Findings Regarding the NSPI 2014 Load Forecast

Incorporating End-Use Analysis

Prepared for the Nova Scotia Utility and Review Board

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AUTHORS

David White, PhD
Bruce Biewald

Synapse Energy Economics, Inc.

485 Massachusetts Avenue, Suite 2
Cambridge, Massachusetts 02139

617.661.3248 | www.synapse-energy.com

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1. INTRODUCTION AND EXECUTIVE SUMMARY

At the request of the Nova Scotia Utility and Review Board (NSUARB), Synapse has conducted a review of the Nova Scotia Power, Inc. (NSPI) 2014 load forecast. This analysis follows Synapse's previous work, since 2006, reviewing the NSPI load forecasts.[1] This report looks at:

- The 2014 energy sales forecast (with and without demand-side management (DSM) effects) and peak-load forecast as compared to prior-year forecasts, and the components that drive differences in results;
- The impact of DSM program effects in the 2014 forecast, and differences in DSM assumptions from the 2013 forecast;
- The econometric and Statistically Adjusted End-Use (SAE) forecasts for the residential and commercial sectors, including an analysis of the factors underlying those forecasts;
- The econometric forecasts for the industrial sector, including an analysis of the factors underlying those forecasts;
- NSPI's move toward end-use forecasting, and differences between the 2014 econometric and SAE forecasts for the residential and commercial sectors; and
- NSPI's peak load forecasting methodology and potential shortcomings of that methodology.

Some of the major findings of our analysis are summarized below; section 9 of this report, "Conclusions and Recommendations," provides a more comprehensive summary. Appendix A of this report discusses DSM assumptions in the 2014 forecast and achievable potential in Nova Scotia. Appendix B compares the 2014 forecast with NSPI load forecasting in other contexts.

Factors Influencing Future Load

A major change impacting Nova Scotia's load over the last several years has been the loss of significant industrial loads in the province; as a result, total system loads (even without demand-side programs) will likely remain below or close to previous historical levels for the 2014 to 2025 forecast period. Another major factor affecting future loads is the growth of electric space heating, and NSPI should explore that more fully in future reports.

Differences between 2014 and Prior-Year Forecasts

The 2014 forecast is very close to that of 2013. The primary differences between the two forecasts are associated with DSM assumptions—DSM program effects in the 2014 forecast are 34 percent less for the year 2023 than DSM effects for the same year in the 2013 forecast.

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[1] D. White and B. Biewald. 2013. *Findings Regarding the NSPI 2012 and 2013 Load Forecasts - Forecasting in an Uncertain Future*; D. White and B. Biewald. 2011. *Findings Regarding the NSPI 2011 Load Forecast – Forecasting in Transition*; D. White and B. Biewald. 2010. *Findings Regarding the NSPI 2010 Load Forecast – Moving towards end-use modeling*; D. White and B. Biewald. 2009. *Findings re the NSPI 2009 Load Forecast - Better Modeling Support for DSM*; D. White, B. Biewald, and M. Chang. 2008. *Findings re the NSPI 2008 Load Forecast*; R. Hornby and D. White. 2007. *Review of NSPI load forecast methodology*. Prepared for Tellus, UARB and NSPI. This also references previous memos from Tellus Institute in 2006.

Econometric Versus SAE Modeling

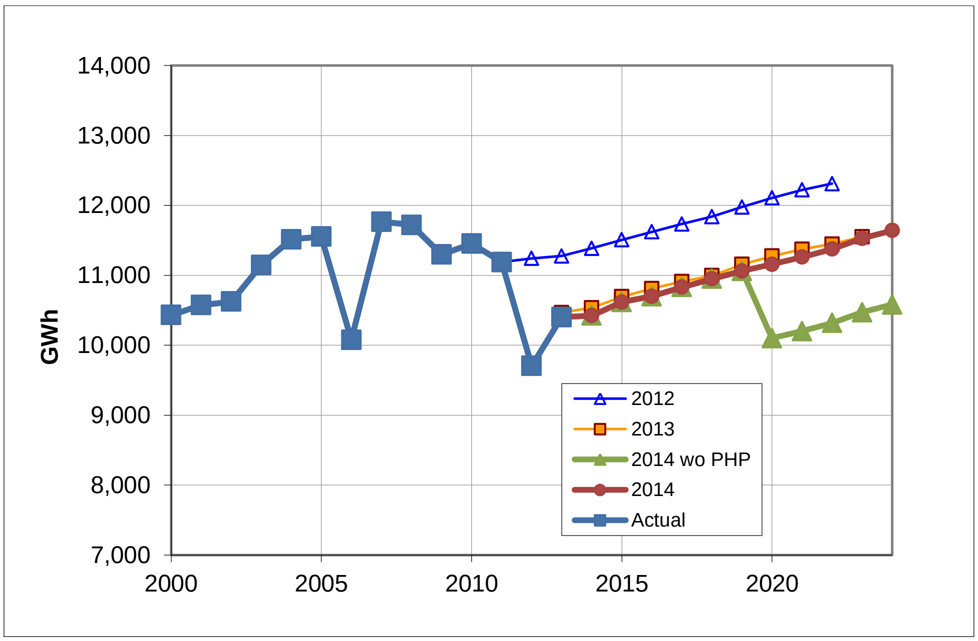
The Statistically Adjusted End-Use forecast has made major progress in the last year, and we recommend that NSPI move rapidly toward using this method for its primary residential and commercial forecasts. SAE modeling allows for a more transparent and robust forecast, and aids in the development of energy efficiency programs. At this point the differences between the econometric and SAE forecasts are not large; the residential SAE forecast is 1.4 percent greater in 2024 than the econometric forecast, and the commercial SAE forecast is 6.6 percent lower in 2024 than the econometric forecast.

2. COMPARISON OF RECENT FORECASTS

2.1. Energy Forecasts without DSM Effects

NSPI's 2014 energy forecast without DSM savings is nearly identical to that of 2013, and follows the same trend as the 2012 forecast. The starting point for the 2012 forecast was higher, but the growth rate was about the same. The growth rates in all three forecasts are very similar, at about 1 percent per year. The levels projected by the 2013 and 2014 forecasts for 2024 are below the actual load levels seen in 2007 and 2008. The wildcard in the forecast is the possible future closure of the Port Hawkesbury Paper (PHP) mill, which would reduce energy sales by about 1,000 GWh (see the green line in Figure 1).

