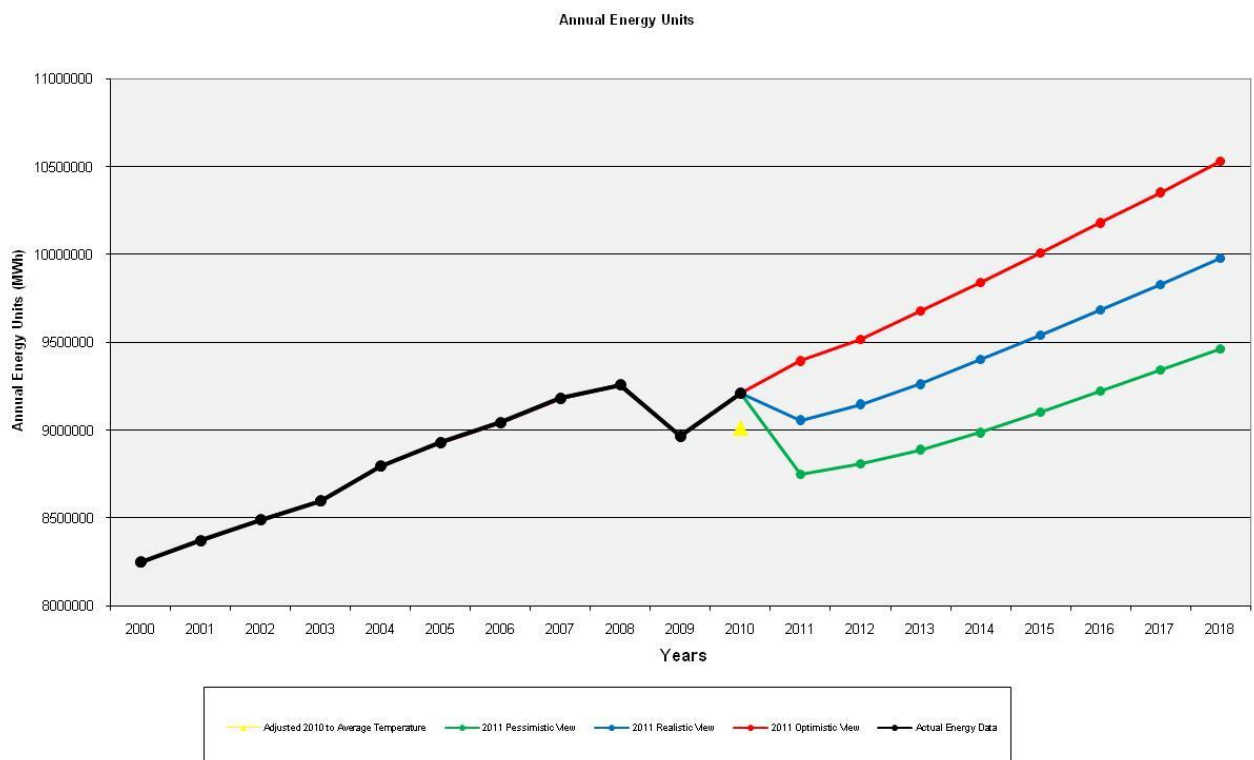


Forecast of Northern Ireland Energy Production & Peak Demand

July 2011



Introduction

SONI, as System Operator for Northern Ireland, is responsible for operating the transmission system in a safe, secure and economic manner. An important aspect of this role is to ensure generation capacity is adequate to meet forecast and actual Demand. To successfully achieve this SONI require accurate annual forecasts of electricity Energy Production (MWh) and Peak Demand (MW).

Given that temperature has been found to have the greatest effect on the demand for electricity, SONI adjust Peak Demand data to a temperature standard known as Average Cold Spell (ACS). Climate condition variation is therefore accounted for in the Peak Demand forecast.

Following on from last year's Energy Production forecast, SONI have carried out further investigations to take into account the effect of temperature on Energy Production. Studies have revealed a significant correlation between temperature and Energy Production throughout the year and this has been used to forecast ahead based on average temperature years.

SONI had historically used a deterministic forecasting modelling tool called "GMAS" which uses regression analysis over varying historic time frames to create forecasts for both Energy Production and Peak Demand. Until 2008 annual forecasts of Energy Production and Peak Demand using GMAS have been reasonably accurate and produced predicted values close to the actual observed values.

However, since 2008, without appropriate adjustment there would have been an increase in the error between the predicted values of the GMAS forecasts and the actual observed values. SONI believe this is explained by the drastic downturn in the global economy that began during the second half of 2008. This sudden economic shock has had a major affect on Peak Demand and Energy Production in Northern Ireland. This affect can be seen in Figure 1 and Figure 2. These show how the GMAS forecasts for Energy Production and Peak Demand have compared against the actual observed values and also how the current economic crisis have affected the Energy Production and Peak Demand.

It should be noted that the decline in Energy Production shown in 2008 is not to the same extent as the decline in Peak Demand during the 2008/09 winter because the economic downturn only began in the second half of 2008. If we were to adjust the 2008 figures for the complete year to represent the decline that happened in the second half of 2008, the Energy Production drop would be considerably more and would then be consistent with the observed drop in Peak Demand for during the 2008/09 winter.

Regression analysis using GMAS looks back over historic time scales to maximise data correlation. This technique is appropriate when considering general longer term trends in energy usage patterns. When sudden non incremental swings occur and uncertainty in the future of the economy exists, it is necessary to investigate other forecasting techniques and demand data analysis must be more granular in nature also. It is for this reason the traditional forecasting approaches have been modified to increase accuracy going forward.

It should be noted that GMAS is the preferred SONI forecasting tool. Its forecast outputs will continue to be monitored closely as it is expected that they will become more accurate as future underlying growth returns to a steady year on year rate.

