

Comparison of Predicted Energy Futures: A comparison of AEO2010 with AEO2011

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The U.S. Energy Information Agency (EIA) prepares an Annual Energy Outlook (AEO) predicting future energy usage by sector and fuel. The AEO presents long-term projections of energy supply, demand, and prices based on results from EIA's National Energy Modeling System (NEMS). NEMS projects the production, imports, conversion, consumption, and prices of energy, subject to assumptions on macroeconomic and financial factors, world energy markets, resource availability and costs, behavioral and technological choice criteria, energy technology cost and performance characteristics, and demographics.

MARAMA is estimating future air pollutant emissions for the years 2017 and 2020. The emissions inventory will support a single integrated, one-atmosphere air quality modeling platform to support State air quality attainment demonstrations. For future projections MARAMA initially used the AEO2010 to estimate change in activity for source categories that burn fuel. AEO2010 was published in May, 2010 (EIA 2010). AEO2010 projections are based on Federal, State, and local laws and regulations in effect as of the end of October 2009. Since the inventory was finalized a new AEO has been released by EIA which relies on information through October 2010. Some important changes have occurred in energy outlook between October 2009 and October 2010. It is important to determine if these changes will impact our future inventories. Though the primary focus lies on years 2017 and 2020, the overall change of the graph is of interest.

This work was undertaken to compare AEO2010 to the recently released AEO2011 to determine what differences exist between the growth scenarios. The difference in expected percent change in fuel usage between 2010 and 2011 was calculated for a variety of fuels and sectors. A negative value indicates that AEO2010 predicted growth is higher than AEO2011.

For this report, Residential, Commercial, Industrial, Transportation, and Electric Power were each reviewed for changes between AEO2010 and AEO2011. Fuel types including distillate fuel oil, residual fuel oil, coal, natural gas, and renewable resources were considered. The regions examined include New England (Includes: CT, ME, MA, NH, RI, and VT), Mid-Atlantic (Includes: PA, MD, DE, DC, WV, and VA) and South Atlantic (Includes: AL, FL, GA, KY, MI, NC, SC, and TN).

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To facilitate the analysis, this report identifies thresholds for what constitutes a major change as follows:

- An increase or decrease of 1% or less is considered to be no change and is not discussed in this report, and is marked on the graphs by a blue color and ends in a “square dot” line
- An increase or decrease of between 1% and 5% is considered to be a minor change, and is marked on the graphs by a green color and ends in a “long dash dot” line;
- An increase or decrease above 5% is considered a major change, and is marked on the graphs by a red color.

Table 1 summarizes the changes observed by fuel type and sector at the year 2020. The sector and fuel combinations with major changes include

New England - Industrial/Natural gas – Major increase
 New England – Electric Power/ Natural Gas – Major increase
 New England – Electric Power/ Coal – Major decrease
 New England – Electric Power/ Renewable energy – Major decrease
 Mid-Atlantic – Electric Power/ Natural Gas – Major increase

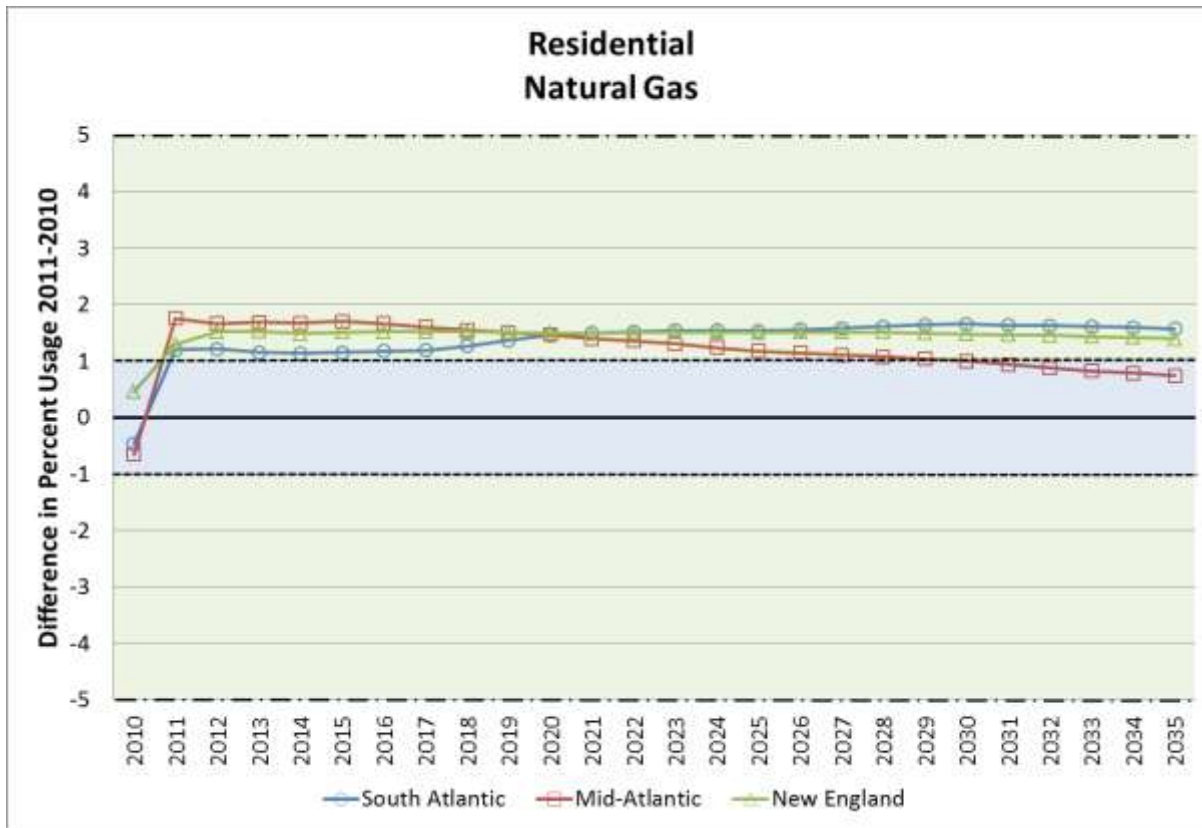
Table 1. Change between AEO2010 and AEO 2011 at the year 2020.