Figure 1: NS Energy Sales - Actual and Forecasts without DSM Savings

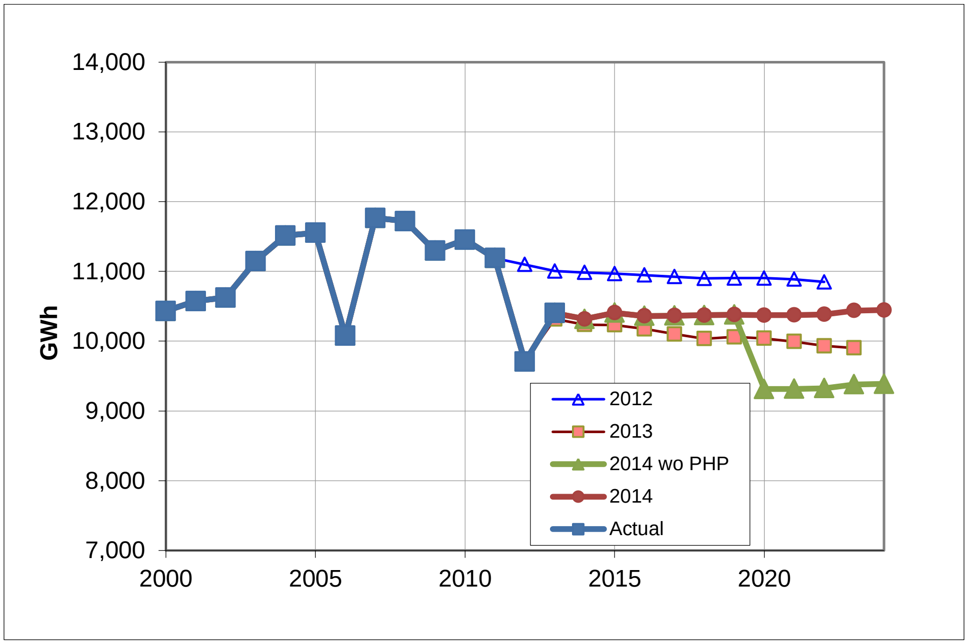


The major dip in 2012 actual load represents the closure of some paper mills, and the partial recovery in 2013 represents the reopening of one of them. Future operation is uncertain, as is represented by the alternate forecast where the PHP mill closes in 2020.

2.2. Energy Forecasts with DSM Effects

The forecasts change direction and relative slope when DSM effects are included (see Figure 2). When DSM is included the 2014 forecast is almost flat, while the 2012 and 2013 forecasts had a slight decline. The DSM savings represent the projections from Efficiency Nova Scotia (ENSC).

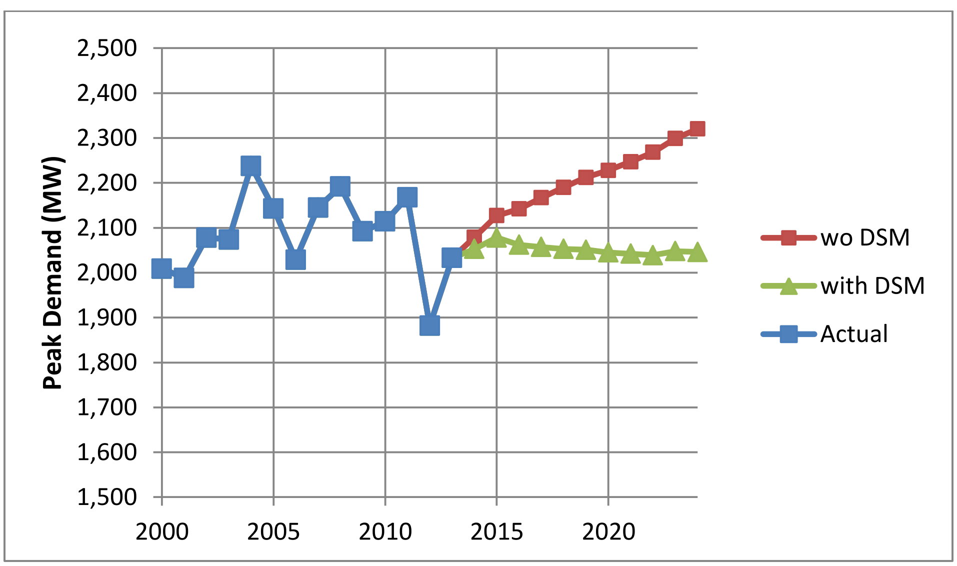
Figure 2: NS Energy Sales - Actual and Forecasts with DSM Savings



2.3. Peak Load Forecast

The peak load forecast (see Figure 3) is based on and closely follows the energy forecast. In the 2014 forecast, assuming the continued operation of the PHP mill, the coincident peak demand without DSM is expected to increase from 2,072 MW in 2014 to 2,320 MW in 2024 (an increase of 274 MW or 13 percent). In the forecast including DSM effects, the 2024 prediction is 2,046 MW (a decrease of 7 MW or 0.3 percent relative to 2014). This parallels the differences in the energy forecasts. With the closure of the PHP mill, the peak load is reduced by 66 MW.

Figure 3: NS Peak Load Historic and 2014 Forecast



2.4. Components of the Forecasts and Their Differences

The following tables compare the forecasts by sector.[2] Overall the 2014 forecast is nearly identical to the 2013 forecast. Table 1 shows the 2014 forecast without DSM; the residential and commercial sectors are up slightly in 2023 compared to the 2013 forecast for the same year, while the industrial load is lower by 4.8 percent.

Table 1: Forecast Comparison without DSM

Sales Forecast for 2023 without DSM (GWh)				
Sector	2013 Forecast	2014 Forecast	Difference	Percent Difference
Residential	4,937	4,985	49	1.0%
Commercial	3,719	3,786	67	1.8%
Industrial	2,896	2,757	-139	-4.8%
Total Sales	**11,552**	**11,528**	**-24**	**-0.2%**

Looking at the forecasts with DSM (Table 2), we see a greater difference. Here the 2014 forecast is predicting 528 GWh less savings in 2023. This will be discussed further in the section on DSM savings.

Table 2: Forecast Comparison with DSM

Sales Forecast for 2023 with DSM (GWh)				
Sector	2013 Forecast	2014 Forecast	Difference	Percent Difference
Residential	4,253	4,488	235	5.5%
Commercial	2,943	3,272	329	11.2%
Industrial	2,714	2,679	-35	-1.3%
Total Sales	**9,910**	**10,438**	**528**	**5.3%**

Although the absolute differences are interesting, a clearer picture emerges when the growth rates are compared. The following table shows the annual growth rates over the ten-year forecast period. The forecasts *without* DSM show comparable overall growth rates. However, the forecasts *with* DSM show larger differences; the 2014 forecast is essentially flat, while the 2013 forecast showed a slight decline. This is discussed more fully in the next section.

[2] For most of the comparisons we look at the results that represent the continued operation of Port Hawkesbury Paper mill, as that represents the continuous and conservative case.