Figure 1 – GMAS Forecasted and Actual Energy Production

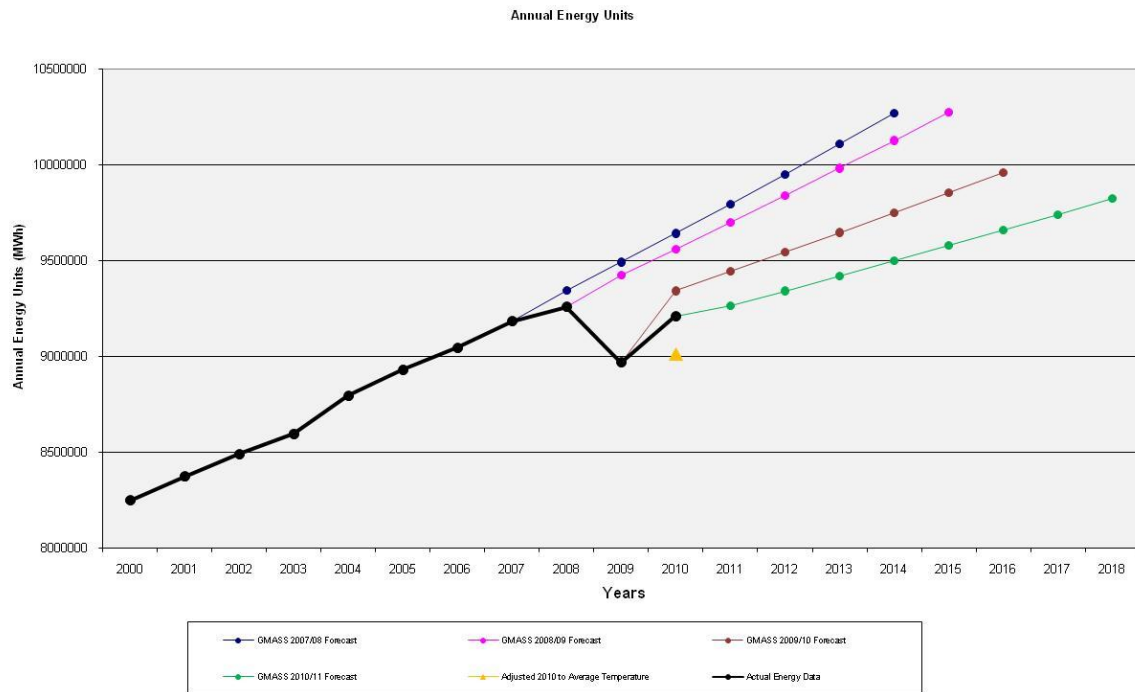
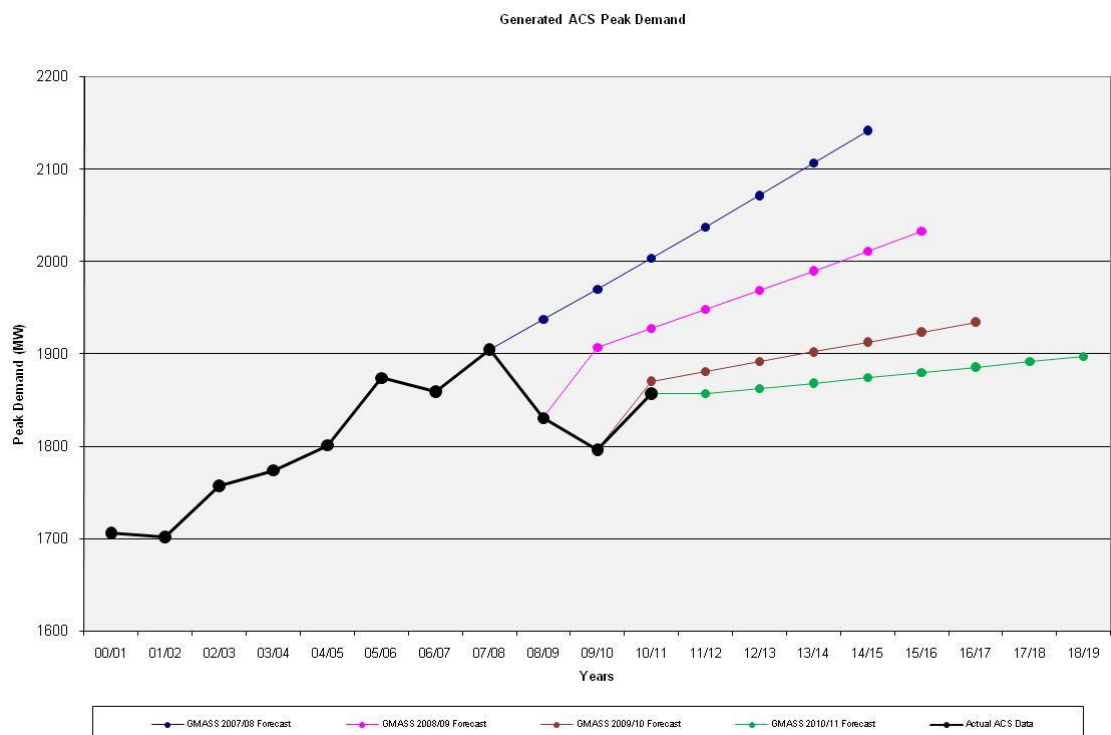