Sector	Fuel	South Atlantic	Mid-Atlantic	New England
Residential	Natural Gas	Minor increase	Minor increase	Minor increase
Residential	Distillate Fuel Oil	No change	No change	No change
Commercial	Natural Gas	No Change	Minor increase	Minor increase
Commercial	Distillate Fuel Oil	No change	No change	No change
Commercial	Residual Oil	No change	No change	No change
Industrial	Natural Gas	No change	Minor increase	Major increase
Industrial	Distillate Fuel Oil	Minor decrease	No change	No change
Industrial	Residual Oil	No change	No change	Minor decrease
Electric Power	Natural Gas	Minor decrease	Major increase	Major increase
Electric Power	Coal	Minor decrease	Minor decrease	Major decrease
Electric Power	Renewable Energy	Minor decrease	Minor decrease	Major decrease
Electric Power	Distillate Fuel Oil	No change	No change	No change
Electric Power	Residual Oil	No change	No change	No change
Transportation	Distillate Fuel Oil	No change	Minor increase	Minor increase
Transportation	Residual Oil	Minor decrease	Minor increase	No change

Residential

As shown in Figure 1, all three regions show a minor increase in the expected percent residential usage of natural gas. Residential distillate usage showed no important change in the comparison.

Figure 1 – Comparison of expected percent change in residential usage of natural gas



Commercial and Industrial

Overall, expected use of natural gas by commercial and industrial sources increased; however the change varied regionally as is shown in Figures 2 and 3. In the South Atlantic, there is no difference between AEO2010 and AEO2011. However, in the Mid-Atlantic region there is a minor increase of 1% to 2% for commercial and a minor to major change, from 1% to 6% increase for Industrial. In comparison, in New England the predicted future use of gas by the commercial and industrial sectors increased between AEO2010 and AEO2011. The commercial sector undergoes a minor increase of 5% while the industrial sector obtains a major increase of 9% to 11% in the out years.

Minor to major changes in the forecast also occurred for the other fuel types. South Atlantic distillate fuel oil demonstrated a minor decrease, whereas New England and Mid-Atlantic showed no important changes. In comparison, a minor decrease was examined for residual fuel oil in the New England region while there was no important change found in the Mid-Atlantic and South Atlantic regions. For industrial coal, there was no change determined in the New England region. In the Mid-Atlantic region there was a minor to no increase in the estimated percent usage of coal. A solid 2% decrease was established in the South Atlantic region.

Figure 2 –Comparison of expected percent change in commercial usage of natural gas

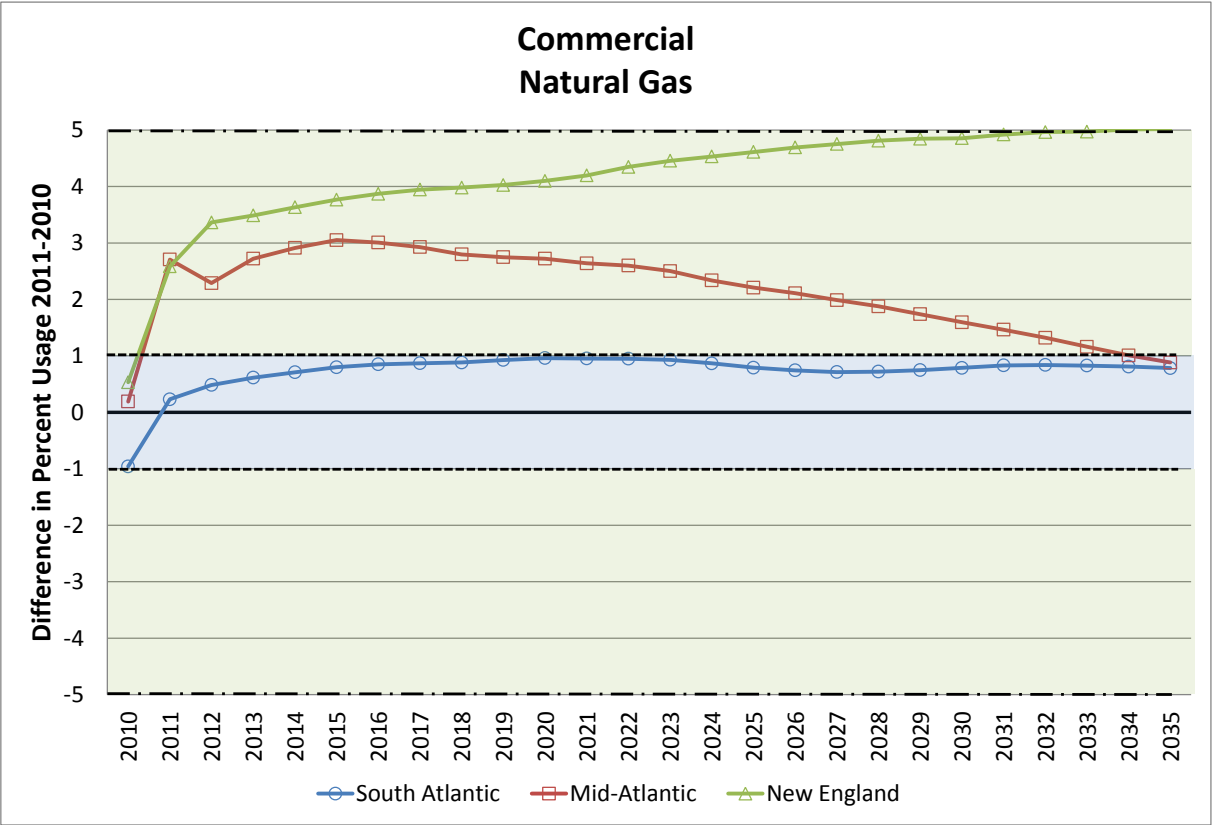
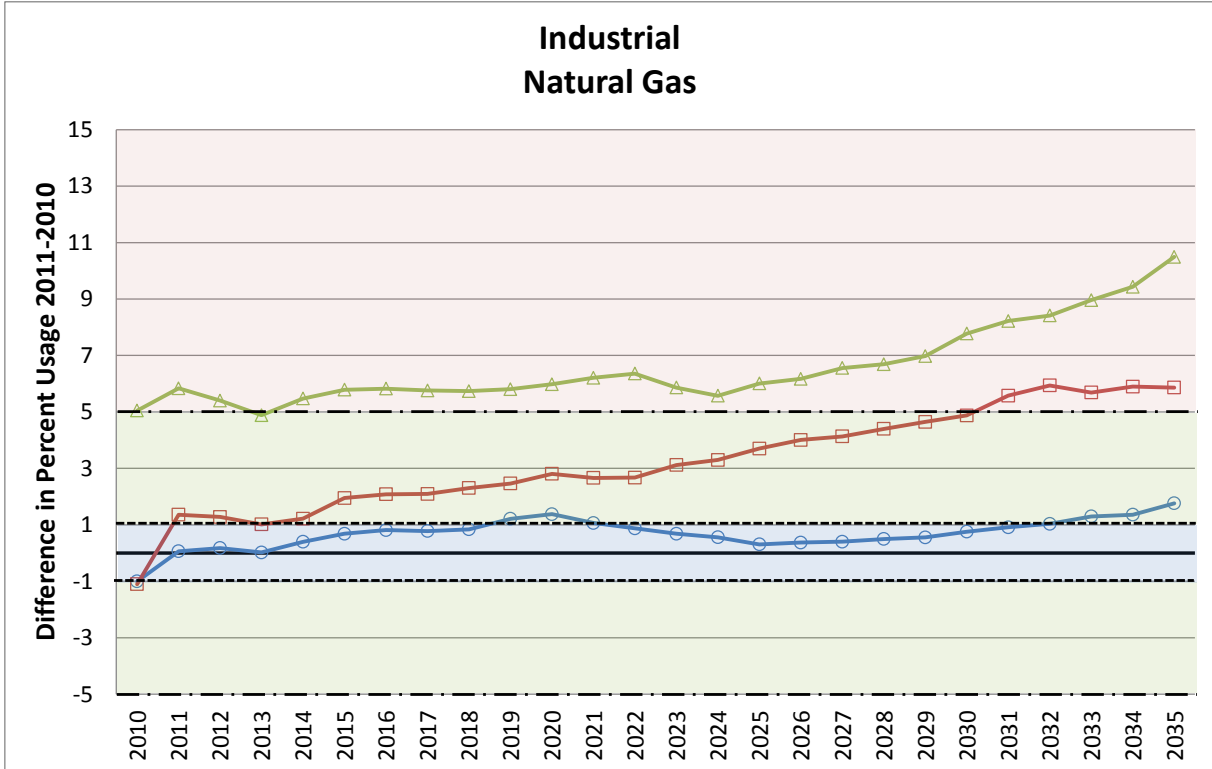