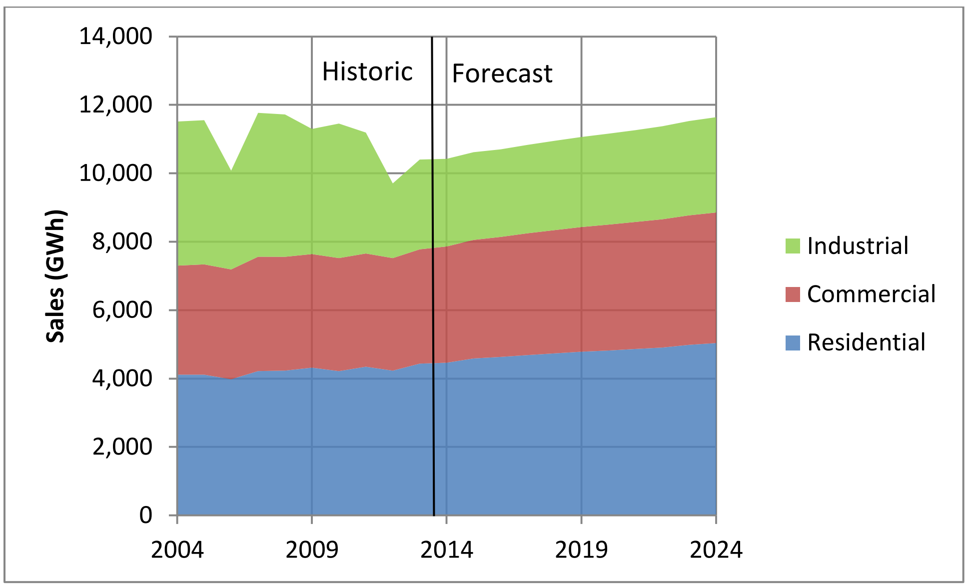
Table 3: Forecast Growth Rate Comparison

Ten-Year Growth Rates						
	Without DSM			With DSM		
Sector	2013 Forecast	2014 Forecast	Difference	2013 Forecast	2014 Forecast	Difference
Residential	1.15%	1.17%	0.02%	-0.20%	0.11%	0.31%
Commercial	1.08%	1.26%	0.18%	-1.06%	-0.21%	0.85%
Industrial	0.61%	0.49%	-0.12%	0.00%	0.20%	0.21%
Total Sales	**0.99%**	**1.03%**	**0.04%**	**-0.41%**	**0.03%**	**0.44%**

2.5. Historic Loads by Sector

To provide context for the following discussions, the figure below shows the historic loads by sector for the previous ten years and for the ten-year forecast period. Here one clearly sees the recent wide variations in industrial loads and the gradual growth in residential and commercial loads. The overall growth rate over the forecast period is just over one percent.

Figure 4: Historic and Forecast Loads by Sector without Future DSM



3. DEMAND-SIDE MANAGEMENT EFFECTS

The DSM program effects are based on the projections of ENSC, and are represented as specific reductions to the econometric forecasts. The DSM savings for the comparable year of 2023 are 34 percent lower in the 2014 forecast than in the 2013 forecast. This shows again that the primary differences between the two forecasts are associated with DSM assumptions and not the unadjusted forecasts.

Table 4: DSM Program Savings in 2023 (GWh)

Sector	2013 Forecast	2014 Forecast	Difference	Percent Difference
Residential	684	498	-186	-27%
Commercial	777	515	-262	-34%
Industrial	188	78	-110	-59%
Total	**1,648**	**1,090**	**-558**	**-34%**

The magnitudes of the DSM effects are illustrated in the summary table below, which uses values from Appendix A of the forecast report. Note that sales increase in the residential and commercial sectors when DSM savings are excluded, whereas sales decline modestly relative to 2014 levels when DSM savings are included. The greatest savings occur in the commercial sector.

Table 5: Summary of DSM Effects in the 2014 Forecast

Energy Sales Forecast (GWh)					
	2014	**2024**			
Sector	With DSM	Without DSM	DSM Savings	DSM %	With DSM
Residential	4,463	5,037	784	15.6%	4,253
Commercial	3,399	3,816	874	22.9%	2,943
Industrial	2,561	2,786	79	2.8%	2,708
Total	**10,423**	**11,640**	**1,737**	**14.9%**	**9,904**

There are some minor differences in the DSM savings presented in the load forecast report and the DSM IRP targets of ENSC, which we understand are related to differences in the reporting periods.

4. RESIDENTIAL FORECAST

4.1. Econometric Model

The residential sales without DSM in the 2014 forecast increase at an annual rate of 1.17 percent, which is slightly greater than the rate of 1.15 percent in the 2013 forecast. The forecasted sales in 2023 are 49 GWh (or 1.0 percent) higher than in the 2013 forecast.

The 2014 forecast was developed using the same econometric model as in 2013. The biggest change compared to earlier models was dropping the lagged residential sales data component. As indicated above, the net effect on the overall residential forecast was minor.

Table 6: Summary of the Residential Econometric Model Variables

Variable Name	Description	Comment
AIDX	Appliance Efficiency Index	Developed by NSPI to represent changes in end-uses – both saturation and efficiency. Includes a customer count forecast
CUSTHDD	Heating Degree Days x Electric Heat Customers	Changed HDD to a ten-year average for the 2008 forecast
RREP	Real Residential Electricity Price	
RYDS	Real Disposable Income	Consumer spending on goods was used previously

The following table indicates the contribution of each model variable to the 2014 residential forecast and its growth rate. The dominant contribution to growth rate is associated with electric heating (CUSTHDD), which represents most of the forecasted growth. The largest component of the forecast is associated with disposable income (RYDS), which appears to replace the role of the lagged sales variable in the previous model.