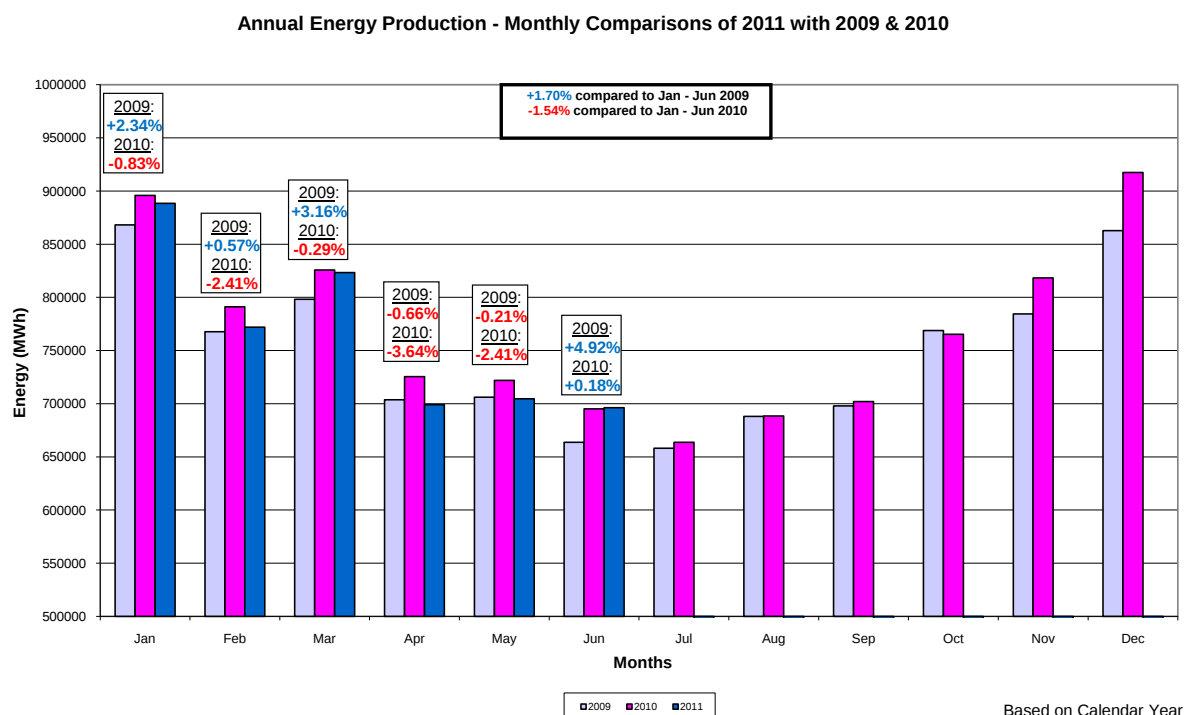
Figure 2 – GMAS Forecasted and Actual Peak Demand



Overview of Current Energy Trends

Figure 3 shows recent monthly energy growth rates comparing the first 6 months of 2011 with the same months in 2009 and 2010. When comparing January – June 2011 with January – June 2010 it can be seen that the Energy has fallen by 1.54% in 2011 for the first 6 months.

Figure 3 – 2011 Energy Production Monthly Comparison

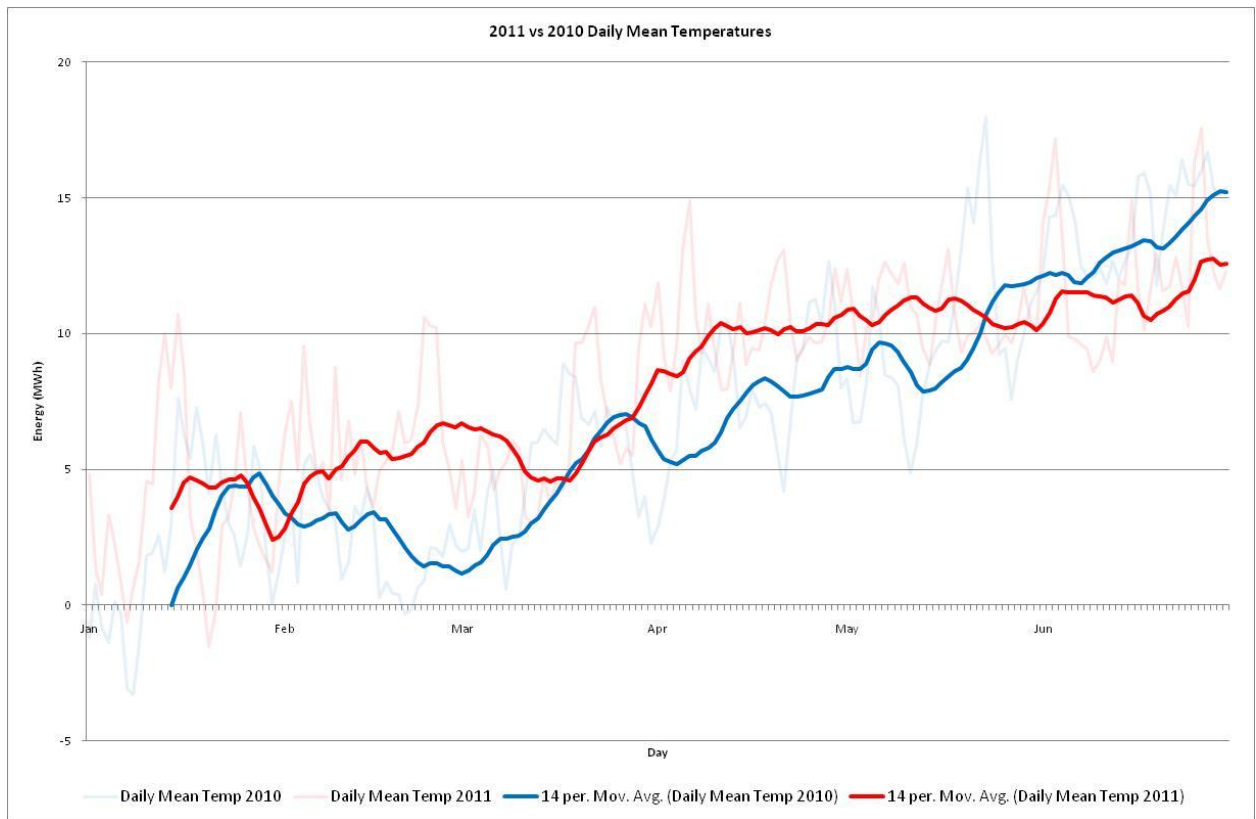


It should also be noted that the winter 2009/10 was very cold and experienced inclement weather conditions with prolonged low temperatures that had not been experienced in Northern Ireland and the UK since the early 1980s. This trend then continued into the 2010/11 winter, with December being particularly cold with heavy snowfalls and record cold temperatures.