Figure 3 – Comparison of expected percent change in industrial usage of natural gas



Electric Power

Predicted future fuel use by the electric power sector changed significantly between AEO2010 and AEO2011 as is shown in Figures 4, 5, and 6. Across all three regions, predicted usage of coal dropped significantly while use of Natural gas increased significantly. In addition, expected usage of renewable energy dropped significantly.

Predicted future coal usage in the Mid-Atlantic region presents a minor decrease up to 5%. In comparison, the South Atlantic's estimated percent future usage decreases steadily from no change to a major change. New England is displaying a consistent decrease from minor, to major. New England begins with a 5% decrease, with a low of 11% decrease which then turns and steadily increases to no change in the out years. Overall, for the New England region AEO2010 was predicting higher coal usage than AEO2011 and the predicted usage of coal will be less than was expected by AEO2010.

Predictions for natural gas usage by the electric power sector generally increased except the South Atlantic as is shown in Figure 5. While the predicted percent of natural gas usage in South Atlantic demonstrates a minor decrease, both the Mid-Atlantic and New England demonstrate major increases. The Mid-Atlantic demonstrated a 6% increase and New England displays up to 24% increase. These increased natural gas numbers are in contrast to the reduction of coal usage in the respective regions. Though there are minor changes in other fuels, it appears that natural gas is the choice to replace coal in coming years.

In general the predicted use of renewable fuels has decreased between AEO2010 and AEO2011 as is shown in Figure 6. In both the South Atlantic and the Mid-Atlantic regions, there is a minor decrease of about 5% in the out years. The most important region in this case is the New England region, with the highest decrease of 24%. Overall, this information demonstrates that the New England region is not expected to make as much headway towards renewable energy as originally estimated in 2010.

For residual oil, there was no important change in the forecast for all three regions.

Figure 4 – Comparison of expected percent change in electric power usage of coal

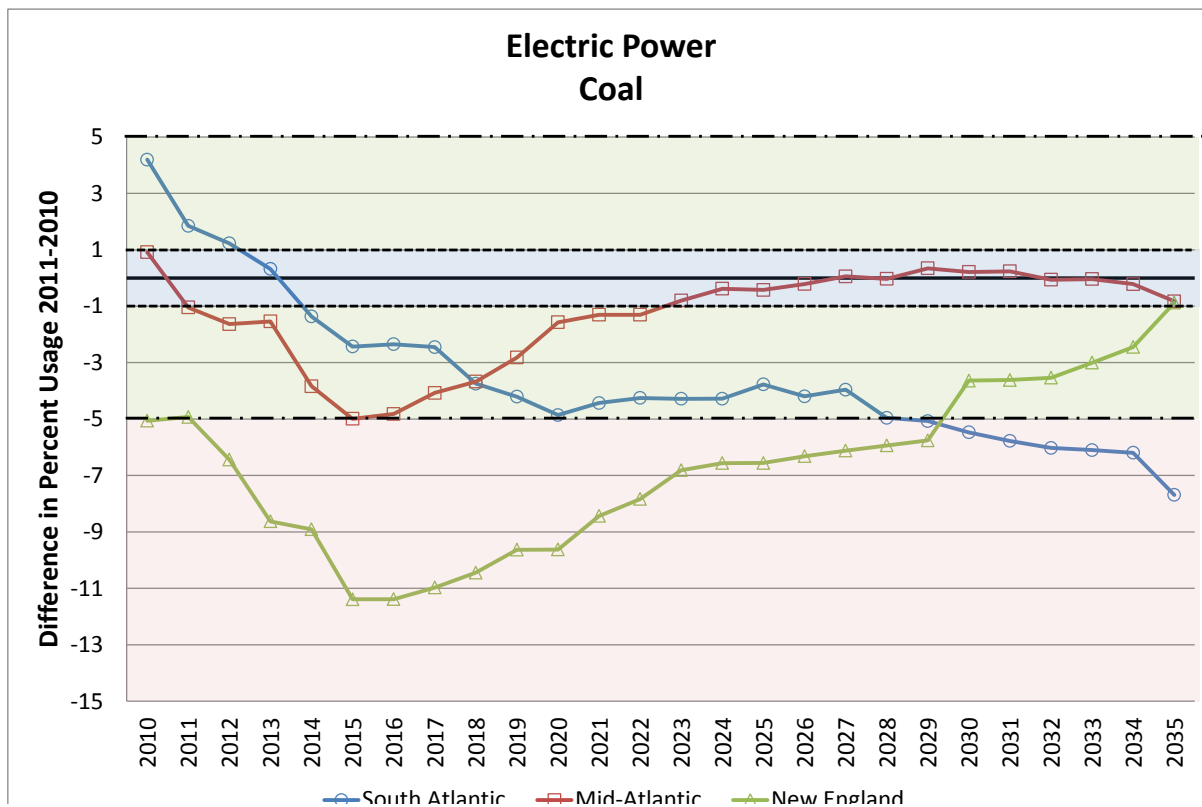


Figure 5 – Comparison of expected percent change in electric power usage of natural gas.