Table 7: Residential Model Components of the 2014 Forecast without DSM (GWh)

Variable	2014	2024	Change	Growth Rate
AIDX Appliance Efficiency	1,019	955	-64	-0.65%
CUSTHDD Electric Heating	1,322	1,617	295	2.03%
RREP Electricity Price	-1,514	-1,470	44	-0.29%
RYDS Disposable Income	3,480	3,687	207	0.58%
Total Sales	4,307	4,789	482	1.07%

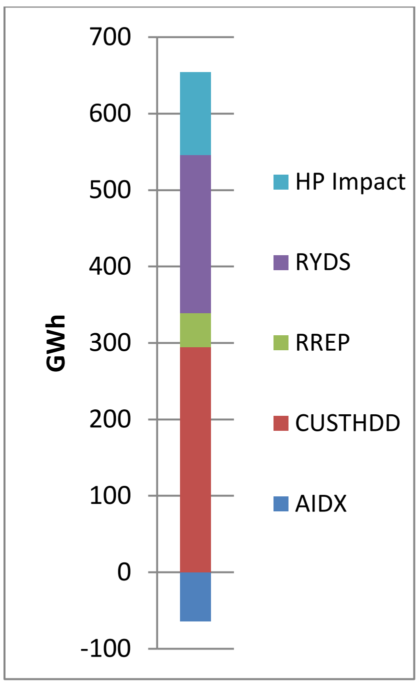
Observant readers may notice that the total 2024 sales here (4,789 GWh) do not match those in Table 5 (5,037 GWh). There are several reasons for this:

1. The econometric forecast has a launch adjustment of 135.2 GWh in 2013 to align with the actual loads;
2. An adjustment is made to the econometric forecast to represent heat pump impacts, which add 130 GWh in 2024; and
3. A further adjustment is made to represent natural gas effects, amounting to -2 GWh.

The nature of the heat pump adjustments is not discussed in the filed report. However, information about this can be found in the discovery materials.[3] This adjustment represents the use of heat pumps both in new home construction and for retrofits. There may be some potential duplication of effects associated with the CUSTHDD variable. In any case, this should be better described and documented in the forecast report, as electric space heat represents a major growth component of the residential sector.

The following figure shows the components of the residential load growth. The dominant contribution is from the electric heating driver (CUSTHDD). The second largest contribution is from disposable income (RYDS). The third largest value is the heat pump adjustment mentioned above. The appliance variable (AIDX), reflecting improved efficiency, produces a small decrease. And the electricity price (RREP), which changes very little, contributes a small effect.

Figure 5: Components of Residential Load Growth – 2014 to 2024



Since electric space heating (CUSTHDD) is the largest contributor to the growth in residential load, it should be more thoroughly explored and discussed in the forecast report. NSPI should also evaluate the effect of electric space heating on winter peak load, as this is an important driver, and explore policies that might influence or moderate this load growth.

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[3] IR-1, Appendix A, Residential Model, Domecon.xls.

4.2. Statistically Adjusted End-Use Model

The SAE model developed by NSPI is a hybrid with a mix of statistical and end-use components.[4] The key difference between the SAE and econometric models is that the basic structure of SAE is based on actual end-use categories at the household level. The three end-use categories used are cooling, heating, and other.

Each of these categories represents a variety of factors that affect the load. For example, the heating category is dependent on: heating degree days, household income, household size, electricity price, heating saturation, efficiency, shell integrity and square footage. This is more explicit and more transparent than the standard econometric approach. These end-use variables are developed using historical and forecast data. Then statistical methods are used to develop the coefficients for the average household usage equation. The statistics for those coefficients are good, so the model appears solid from that perspective.[5] Any uncertainty primarily lies in the projections of the underlying drivers, such as heating saturation, efficiency, etc.

The following table summarizes the SAE model results. The muni load is from a separate calculation that is then added to the model results. Note that the SAE load forecast for 2024 is just 70 GWh greater than that of the econometric model. In terms of load growth (not shown in Table 8), heating is increasing at a rate of 2.0 percent, cooling at 6.0 percent, and other is decreasing at a rate of 0.3 percent. Heating represents 62 percent of the overall load growth, and cooling the remainder. Overall the SAE model provides a more transparent understanding of the factors affecting load growth.

Table 8: SAE Residential Model Load Forecast Components

End-Use	2024 Load (GWh)	Fraction of Load
Heat	1,973	39%
Cool	261	5%
Other	2,818	55%
Muni	71	1%
Total	**5,123**	**100%**

Although there are just three major usage categories represented in the SAE forecast, there is much greater detail in the underlying end-use model. More of that detail should be revealed and discussed, especially in regards to heating usage, which is also a key driver in the peak loads.

We also recommend closer evaluation of the factors affecting space heating loads, and the actions that might moderate those impacts—especially on peak loads.

[4] See Appendix D of the 2014 Load Forecast report.

[5] The SAE model calibration period starts in 2002 and extends monthly for 12 years. The residential econometric modeling used 16 years of annual data.

5. COMMERCIAL FORECAST

5.1. Econometric Model

The 2014 commercial sales forecast without the DSM adjustment increases from 3,399 GWh in 2014 to 3,816 GWh in 2024—an overall increase of 12.3 percent. This is a little above the 2013 forecast increase of 11.8 percent over the forecast period.

The same econometric model was used as for the 2013 forecast.

Table 9: Summary of the Commercial Econometric Model Variables

Variable Name	Description	Comment
RQTOS	Real GDP for the province	Was only commercial GDP last time
HDD	Annual Heating Degree Days	For matching historical data
COMENG1	Commercial sales from previous year	A lag factor to previous year's sales

The regression period used to develop the coefficients for this model was 16 years, which is less than the 20 years used previously. All of the model coefficients have good statistics.

The primary driver in the commercial forecast is gross domestic product (RQTOS). The Heating Degree Days value (HDD, representing a historical average) does not change over the forecast period. The lag term with the previous year's sales (COMENG1) represents other growth effects.

Table 10: Commercial Model Components in the 2014 Forecast without DSM (GWh)

Variable	2014	2024	Change	% Change
RQTOS Real GDP	1,330	1,529	199	15.0%
HDD Heating DD	372	372	0	0.0%
COMENG1 Lagged Sales	1,711	1,949	239	13.9%
Muni	0	-20	-20	
Adjustment	-13.5	-13.5	0	
Total Sales	**3,399**	**3,816**	**417**	**12.3%**

The real GDP makes good theoretical sense for the commercial sector. However, this model doesn't represent any changes in energy intensity or efficiency.[6] That might be a problem, especially with changes in lighting technology.

Again, this is a situation where an end-use model would help shed light on what is happening in the commercial sector.

[6] Historically, the electricity sales-to-GDP ratio has been declining. This model does not capture that effect, and maintains a constant future ratio.

5.2. Statistically Adjusted End-Use Model

The commercial SAE modeling is similar to the residential SAE modeling in that it has the same three main end-use categories: heating, cooling, and other. However, two models are used in the commercial sector: one for Small General Service (SGS) customers, and another for larger General Service (GS) customers.

Underlying the SGS model are intensity trends for heating, cooling, ventilation, electric water heat, cooking, refrigeration, lighting, office equipment, and miscellaneous uses. The figure below shows the relative shares of the specific end-uses that make up the average small commercial load. The largest category is miscellaneous, which is not well defined and may include things that could be mapped into other categories. The bulk of the load shown in Figure 6 would map into the SAE model's higher-level "other" category. The SAE large commercial customer (GS) model has a similar structure.