Figure 4 below shows that as the first 5 months of 2011 progressed, the temperatures as compared to first 5 months of 2010 were relatively high before this trend reversed in June when the June 2011 temperature is colder than June 2010. When this is viewed along with the Energy Production comparison in Figure 3 it is clear to see that this trend follows through here where the year on year monthly energy growth declined for the first 5 months of 2011 before it reverses in June 2011.

This accounts for the ~2% decrease in Energy Production from January 2011 to May 2011. However, in June 2011, when temperatures are lower than June 2010, a positive growth rate is observed.

Figure 4 – 2011 Temperatures vs 2010 Temperatures at Castlereagh House



SONI have therefore carried out further investigations around this correlation of temperature on Energy Production to produce an Energy Production forecast that not only takes into account the general econometric factors in Northern Ireland but also a forecast that is based on an average temperature over a number of years.

The method used to produce this forecast will be explored in more detail in the following section.

Forecast of Annual Energy Production

Realistic Annual Energy Production Forecast

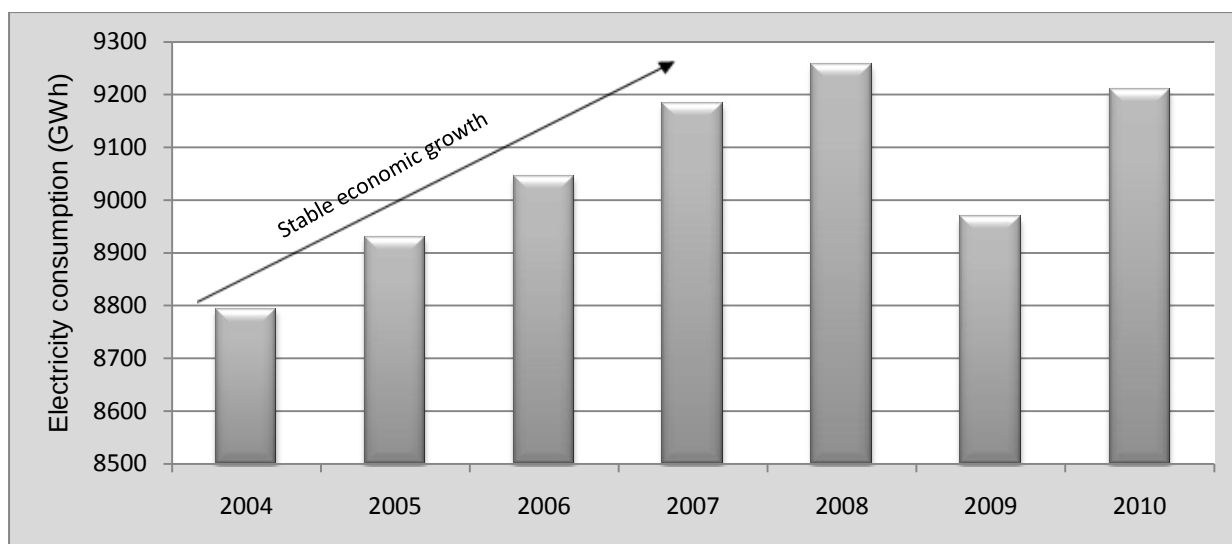
Before the ongoing economic downturn began towards the end of 2008 the Energy Production in Northern Ireland had an underlying year on year growth of $\approx 1.5\%$. There are several factors which can affect this growth including the growth or decline of the economy, weather conditions or special public events etc.

Figure 5 below illustrates this stable growth in Energy Production from 2004 to 2007. Following the sudden shock of the economic downturn in 2008 the growth rate began to slow, and by 2009 Energy Production had declined to levels comparable to 2005.

It should be noted that the decline in Energy Production shown from 2007 to 2008 is not to the same extent as the decline from 2008 to 2009 because the economic downturn only began in the second half of 2008. If we were to adjust the 2008 figures for the complete year to represent the decline that happened in the second half of 2008, the Energy Production decline would be considerably more.

A sudden increase in Energy Production is then observed from 2009 to 2010, despite only a modest economic growth (0.8% GDP Growth¹) over the same period. This increase is explained by the very cold and inclement weather conditions along with prolonged low temperatures and heavy snowfalls that occurred at both the beginning and the end of 2010.

Figure 5 – Energy Production from 2004 to 2010



It is for this reason that SONI have now formulated a method to forecast Energy Production that takes both the effect of temperature as well as econometric factors into consideration.

¹ PWC NI Economic Outlook (March 2011) http://www.pwc.co.uk/ni/publications/nieo_mar_2011.html

This method is based on adjusting Energy Production for the last known full year of data to a level where it would have been had that year been an average temperature year. This adjusted Energy Production can then be used as a base year to forecast future years assuming that they also are average temperature years.

The adjustment is made by establishing the correlation equation between the daily energy and the daily average temperature for each week day of the year. For example, Figure 6 shows the correlation between daily energy and temperature for Tuesdays in 2010. The average temperature for each week day of each month over that last 7 years is also calculated and then applied to the corresponding established correlation equation for each week day of the forecasted year.