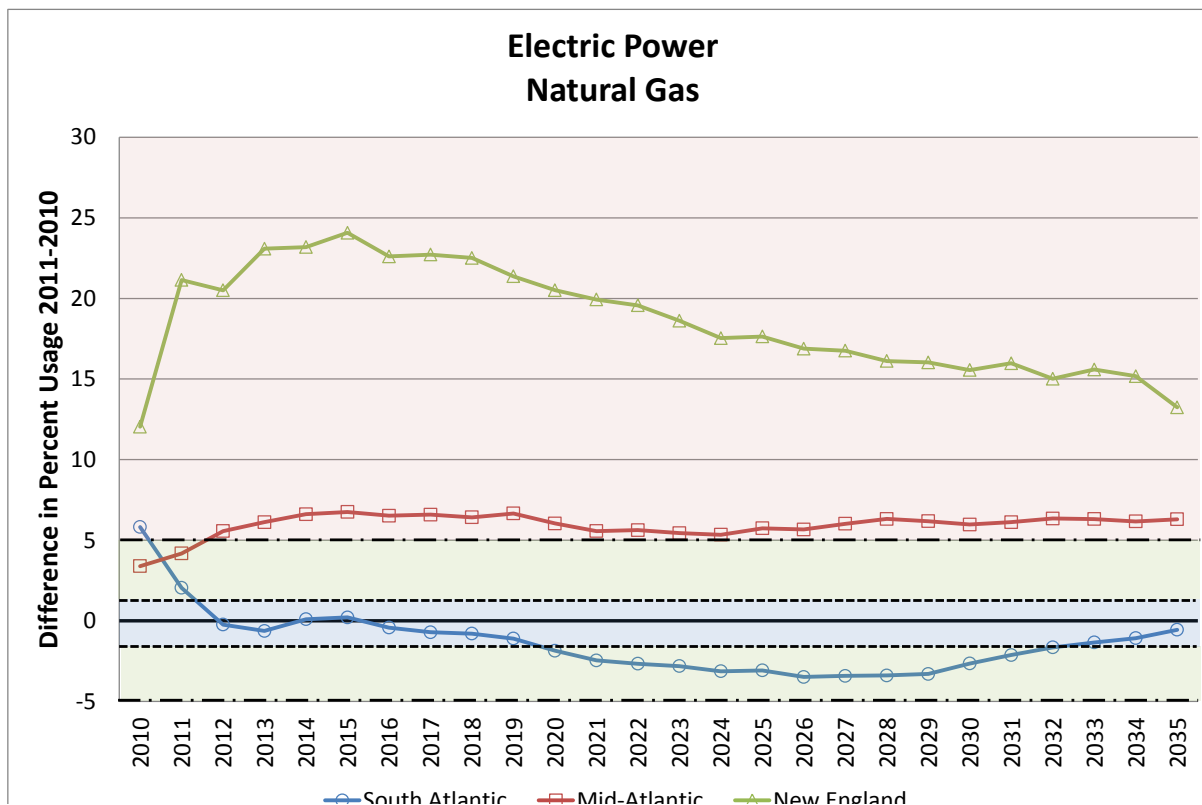
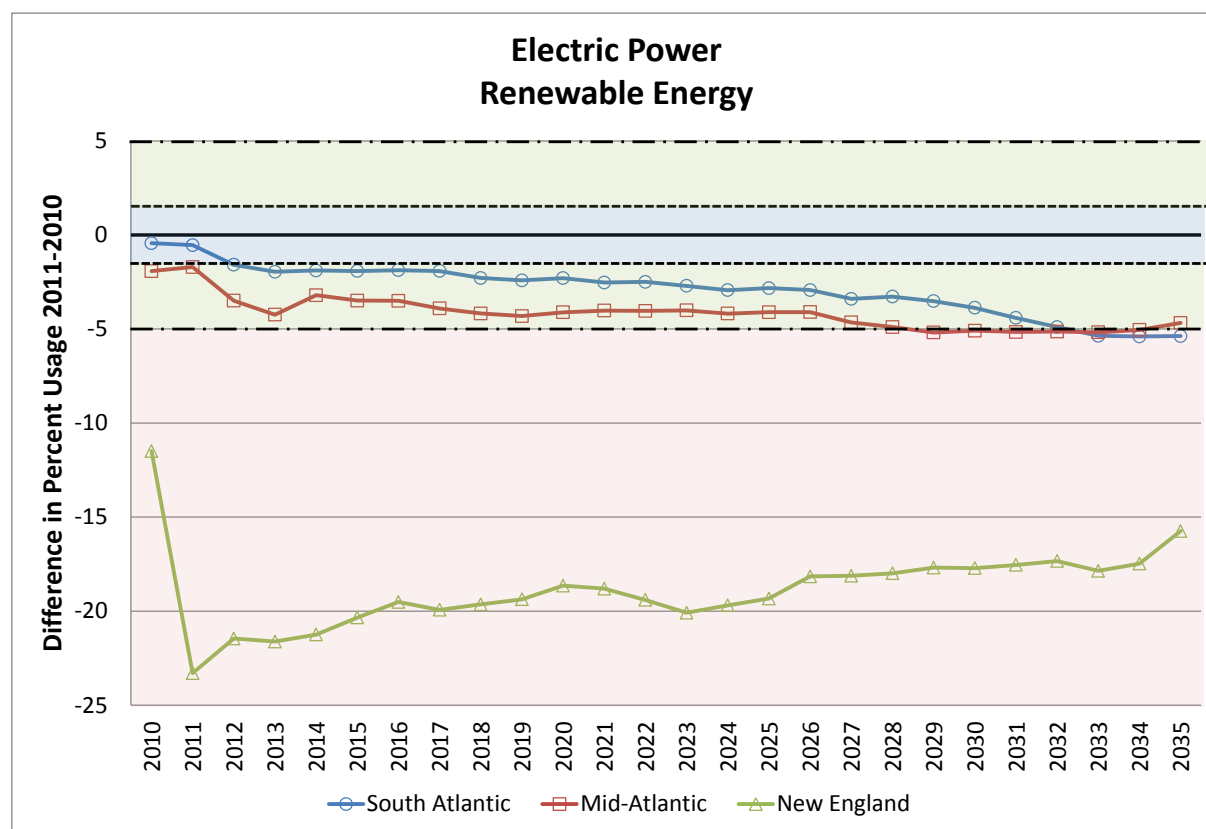


Figure 6 – Comparison of expected percent change in electric power usage of renewable fuels.



Transportation

There are no change or minor changes in the predicted use of fuels in the transportation sector. For the South Atlantic region, no changes are present in the percent usage of distillate fuel oil. A minor increase is expected for both the Mid-Atlantic and New England regions. While no change is demonstrated for residual fuel oil in the New England region, a minor decrease was present in the South Atlantic region and a minor increase was seen in the Mid-Atlantic region. All other fuel types demonstrated no important change for all regions. Charts of distillate and residual fuel oil changes are shown in figures 7 and 8

Figure 7 – Comparison of expected percent change in transportation usage of distillate oil.