Figure 6: Small Commercial End-Use Intensities - 2024

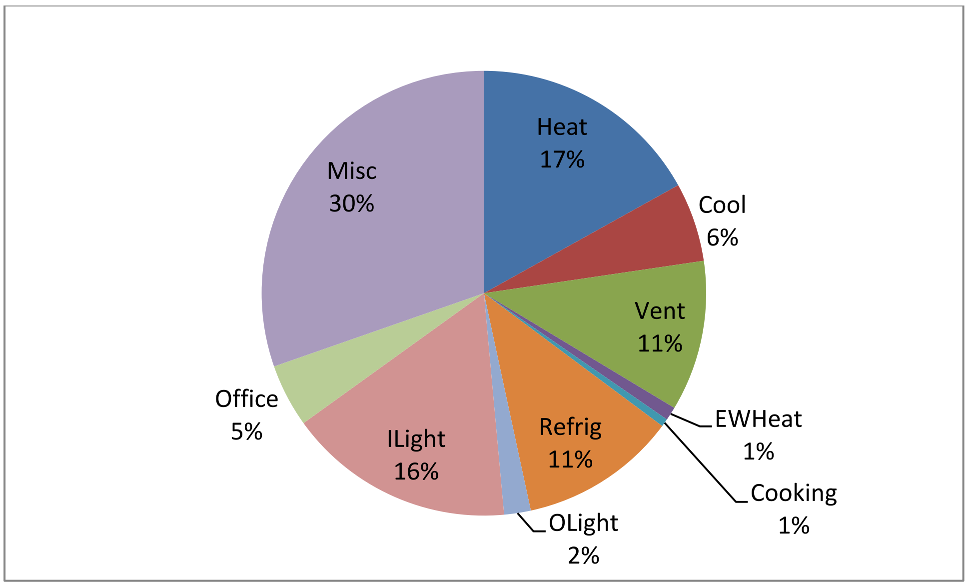


Table 11, which is based on the results shown on page 77 of Appendix D of the forecast report, shows how this load is distributed among the SAE commercial model's load categories. Two-thirds of the load is in the "other" category—and even more would be identified as "other" if the "large" category were broken out. The total 2024 load of 3,581 GWh is 255 GWh (or 6.6 percent) below that of the econometric forecast. The load growth in the SAE model is almost entirely associated with the "other" category. Better understanding of that category is key to the commercial SAE forecast.

Table 11: SAE Commercial Model Load Forecast Components

End-Use	2024 Load (GWh)	Fraction of Load
Heat	424	12%
Cool	73	2%
Other	2,378	66%
Large	421	12%
Unmetered	119	3%
Muni	71	2%
Adjustment	95	3%
Total	**3,581**	**100%**

6. INDUSTRIAL FORECAST

6.1. Econometric Model

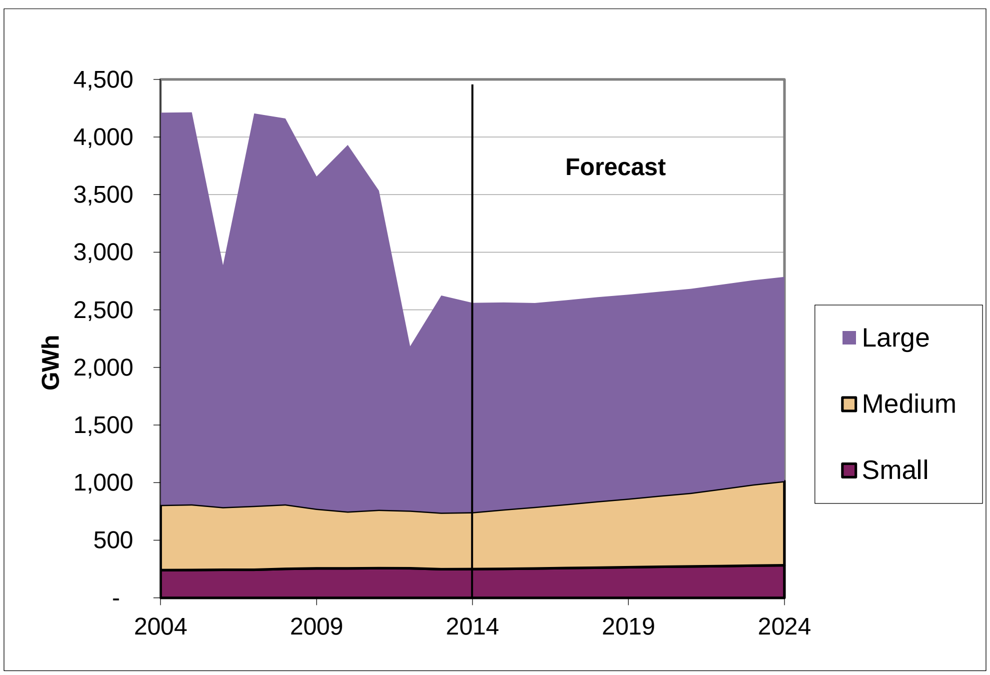
The 2014 total industrial sales forecast without a DSM adjustment increases from 2,561 GWh in 2014 to 2,786 GWh in 2024 (assuming the continued operation of the Port Hawkesbury Paper mill). If that mill discontinues operation, the load loss would be about 1,060 GWh.

The industrial sector forecast is composed of three customer classes: small, medium, and large. Separate econometric models are used for the first two groups, while individual customer information is used for the last one.

Historically, large customers have represented about 80 percent or more of the industrial sales. In the 2014 forecast that ratio has dropped to just below 70 percent. Further closures (e.g., the PHP mill) could reduce it further.

The largest relative growth occurs with the medium customers (see Figure 7), with a 49-percent increase over the forecast period; this is rather high compared to the 13-percent decline for medium customers over the previous ten years.

Figure 7: Industrial Sales – Historic and Forecast



The 2014 forecast uses separate econometric models for the small and medium customers. The models are nearly the same as last year's, and use 20 years of data. The coefficients vary some from last year, but are similar. The primary driver of the growth in the medium customer forecast is related to the 53 percent increase in manufacturing gross domestic product (GDP) over this period. The models' variables are summarized in the following tables.

Table 12: Small Industrial Customer Forecast Model Variables

Variable Name	Description	Comment
RQTOS	NS GDP	Total provincial GDP
SMIND[-1]	Industrial sales from the previous year	A lag factor to the previous year's sales.

The 2013 small industrial model also used non-residential investment, which is dropped in the current model.

Table 13: Medium Industrial Customer Forecast Model Variables

Variable Name	Description	Comment
RQMANS	NS Manufacturing GDP	RQMFS previously. This shows a substantial increase over the forecast period.
MEDIND[-1]	Industrial sales from the previous year	A lag factor to the previous year's sales.