Figure 6 – Correlation between Daily Energy Production and Temperature for Tuesdays in 2010

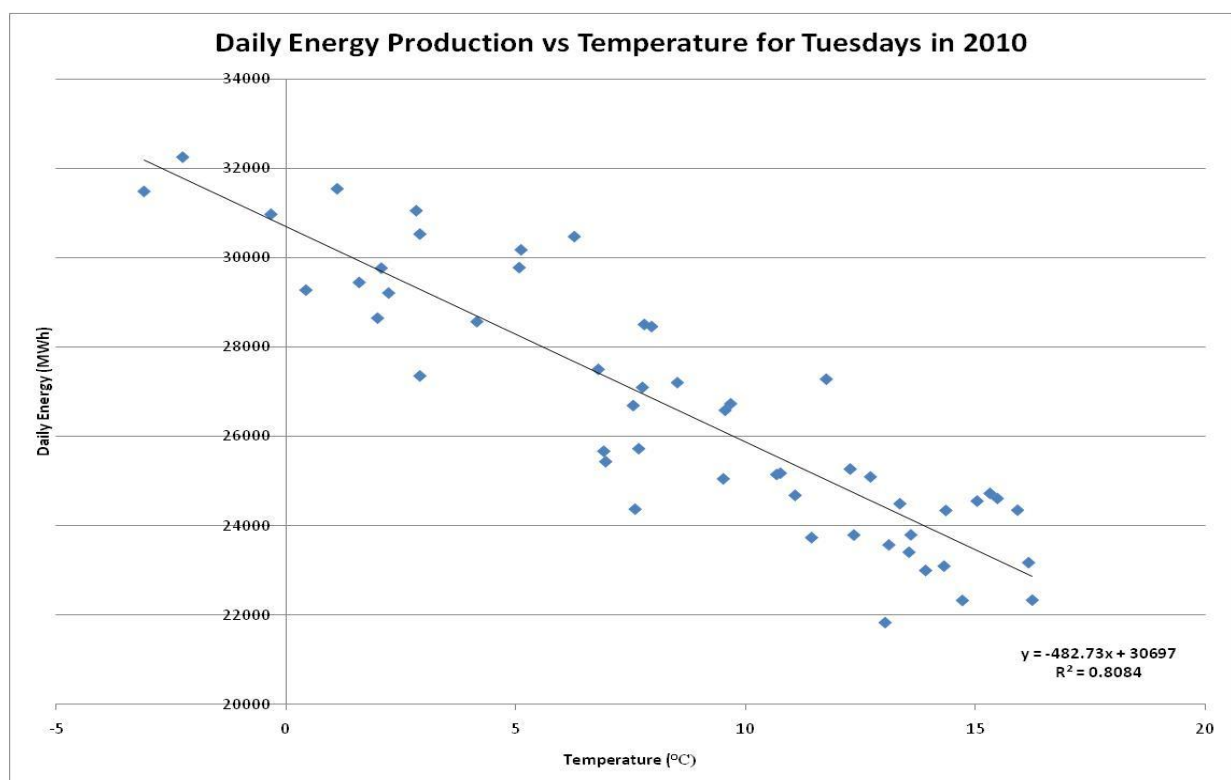


Figure 7 below shows an example of the correlation equations for each week day of 2010 and the corresponding average July temperatures over the last 7 years that are applied to adjust the Energy Production for July 2011 to level had it been an average temperature year.

Figure 7 – Temperature Adjusted Energy for each weekday in July

2010 Correlation Equations for Each Week Day in 2010		7 Year Average Temp (°C)		Temperature Adjusted July Energy Forecast for Each Weekday (MWh)
Monday	Energy = -476 T + 29641	July Monday	15.05	22477
Tuesday	Energy = -493 T + 30349	July Tuesday	14.97	22974
Wednesday	Energy = -457 T + 30269	July Wednesday	15.40	23228
Thursday	Energy = -483 T + 30697	July Thursday	14.91	23498
Friday	Energy = -431 T + 29391	July Friday	14.56	23115
Saturday	Energy = -452 T + 26867	July Saturday	14.34	20392
Sunday	Energy = -444 T + 26032	July Sunday	14.71	19526

This is carried out for each month of the year to build up the total Energy Production for the forecasted year.

Using this adjusted Energy Production for future years effectively assumes an economic growth rate of 0% as only temperature has been used to make the adjustment. This may not be the case so a view of forecasted economic growth rate is examined also to apply to the adjusted base year.

This results in an Energy Production forecast that takes both the temperature and economic growth forecast into account.

This method also allows for a number of forecast scenarios to be derived. The Energy Production for the last known full year of data can also be adjusted to an average cold temperature year or an average warm temperature year as well as the average temperature year as described above. As well as this varying forecasted economic growths can also be applied.

This results in the 'optimistic' forecast being based on an average cold temperature year with a high economic growth applied and the 'pessimistic' forecast being based on an average warm temperature year with a low economic growth Rate applied.

Econometric Factors

Until 2008 factors affecting energy consumption, such as economic growth represented by various econometric indices, have been used to validate system demand forecasts.

The global economy weakened rapidly towards the second half of 2008 and has continued to decline each year since then. Continuing uncertainty surrounding the Euro zone has lead to world markets becoming unstable, making them hard to predict going into the future. This sort of uncertainty can have a knock-on effect upon consumer spending and overall demand.

To date the private sector of the Northern Ireland economy has bore the main pressures of the economic downturn with the retail sector, the manufacturing sector, and the construction industry suffering the most. It is becoming more evident that these sectors have experienced a huge contraction since 2008. In the past it was hoped that Northern Ireland was in a better position to deal with the ongoing downturn compared to many other UK regions as it has a higher share of public sector employment than other regions of the UK with these jobs being less likely to be at risk.