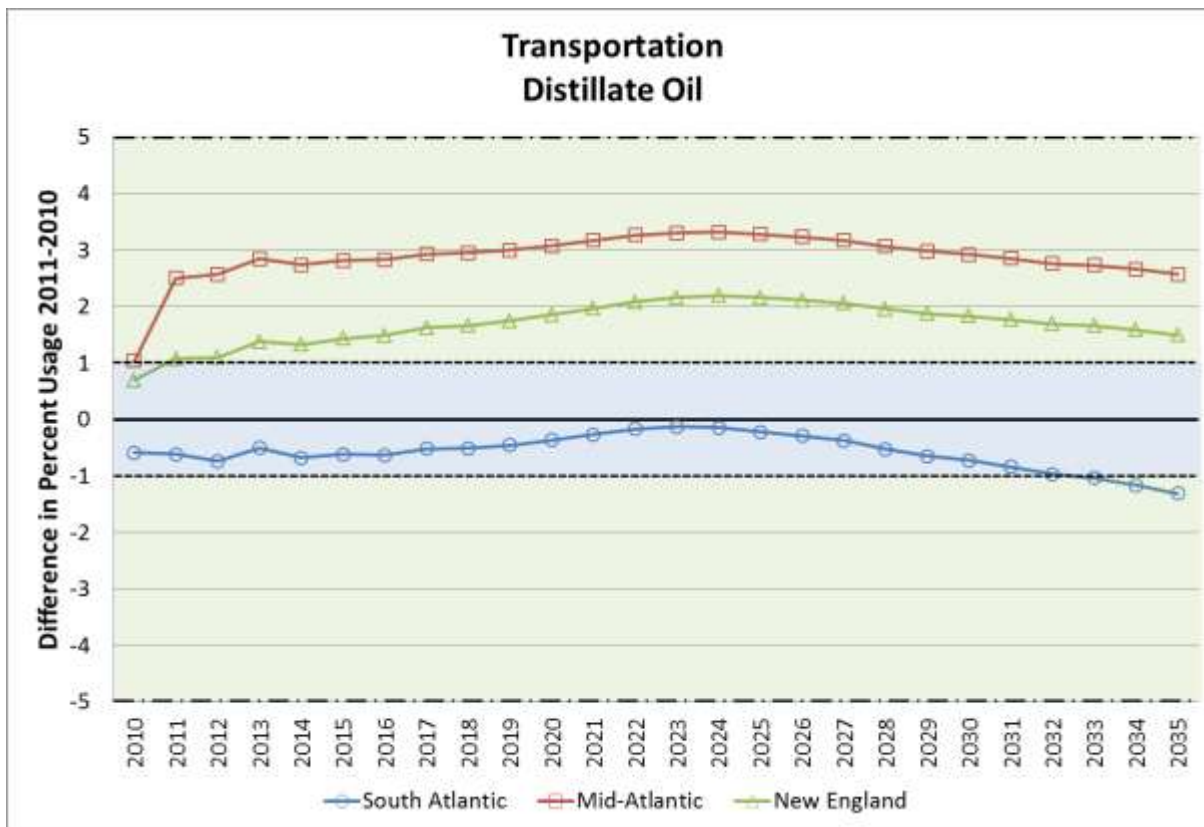
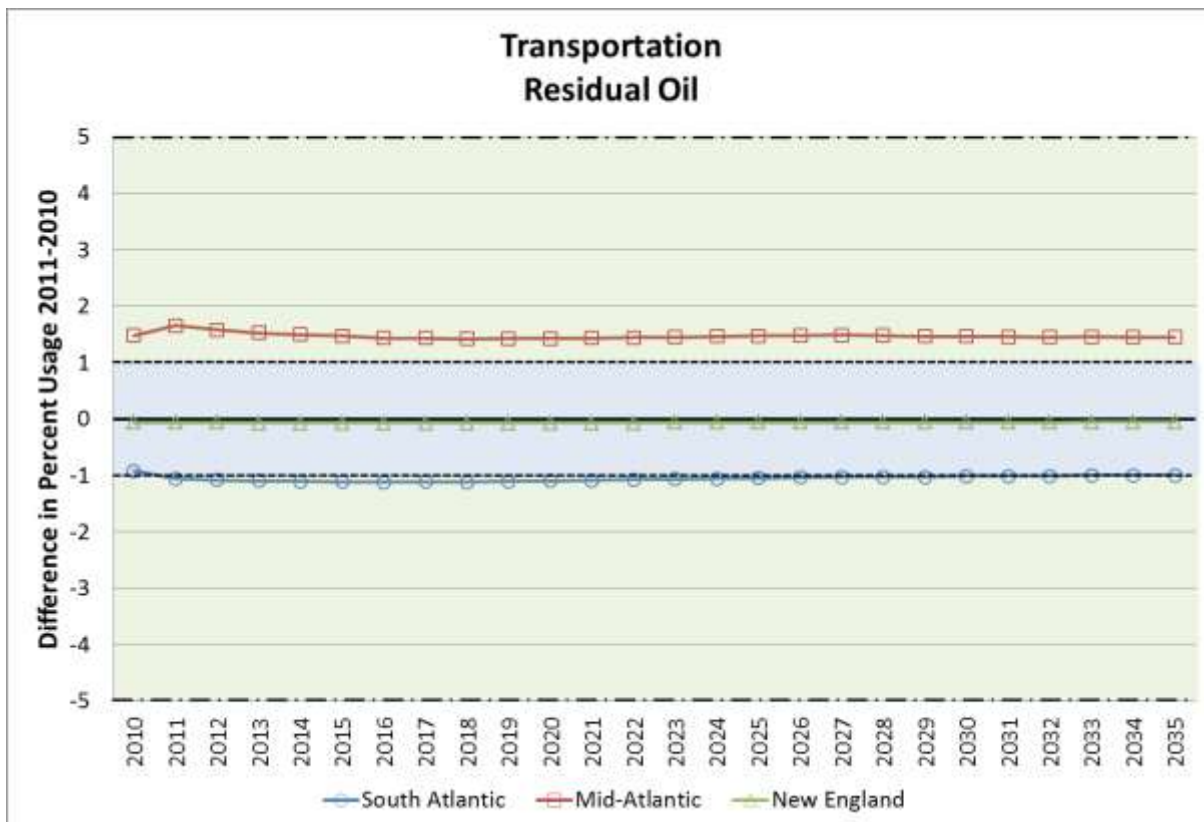


Figure 8 – Comparison of expected percent change in Transportation usage of residual oil.



Distillate and Residual Fuel Oil

Though there were no changes demonstrated in the distillate and residual oil graphs, they have been included to prepare for the policy changes regarding fuel sulfur content. These are presented in Figures 9 through 15.