The overall growth rate for small industrial sales is 1.25 percent, driven by the increase in GDP, which grows at a rate of 1.41 percent.

The overall growth rate for medium industrial sales is 4.00 percent, driven by the manufacturing GDP, which grows at a rate of 4.33 percent.

These industrial sales growths seem a little high, as one would expect some natural efficiency improvements over the forecast timeframe.

There is no linkage of the industrial forecasts with the residential or commercial forecasts other than through various economic assumptions, which should be self-consistent.

It is important to keep in mind that the bulk of the industrial forecast is determined outside of the econometric models based on information and projections for the large customers.

6.2. Statistically Adjusted End-Use Model

No end-use model has been developed for the industrial sector, nor is one being considered given the unique nature of this sector.

7. END-USE LOAD FORECASTING

For a number of years, a process has been underway to incorporate SAE modeling in the NSPI forecast to better characterize the components behind electricity sales and load growth. The intent is to produce a more robust forecast and also to aid in the development of energy efficiency programs.

Following is a timeline describing NSPI's progress toward incorporation of SAE modeling:

- **2009** – Directed by NSUARB to investigate implementation of an end-use model. Selected vendor (Itron) acquired data.
- **2010** – Populated model and developed a trial forecast. Calibration and tuning in Q4.
- **2011** – Prepared analysis report on load forecasting with end-use models (April). Continued to refine models and engage in discussions with ENSC.
- **2012** – Continued work on the end-use model for the residential and commercial sectors. Presented results to date in October.
- **2013** – Did not include end-use analysis in the official filed forecast, but prepared a status report in February.[7] Provided an update in July comparing the end-use forecasts with those using the current econometric model.[8]
- **2014** – Included some discussion of the SAE residential and commercial models in the body of the forecast report and in Appendix D. Continued to use the econometric model results for the base forecast, although a comparison was provided in the appendix.

At this point the differences between the econometric and SAE forecasts are not large. The residential SAE forecast is nearly identical to the econometric one, and is only 1.4 percent greater in 2024 (see Figure 8).

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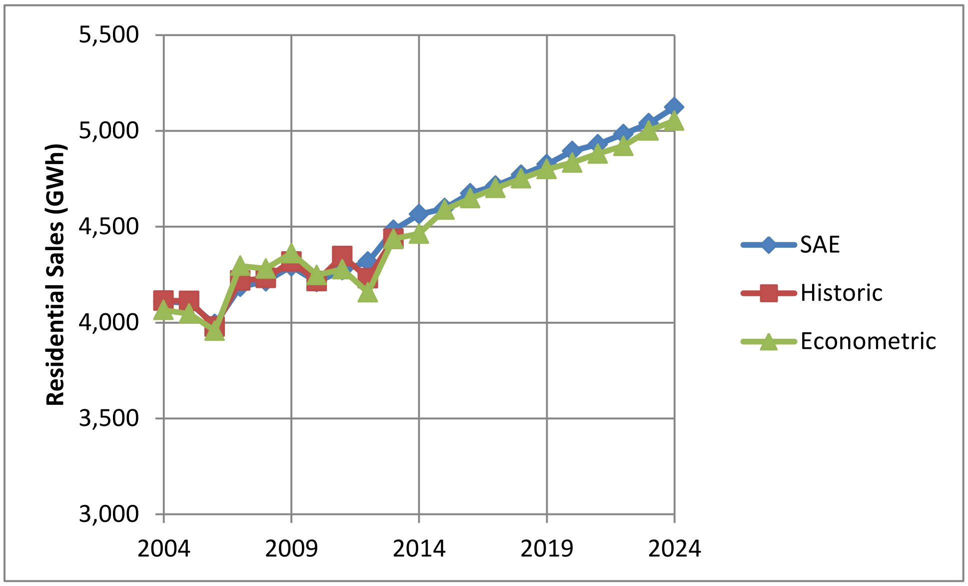
[7] "Electricity Load Forecasting using Statistically-Adjusted End-Use models," NSPI, February 28, 2013.

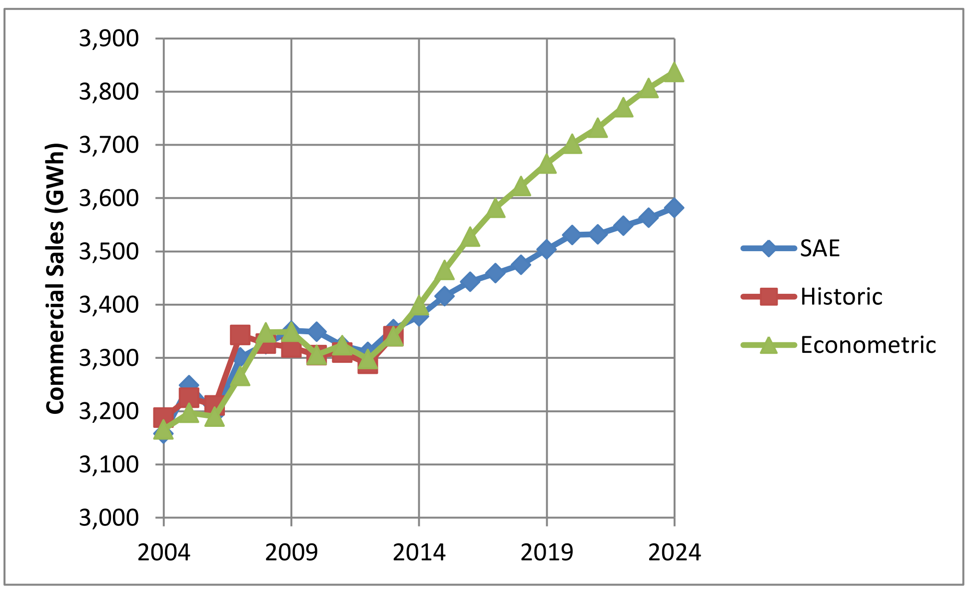
[8] "2013 load forecast comparison.docx," from Sandy Allen, 7/25/13.

Figure 8: Residential Forecast Comparisons



The differences between the commercial forecasts are greater, but not by a lot; the SAE forecast is 6.6 percent lower in 2024 than the econometric forecast. Both forecasts show modest growth, although the loads in the recent several years have been relatively flat. The SAE forecast seems a bit more reasonable, but a few more years of data might help resolve the issue.