However, now that the UK Government have outlined a number of austerity plans to reduce the UK deficit, massive cut backs in UK public sector spending is underway, including reductions in public sector employment. This will have substantial negative affect on the Northern Ireland economy precisely due to the fact that a large public sector that exists in Northern Ireland. This will also have a further negative knock on affect on the private sector because fewer contracts that were previously available through public sector projects, such as building new roads, will no longer be available.

With all of these factors in mind, economic analysts are continually adjusting their predictions on economic growth. SONI has therefore used a number of local sources, available as of July 2011, to make a judgement on economic growth forecast for Northern Ireland:

- A recent economic outlook report from the Northern Bank² stated that predicted economic growth for Northern Ireland will be 0.8 - 1.3% for 2011 and 1.7 – 2.2% for 2012.
- A recent PricewaterhouseCoopers³ press release has stated that they believe the Northern Ireland Economy will grow no more than 0.8% in 2011. They also published a UK Economic Outlook Report in July 2011⁴. This further estimated the Regional Growth for Northern Ireland in 2012 would be ≈1.6%.
- The Economic Briefing: June 2011⁵ paper from the Northern Ireland Assembly Research and Information Service quotes a range of 0.5% - 1.1% growth in the Northern Ireland economy in 2011, with a 1% growth in 2012. It also states that the Northern Ireland economic recovery continue to be slower and more protracted than the UK average, with economic performance expected to be significantly below that of the UK.

Figure 8 below shows the SONI predictions for economic growth in Northern Ireland that will be applied in the Energy Production forecasts. These were based on taking into account all of the local economic forecasts, the current uncertainty being experienced by markets worldwide and the ongoing public sector cuts that the Northern Ireland Executive are implementing. Given the high degree of uncertainty over the future SONI feel the best approach is to consider three alternative possible scenarios for the economy; Optimistic, Realistic and Pessimistic.

² Northern Bank Quarterly Sectoral Forecasts – Quarter 3 2011

(<http://www.northernbank.co.uk/SiteCollectionDocuments/economic/2011/economic-forecast-q3-2011.pdf>)

³ PWC NI Press release (July 2011) (http://www.pwc.co.uk/ni/press_release/ni_ukgdp_growthmarginallypositive.html)

⁴ PWC UK Economic Outlook Report (July 2011) (http://www.pwc.co.uk/eng/publications/ukeo_complete.html)

⁵ Northern Ireland Assembly Economic Briefing: June 2011

(<http://www.niassembly.gov.uk/researchandlibrary/2011/7811.pdf>)

Figure 8 – Economic Growths Rates Used in Forecasts

	Yr on Yr % Economic Growth Rates		
	Optimistic	Realistic	Pessimistic
2011	0.70	0.50	0.30
2012	1.30	1.00	0.70
2013	1.70	1.25	0.90
2014	1.70	1.50	1.10
2015	1.70	1.50	1.30
2016	1.70	1.50	1.30
2017	1.70	1.50	1.30
2018	1.70	1.50	1.30

In terms of when the economic trends will return to normal is also open to much debate. Economists are hesitant to project when a return to normal and/or steady economic growth will return, with some predicting 2014, while others vary on either side of this.

In the Realistic scenario SONI assumes that a steady econometric growth rate of 1.5% has returned by 2014. The Optimistic scenario assumes that a growth has returned by 2013 but at a higher rate (1.7%), while the Pessimistic scenario assumes steady growth will return in 2015 but at a lower rate (1.3%).

Figure 9 shows the resultant forecasted monthly Realistic Energy Production that is based on both an average temperature year and the realistic economic growth prediction.

Figure 9 – Forecasted Realistic Monthly Energy Production

	Forecasted Realistic Monthly Energy Production (Sent-Out, MWh)								
	2010	2011	2012	2013	2014	2015	2016	2017	2018
January	895909	888446	837808	848281	861005	873920	887029	900334	913839
February	791068	772017	764925	774486	786103	797895	809863	822011	834341
March	825732	823332	832190	842592	855231	868060	881080	894297	907711
April	725400	698971	765233	774798	786420	798217	810190	822343	834678
May	721976	704564	762352	771881	783460	795211	807140	819247	831535
June	695060	696319	694148	702825	713367	724068	734929	745953	757142
July	663705	691449	694163	702841	713383	724084	734945	745969	757159
August	688426	701396	704149	712951	723646	734500	745518	756701	768051
September	702086	699731	702478	711259	721928	732757	743749	754905	766228
October	765250	758597	761575	771095	782661	794401	806317	818412	830688
November	818354	781718	784787	794597	806516	818614	830893	843356	856007
December	917377	840360	843659	854205	867018	880023	893223	906622	920221
Yearly Total	9210345	9056899	9147468	9261811	9400739	9541750	9684876	9830149	9977601
Yr on Yr Growth Rate		-1.67	1.00	1.25	1.50	1.50	1.50	1.50	1.50

Figure 10 shows the predicted values of Annual Energy Production in future years under the three various scenarios. The blue line depicts the forecast values if the Realistic Scenario occurs, where the realistic economic growth occurs and average temperature years are experienced. The red line depicts the Optimistic Scenario where the economy recovers sooner than some expect at a higher rate and average cold temperatures are experienced. The green line depicts the Pessimistic Scenario where economic conditions are predicted to return to a lower rate at a slow pace along with average warm temperatures occurring. The yellow triangle illustrates the adjusted 2010 Annual Energy Production corrected to a level if an average temperature year had occurred.

Figure 11 shows a table of the values of the forecasted Annual Energy Production and the corresponding year on year growths rates.