Recommendations

The differences between AEO 2010 and AEO2011 are most pronounced in the electric power sector. Fortunately, AEO2011 has already been implemented in electric power sources in the MARAMA inventory. However, the reduced expectation in the penetration of renewable energy for electric power, particularly in New England should be considered in sensitivity runs.

MARAMA recommends that AEO2011 be implemented in the future year modeling inventory for industrial sources. This is because of the rate of change in the expected in natural gas usage in industrial sources is considered to be major. The small change in the shift to natural gas in residential sources indicates that no adjustment is warranted in this category.

Because transportation fuel usage is predicted by MOVES no adjustment is needed to the MARAMA future year inventories for this source category.

Figure 9 – Comparison of expected percent change in residential usage of distillate fuel oil.

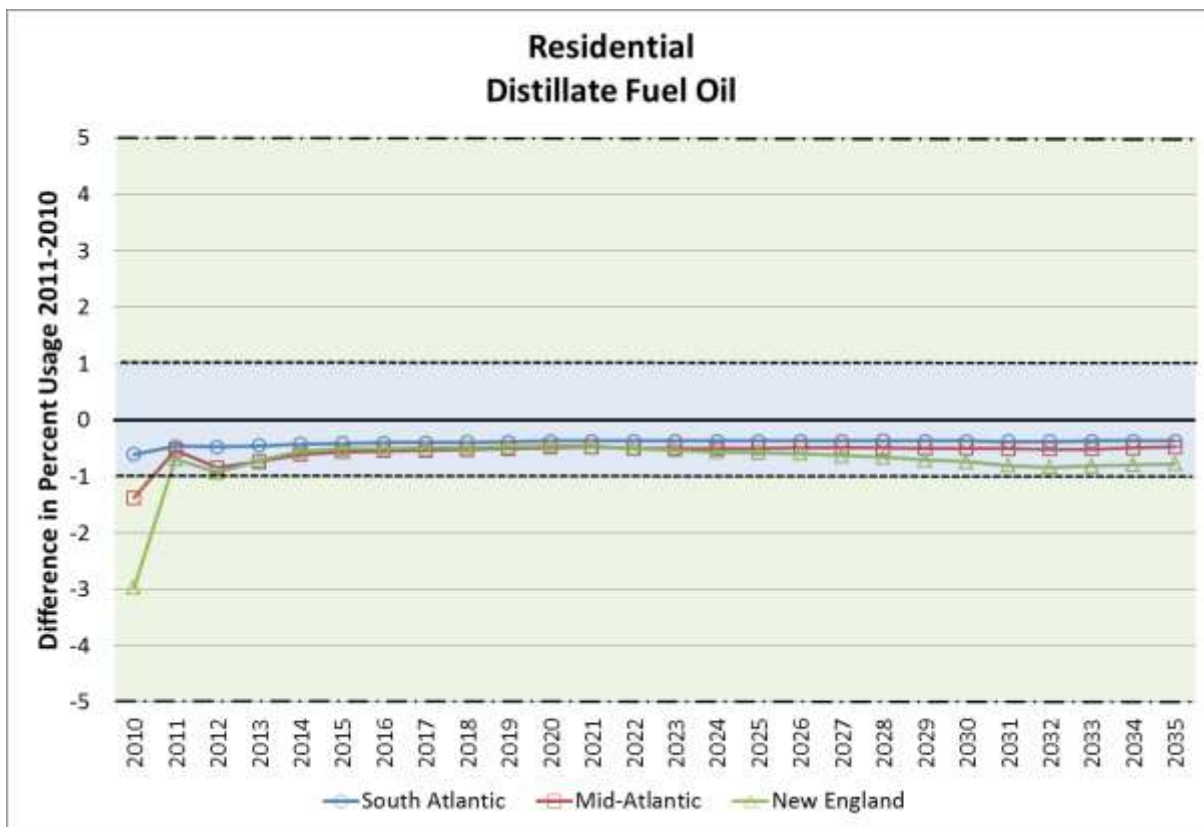


Figure 10 – Comparison of expected percent change in commercial usage of distillate oil.

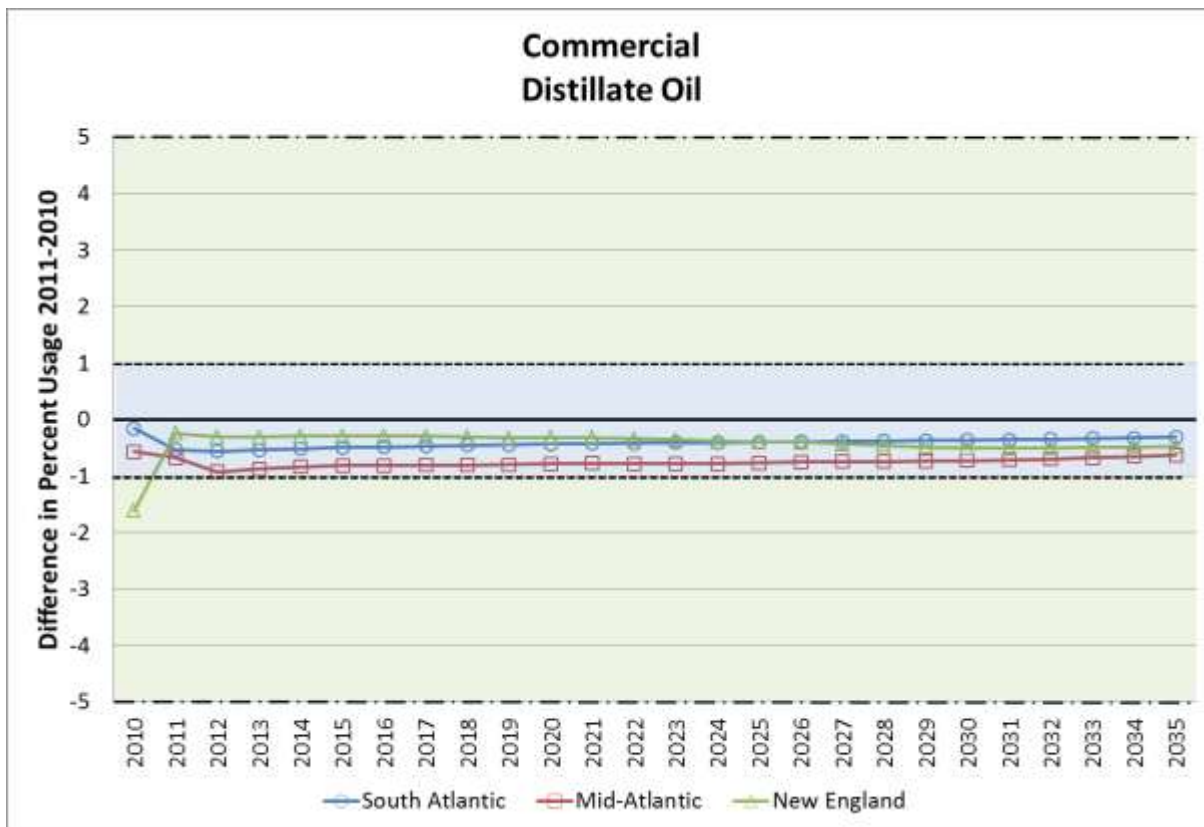


Figure 11 – Comparison of expected percent change in commercial usage of residual oil.