Figure 9: Commercial Forecast Comparisons



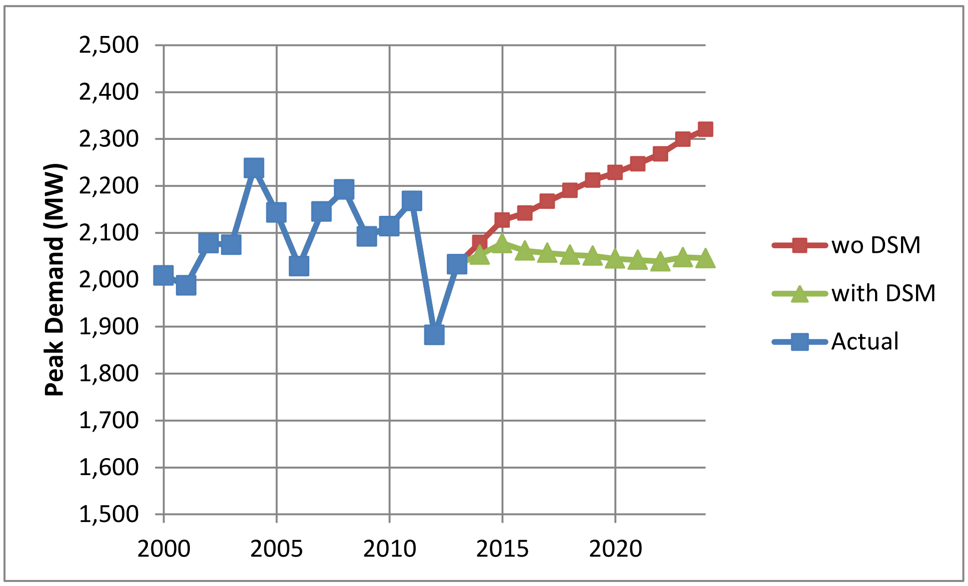
Our sense is that the end-use forecasts are now developed enough to stand on equal footing with the econometric forecasts, and are probably ready to play the primary role for the residential and commercial sectors.

8. PEAK LOAD FORECASTING

Although the peak load forecast is driven by the energy forecast, it is a very important component of resource planning and needs careful review.

The peak load forecast (see Figure 10) is based on the energy requirements and the expected load shapes for various customer classes. The load shapes are based on historical analysis with adjustments for known changes. In the 2014 forecast, assuming the continued operation of the PHP mill, the coincident peak demand without DSM is expected to increase from 2,072 MW in 2014 to 2,320 MW in 2024 (an increase of 274 MW or 13 percent). In the forecast including DSM effects, the 2024 prediction is 2,046 MW (a decrease of 7 MW or 0.3 percent relative to 2014). This reflects the differences of the energy forecasts. With the closure of the PHP mill, the peak load is reduced by 66 MW.

Figure 10: NS Peak Load Historic and Forecast



Although the SAE model is also capable of forecasting peak loads, it was not done with this report. We recommend that in the next report both the load-shape-based and SAE peak load forecasts be presented and discussed. This is important because of the anticipated growth in electric space heating usage, which may have a disproportionate effect on the winter peak loads.

There is also the question of whether the load from the big mills should be included in the peak forecast or not since some of them are on marginal rates without fixed-cost components. However, this may be more of a rate or an IRP issue than a forecast one.

9. CONCLUSIONS AND RECOMMENDATIONS

The 2014 forecast is very similar to that of 2013. The residential and commercial forecasts are very close to those of last year; the econometric models are nearly identical, although the coefficients have changed slightly.

The big changes in the past and potentially in the future relate to the industrial sector and the closings of large mills. The PHP mill is now back in partial operation under a load retention tariff, but that could change in the future. The underlying growth in other sectors (residential and commercial) is relatively low, and with modest energy efficiency efforts sales will likely remain relatively flat over the forecast period.

The primary growth driver for residential load is electric space heating, which contains many assumptions that should be more closely investigated and fully described in the forecast report.

The industrial medium customer forecast shows a high growth rate associated with forecasted increases in manufacturing GDP that may or may not play out.

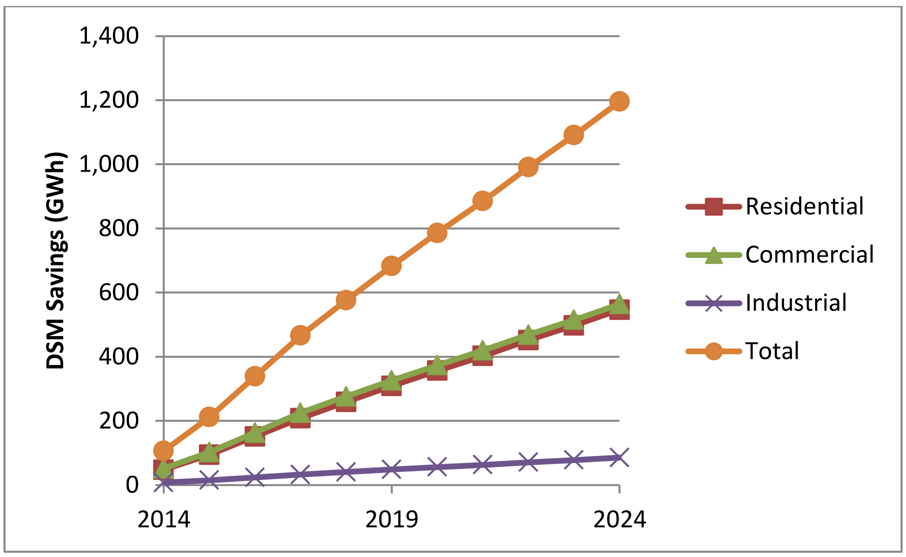
General Recommendations

1. Switch to using the SAE models for the primary residential and commercial sector forecasts.
2. Collaborate with ENSC in developing common assumptions and understandings of the end-use components and continue to refine the SAE models.
3. Evaluate more closely the factors affecting space heating loads and programs that might moderate those impacts, especially on peak loads.
4. Evaluate the industrial sector small and medium econometric models and consider alternative formulations given that the predicted growth rates are much above recent historical trends.
5. Review the system peak forecast methodology, and more explicitly incorporate the end-use components of the SAE models.
6. Consider representing a forecast range based on different assumptions about demographics, economics, technology, and DSM levels, as was done for the current IRP.

APPENDIX A: DEMAND-SIDE MANAGEMENT (DSM)

The amount of future DSM is determined by the activities of the independent Efficiency Nova Scotia (ENSC). As such it is an exogenous input to the forecast developed by NSPI. The figure below shows the levels of DSM assumed in the filed forecast. The total sales reduction from DSM in 2024 is 1,196 GWh, or 10.3 percent of the unadjusted load. In absolute terms the residential and commercial sector savings are about the same, but the commercial savings are greater as a proportion of the load, at 14.8 percent. The industrial savings are low both in absolute and percentage terms. The average annual incremental savings overall are 1.05 percent, but are 1.11 percent for residential, 1.55 percent for commercial, and 0.30 percent for industrial (see Figure A-1).