Figure 10 – Annual Energy Production Forecast

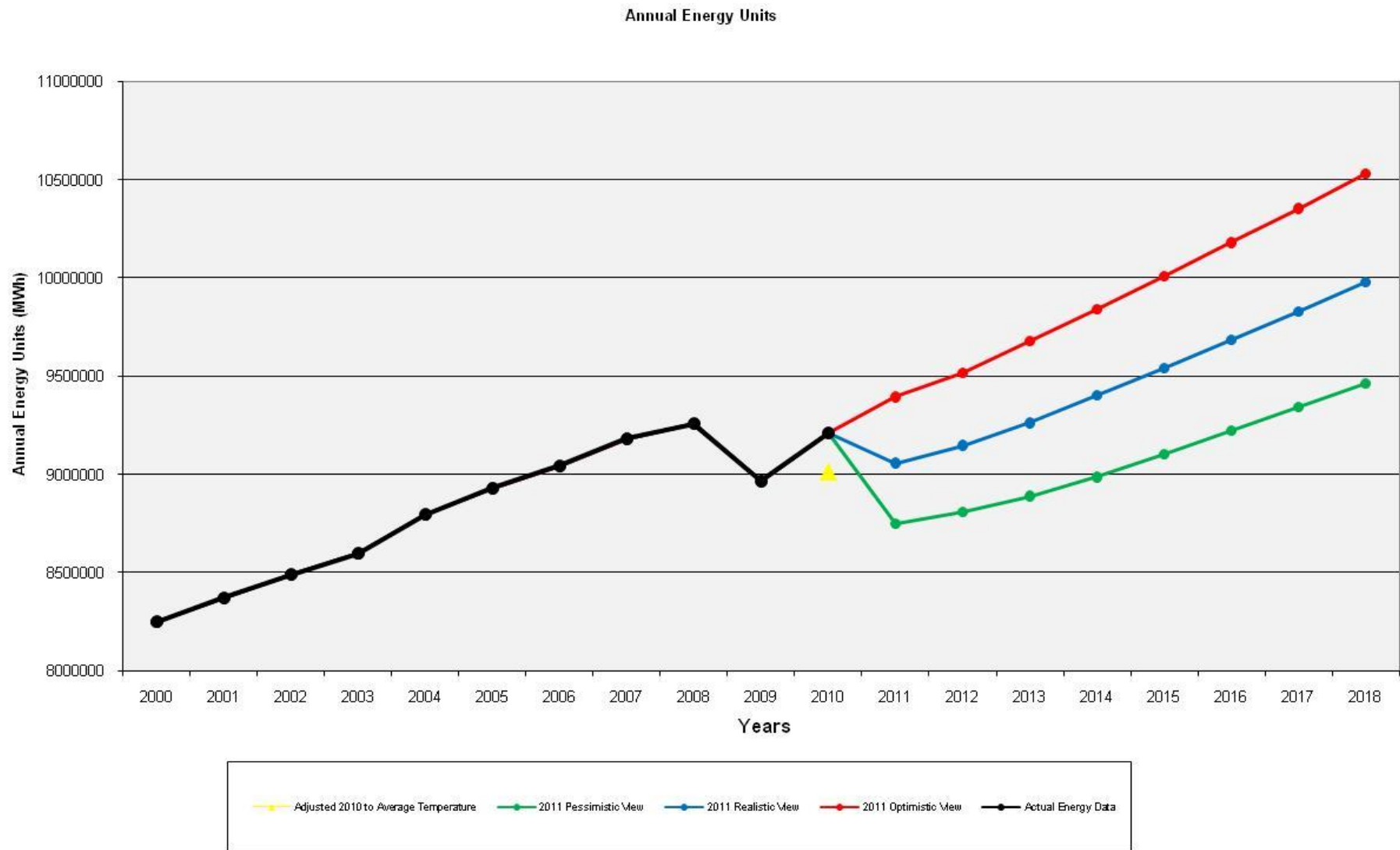


Figure 11 – Forecasted Annual Energy Production and associated Year on Year Growth Rates

	Forecasted Energy Production (Sent-Out, MWh)								
	2010	2011	2012	2013	2014	2015	2016	2017	2018
2011 Realistic View	9210345	9056899	9147468	9261811	9400739	9541750	9684876	9830149	9977601
Year on Year % Growth		-1.67	1.00	1.25	1.50	1.50	1.50	1.50	1.50
2011 Optimistic View	9210345	9393941	9516063	9677836	9842359	10009679	10179844	10352901	10528900
Year on Year % Growth		1.99	1.30	1.70	1.70	1.70	1.70	1.70	1.70
2011 Pessimistic View	9210345	8748096	8809333	8888617	8986391	9103214	9221556	9341437	9462875
Year on Year % Growth		-5.02	0.70	0.90	1.10	1.30	1.30	1.30	1.30

Forecast of Future Generated ACS Peak Demand

Generated ACS Peak Demand Scenarios

As the Peak Demand has already been average cold spell (ACS) corrected, then no further adjustment is needed as the effect of temperature has already been taken into account. The same economic predictions in Figure 8 that were used in the Annual Energy Production forecast have also been used to derive the 3 forecast scenarios for future Peak Demands.

1. Realistic Scenario – Generated ACS Peak Demand

In this scenario it is assumed that the ACS Peak Demand will grow in line with the 0.5% economic increase that is forecast for 2011 (see Figure 8). This is expected to return to the normal 1.5%⁶ growth rate by the 2014/15 winter and continue on at this normal 1.5% growth year on year from then.

2. Optimistic Scenario – Generated ACS Peak Demand

This scenario assumes that the economy will recover faster than some expect. The ACS Peak Demand will return to a steady growth rate in a shorter period and reach a higher stabilised growth rate of 1.7% by the 2013/14 winter.

3. Pessimistic Scenario – Generated ACS Peak Demand

This scenario assumes that the economy does not recover as fast as hoped and a prolonged economic downturn occurs. The ACS Peak Demand will therefore will only return to a steady growth rate over a longer period, reaching a lower stabilised growth rate of 1.3% by the 2015/16 winter.