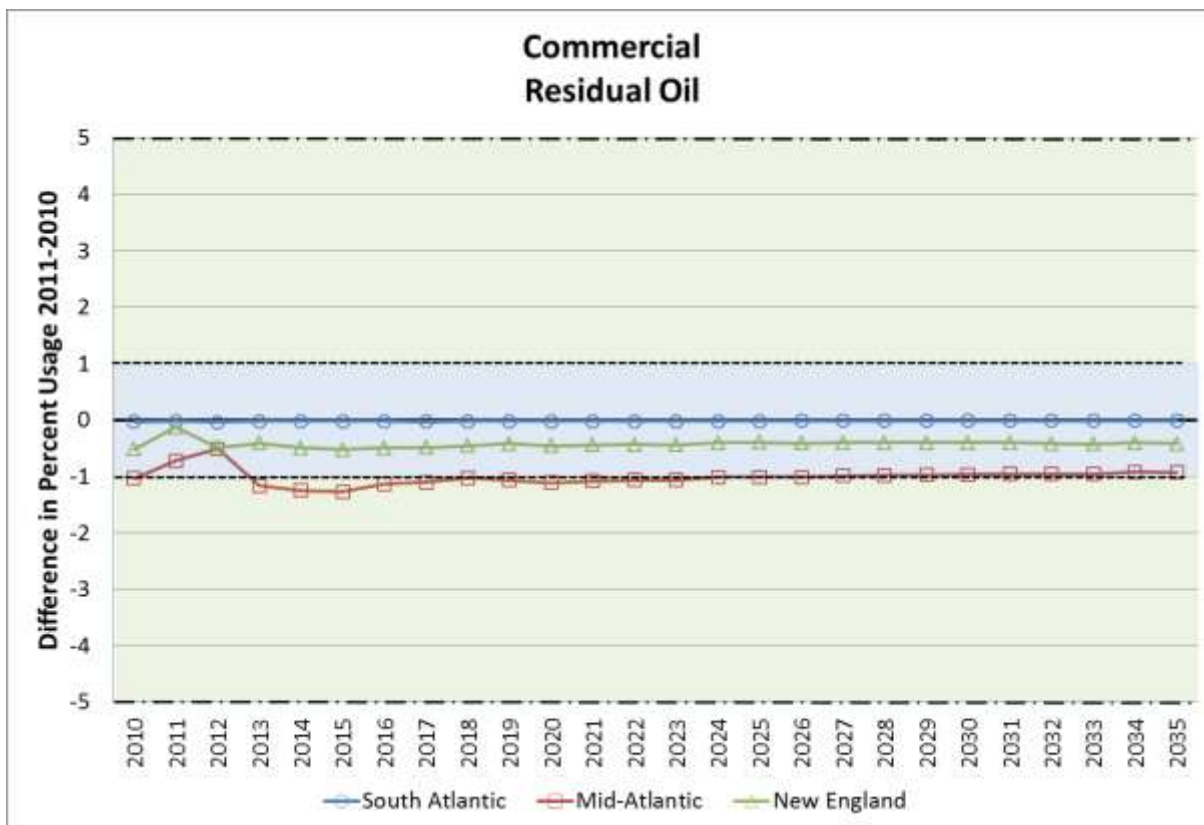


Figure 12 – Comparison of expected percent change in industrial usage of distillate oil.

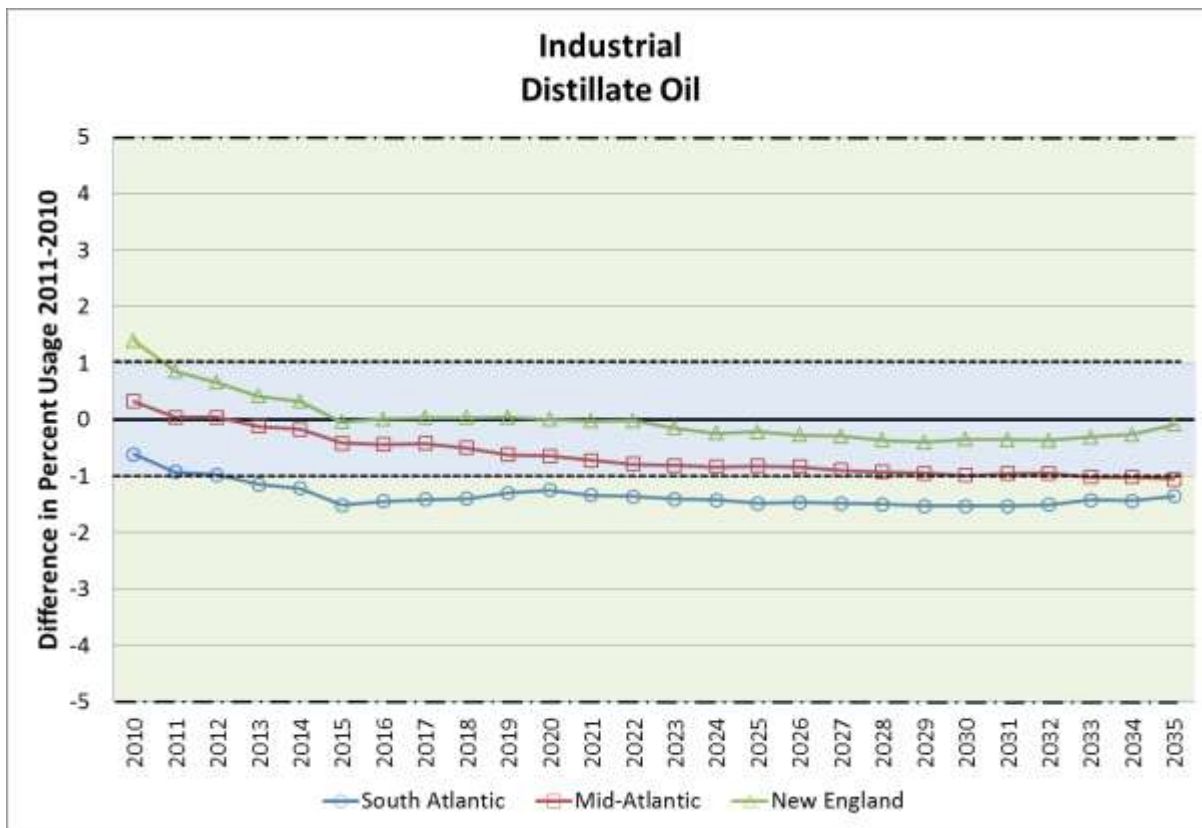


Figure 12 – Comparison of expected percent change in industrial usage of residual oil.