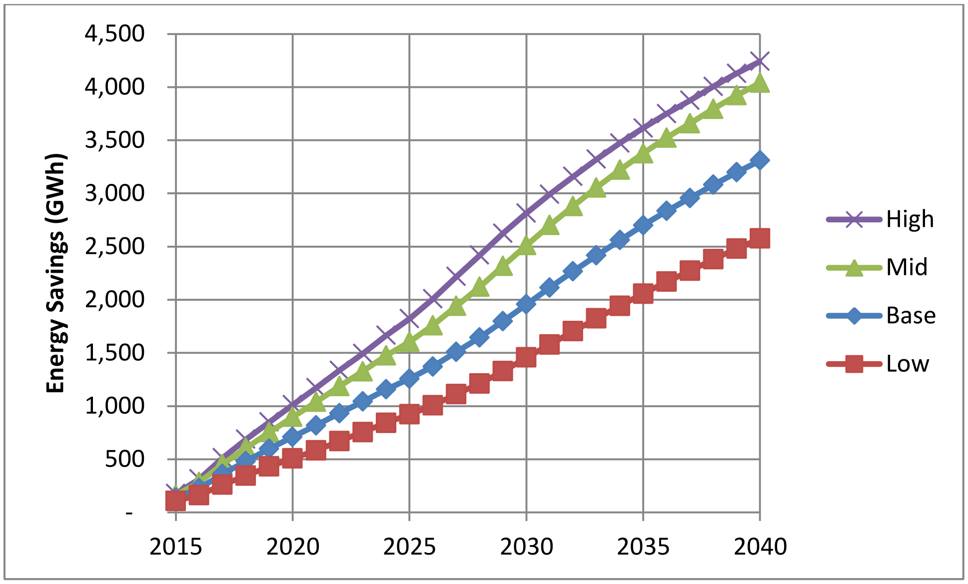
Figure A-1: DSM in the 2014 Forecast



The level of DSM is really a discretionary factor depending on the overall potential and the efforts by ENSC. In 2013 ENSC commissioned Navigant to perform a study of the DSM potential in Nova Scotia through 2040.[9] The Base Case achievable potential that Navigant identifies for 2024 is very close (1,155 GWh) to that used in the 2014 forecast report (1,196 GWh). However, Navigant also identifies a range of DSM savings depending on the DSM program efforts, which in 2024 range from 841 to 1,664 GWh. The achievable potential increases over time, and by 2040 the range is from 2,576 to 4,241 GWh (see Figure A-2).

[9] "Nova Scotia 2015-2040 Demand Side Management (DSM) Potential Study," Navigant Consulting, January 2014.

Figure A-2: Achievable DSM Potential



This indicates that a very important and potentially controllable element of Nova Scotia electricity loads is the levels chosen for the DSM programs. Given other driving factors behind Nova Scotia loads, it seems quite feasible to maintain flat load levels into the foreseeable future with appropriate DSM program efforts.

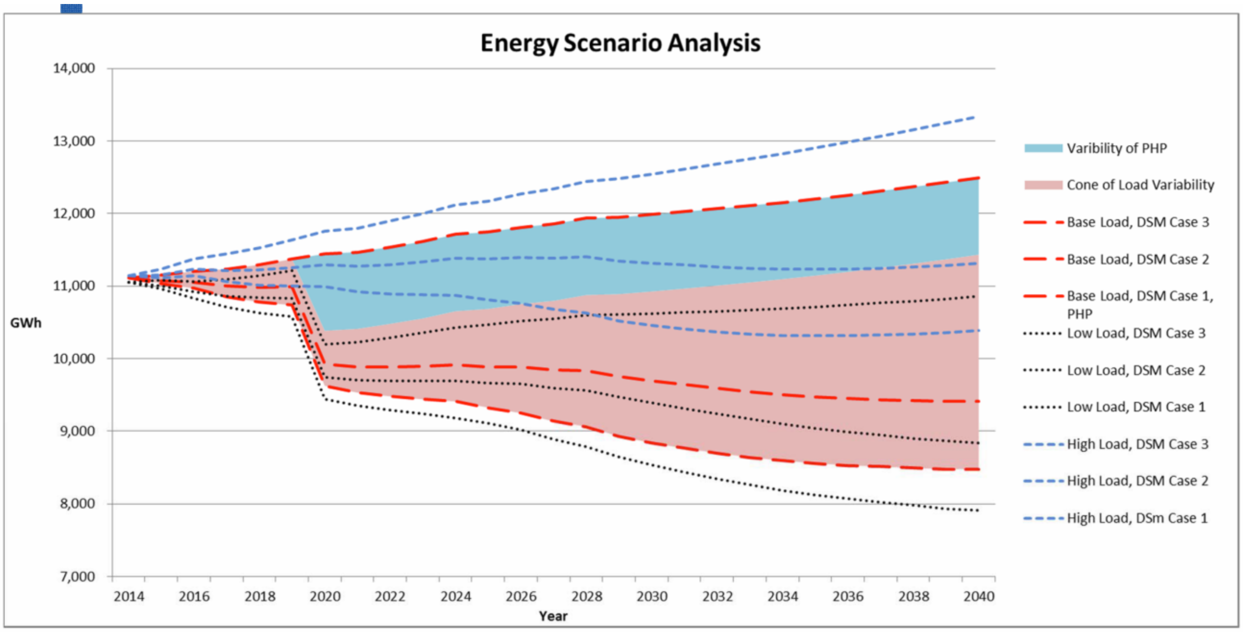
APPENDIX B: COMPARISON WITH OTHER FORECASTS

Concurrent with the filed 2014 load forecast, a number of other forecasts have also been put forward in other contexts.

In June of 2014 NSPI released its 10-year system outlook report.[10] In that report NSPI used the SAE model results, which as discussed previously are close to those of the econometric models used in the filed report.

In addition, a number of load forecasts were considered for the current IRP.[11] The following figure from slide 79 of the IRP assumptions report illustrates the possible range. The various parameters considered included the closure (or not) of the PHP mill, various DSM levels, and different underlying load growth. The current 2014 forecast, which only runs to 2024, corresponds to the mid-range of these IRP scenarios. The scenario range in loads by 2040 is substantial—from about 8,000 to over 13,000 GWh per year. In the near term, the largest change is associated with the closure, or not, of the PHP mill.

Figure B-1: Forecast Scenario Range in the 2014 IRP



[10] "10 Year System Outlook 2014-2023 Report," NSPI, June 2014.

[11] "20140411 NS Power IRP Assumptions - Final.pdf," NSPI, April 2014.