Figure 12 shows the predicted values of Generated ACS Peak Demand in future years under the three various scenarios. The blue line depicts the forecast values if the Realistic Scenario discussed above were to occur. The red line depicts the Optimistic Scenario outlined above where the economy recovers sooner than some expect. The green line forecasts possible future peak demand values if economic conditions were to be possibly worse than expected as outlined in the Pessimistic Scenario.

Figure 13 shows a table of the values of the forecasted Generated ACS Peak Demand and the corresponding year on year growths rates.

⁶ Before the ongoing economic downturn began towards the end of 2008 the Peak Demand in Northern Ireland had an underlying year on year growth of $\approx 1.5\%$.

Figure 12 – Generated ACS Peak Demand Forecast

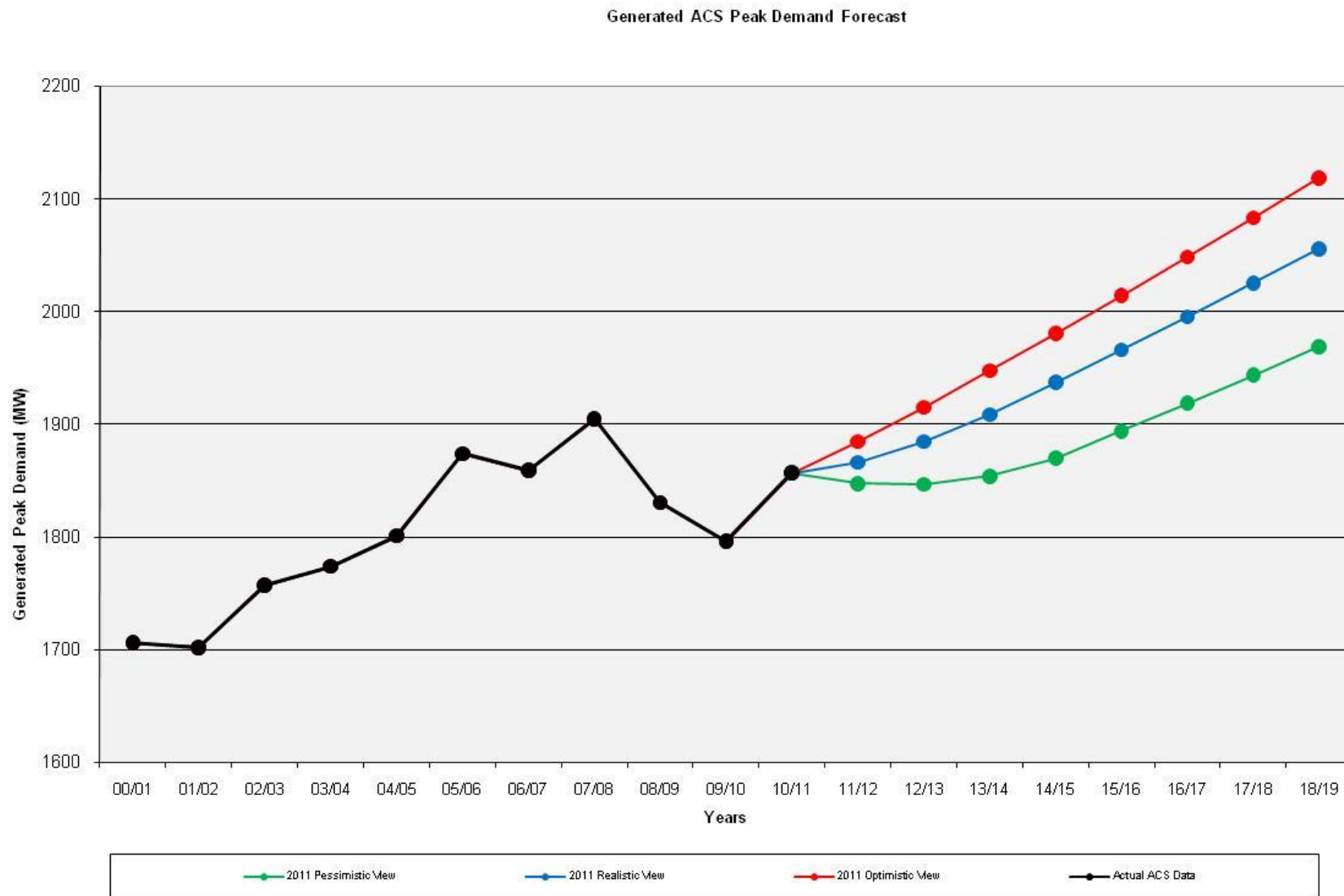


Figure 13 – Forecasted Generated ACS Peak Demand

	Forecasted ACS Peak Demand (Generated, MW)								
	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19
2011 Realistic View	1857	1866	1885	1909	1937	1966	1996	2026	2056
Year on Year % Growth		0.50	1.00	1.25	1.50	1.50	1.50	1.50	1.50
2011 Optimistic View	1857	1885	1915	1948	1981	2014	2049	2084	2119
Year on Year % Growth		1.50	1.60	1.70	1.70	1.70	1.70	1.70	1.70
2011 Pessimistic View	1857	1848	1847	1854	1870	1894	1919	1944	1969
Year on Year % Growth		-0.51	-0.05	0.40	0.85	1.30	1.30	1.30	1.30

Economic statistics sourced from the following publications:

PWC NI Economic Outlook (March 2011)

http://www.pwc.co.uk/ni/publications/nieo_mar_2011.html

Northern Bank Quarterly Sectoral Forecasts – Quarter 3 2011

<http://www.northernbank.co.uk/SiteCollectionDocuments/economic/2011/economic-forecast-q3-2011.pdf>

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