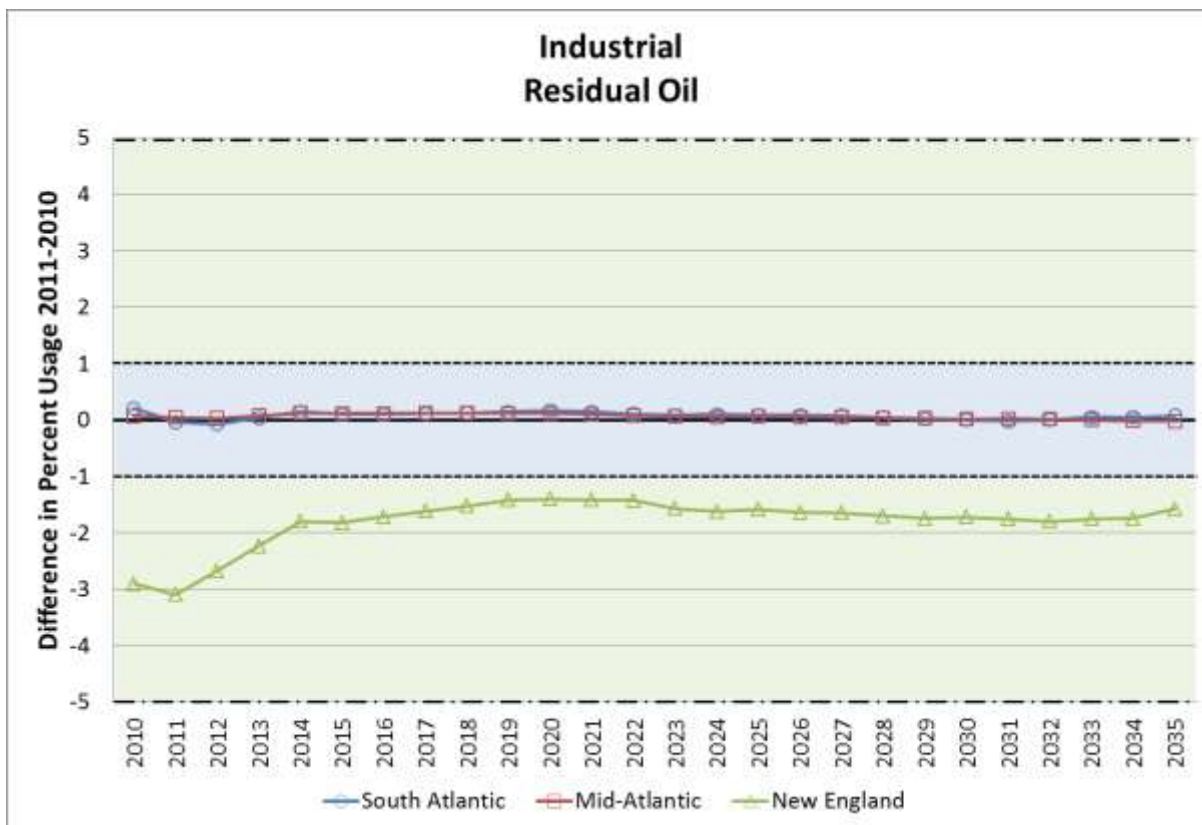


Figure 14 – Comparison of expected percent change in electric power usage of distillate oil.

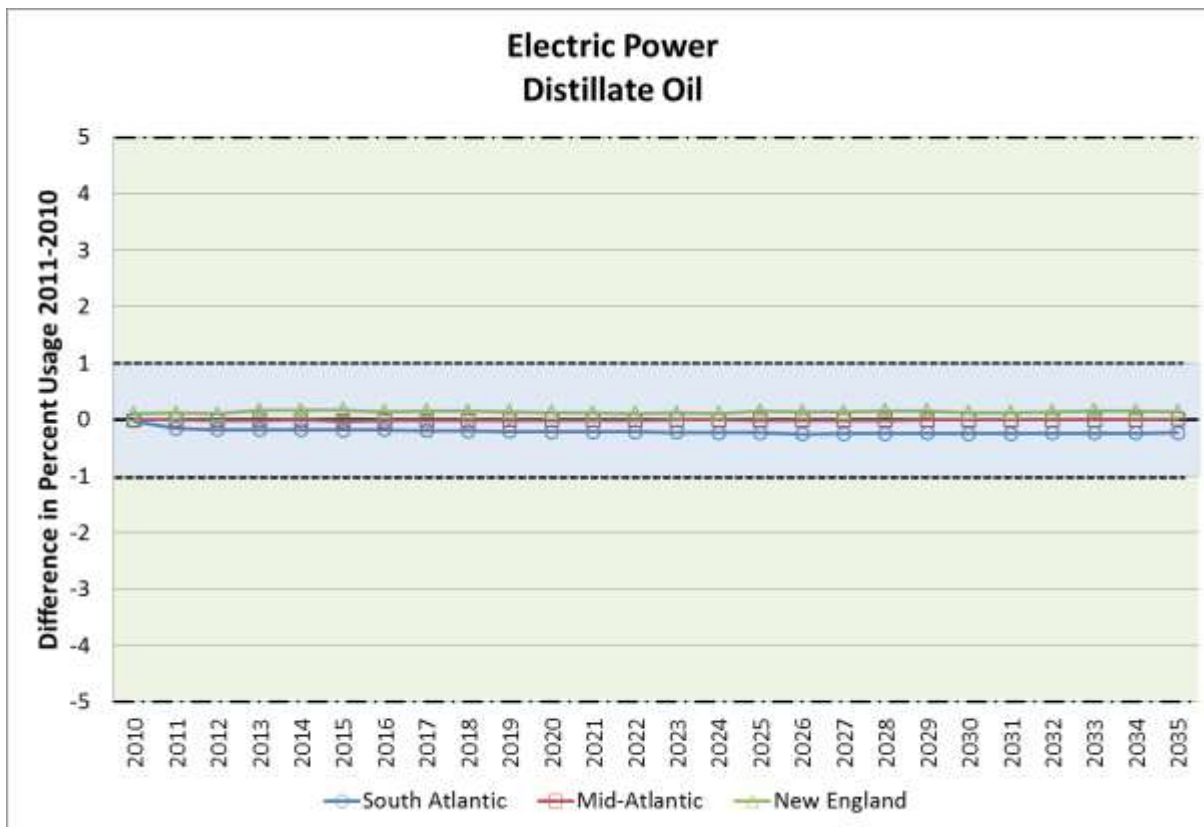


Figure 15 – Comparison of expected percent change in electric power usage of residual oil

