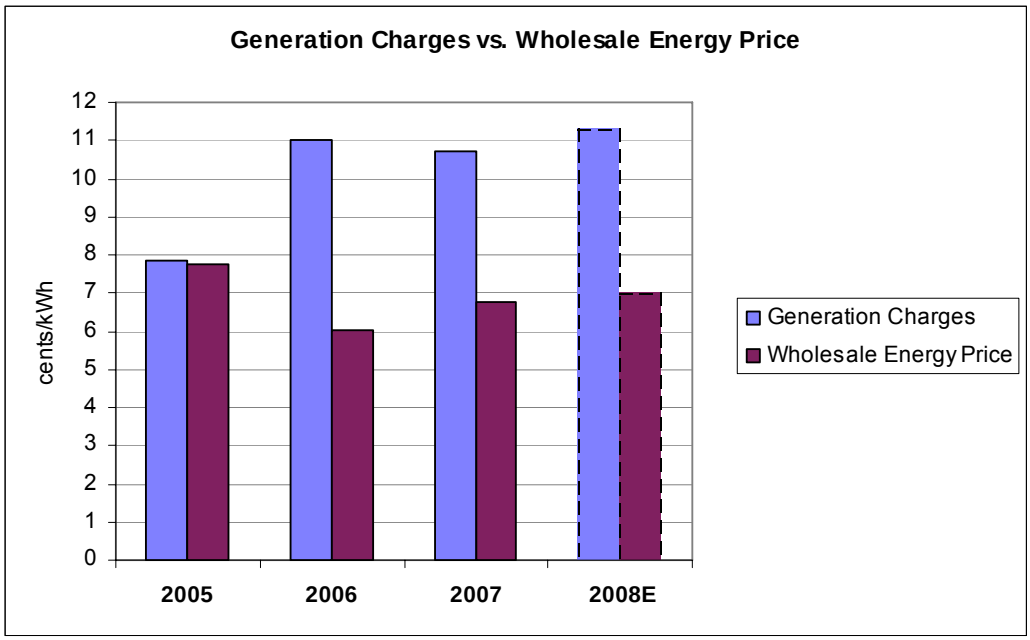
The relationship between retail electricity prices versus wholesale natural gas prices is a function of the following two relationships:

- wholesale electricity prices and wholesale natural gas prices, and
- the generation service component of retail electricity prices and wholesale electricity prices.

Our analyses in Chapter 3 indicate that a $1/MMBtu increase in wholesale natural gas prices typically lead to a $0.77 cents/kWh increase in wholesale electric energy prices. In this section we examine the second relationship, i.e., the generation service component of retail electricity prices as a function of wholesale electricity prices.

In Figure 11 we compare annual average residential generation charges to annual average wholesale electric energy prices from 2005 through 2008. The data for 2005 is not informative as generation service charges were still capped in that year. Since the switch to Default Service in 2006, the generation charges in retail rates have been considerably higher than wholesale energy prices. In 2006 and 2007, the average wholesale electric energy price represents only about 60% of the generation charge.

Figure 11. Annual Average Generation Component of Residential Rates Versus Annual Average Wholesale Electricity Energy Prices, 2005 through 2008

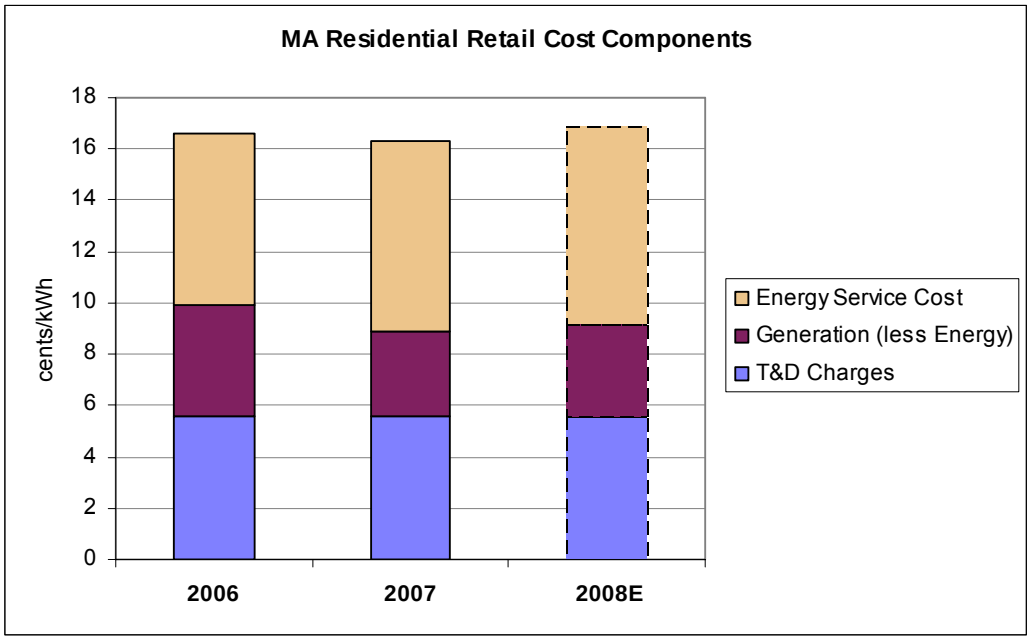


Generation charges in retail rates are higher than average annual wholesale energy prices for several reasons. First, there is a "load shape premium". This premium reflects the difference between serving a flat load, e.g., 1 kWh in each hour of the year, which results in a simple annual average wholesale electricity price, and acquiring varying quantities of kWh in each hour reflecting the shape of residential customer actual load, i.e. a "load-weighted" annual price. Second, there are distribution losses

such that some of the purchased wholesale energy is lost before getting to the customers. This premium depends on many factors and varies by service territory and customer class. Based on analysis of retail loads in Massachusetts and studies in other states we estimate that the premium for residential loads is about 10% of the simple average annual wholesale electric energy price. Thus a 1 cent/kWh increase in the average wholesale energy price will lead to an increase in residential retail generation charges of 1.1 cents/kWh.

Figure 12 summarizes the components of average annual residential retail prices in Massachusetts, distinguishing between electric energy service costs reflecting the retail premium, other generation service costs, and T&D costs. At the present time, electric energy service costs reflecting this premium represent about 45% of total annual residential average retail prices.

Figure 12. Average Annual Residential Retail Prices in Massachusetts by Major Component, 2006-2008



Conclusion

Our analyses in Chapter 3 indicate that a $1/MMBtu increase in natural gas prices would increase the wholesale energy price by 0.77 cents/kWh. Applying our estimated load shaping premium for residential customer loads to that relationship indicates that a $1/MMBtu change in natural gas prices would change average annual residential retail prices by about $0.85 cents/kWh. However, a change in wholesale natural gas prices will not lead to an immediate change in residential retail rates because of the multi-month procurement process followed to acquire supply for generation service.