Impact of uniform TLAFs on SMP and MSQs

A study for Viridian

REDPOINT

Version History

Version	Date	Description	Prepared by	Approved by
1	13/08/2010	Final report	Marc Daube	Nick Screen Oliver Rix

Copyright

Disclaimer

While Redpoint Energy Limited considers that the information and opinions given in this work are sound, all parties must rely upon their own skill and judgement when interpreting or making use of it. In particular any forecasts, analysis or advice that Redpoint Energy provides may, by necessity, be based on assumptions with respect to future market events and conditions. While Redpoint Energy Limited believes such assumptions to be reasonable for purposes of preparing its analysis, actual future outcomes may differ, perhaps materially, from those predicted or forecasted. Redpoint Energy Limited cannot, and does not, accept liability for losses suffered, whether direct or consequential, arising out of any reliance on its analysis.

Contents & List of figures

1.1 Executive Summary

Redpoint Energy has been commissioned by Viridian to undertake market modelling in PLEXOS in order to analyse the impact of a move to uniform TLAFs on System Marginal Price (SMP) and Market Schedule Quantities (MSQs) in the Single Electricity Market (SEM), outlined as an interim measure in a Proposed Decision Paper by the Regulatory Authorities (RAs) on 18 June 2010.

The PLEXOS model used is the RAs' validated model for 2010/2011, with the following changes:

- Current forward curve commodity prices; *and*
- Redpoint assumptions for VOM costs, start costs and maintenance rates.

The analysis is centred on a Base case, with a number of sensitivities to assess the impact of changes in assumptions for key variables. In each scenario modelled we compared the results under the existing TLAF structure with the proposed uniform TLAF of 0.98.

SMP, Shadow Price and Uplift

There was an increase in SMP under a uniform TLAF in the Base Case (see Table 1). However, this was not always the case under our sensitivities. Whilst Shadow Prices typically increased, the impact on Uplift was more variable. As the magnitude of the changes in Uplift sometimes exceeded those in Shadow Prices, the directional effect on total SMP was not consistent.

We found a particular variability in relation to start cost assumptions, especially for CCGTs. Fuel price assumptions are also important and directionally impact SMPs. The nature of Uplift in the SEM makes it particularly sensitive, in an unpredictable manner, to a wide range of assumptions, and it is correspondingly difficult to draw robust conclusions about the directional Uplift development under uniform TLAFs.

Table 1 Change in SMP, Shadow Price, Uplift (uniform minus Existing)

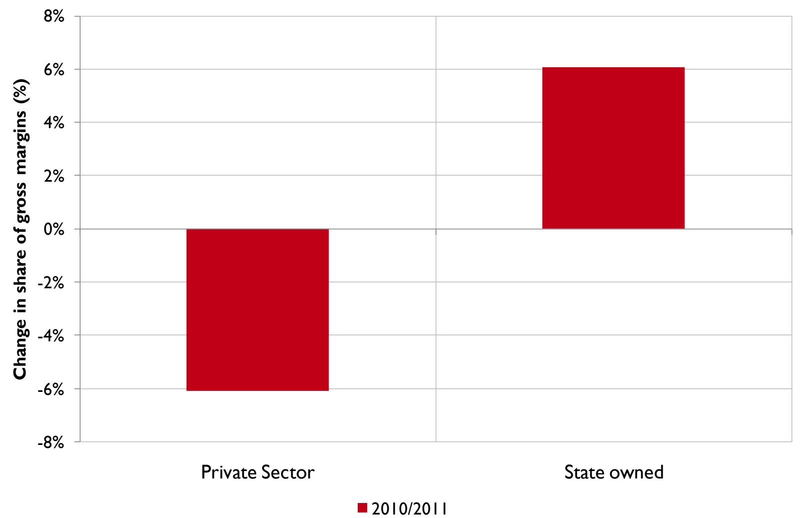
€/MWh	SMP	Shadow Price	Uplift
Base case	0.36	0.76	-0.41

Plant load factors, locational signals and redistribution effects

The impact on load factors and the reduction in locational signals (changes in gross margin) is clear. The effects on individual generators and company gross margin levels are consistent across a number of different scenarios and are of significant size. In addition, there is a significant jurisdictional redistribution from Northern Ireland (NI) to the Republic of Ireland (ROI) associated with uniform TLAFs, as well as between state-owned and private sector companies (see Figure 7 and Figure 1).

Further, although the RAs' Proposed Decision Paper does not specifically mention how capacity payments would be treated, a move to uniform TLAFs could also affect the distribution of capacity payments. If the same uniform TLAFs were directly applied in determining the eligible availability for capacity payment calculations, this would lead to a directionally similar redistribution of capacity payment funds.

Figure 1 Change in share of gross margin by company type



2 Introduction

2.1 Introduction & context

The RAs published a Proposed Decision Paper on options for all-island harmonised TLAFs on 18 June 2010[1], which explores potential interim and long term options for changing the TLAF regime. As an interim measure, the RAs are proposing that a uniform TLAF of 0.98 be applied to all generators.

Redpoint Energy has been commissioned by Viridian to undertake market modelling in PLEXOS in order to analyse the impact of an interim move to uniform TLAFs on System Marginal Price (SMP) and Market Schedule Quantities (MSQs) in the SEM. Outside the scope of this analysis was any assessment of the long term options discussed in the Proposed Decision Paper, as well as the impact on constraints, Dispatch Quantities (DQs), transmission losses, the Error Supplier Unit, and emission levels. The modelling required to assess those impacts is significantly more involved and would require a longer time frame than was available for this study. We also have not quantified the distributional impacts on Capacity Payments.

The PLEXOS model used is the RAs' validated model for 2010/2011, with the following changes:

- Current forward curve commodity prices; *and*
- Redpoint assumptions for VOM costs, start costs and maintenance rates.

The aim of this report is to show the analysis for the next SEM year, 2010/2011, on the assumption that the proposed interim changes would apply initially for the next year only.

The analysis is centred on a Base case, with a number of sensitivities to assess the impact of changes in assumptions for key variables. In each scenario modelled we compared the results under the existing TLAF structure with the proposed uniform TLAF of 0.98.

There are three main sensitivity types we modelled:

- Uniform TLAF value: Modelling a uniform TLAF value of 0.975 in addition to the Base case;
- Start cost sensitivities: Changing the relative level of start costs for plant with currently favourable and unfavourable TLAFs; *and*
- Fuel price sensitivities: High Gas and Low Gas with a +/- 10% shift in the gas price, keeping everything else equal.

In presenting our results, we show the split of SMP between Shadow Price and Uplift. In general, Shadow Price movements (for a given set of assumptions) are more predictably driven, given their derivation from system short run marginal costs. The impact on Uplift, on the other hand, is much more volatile, and very sensitive to assumptions such as the start costs generators offer into the market. In fact, modelling results for directional movements in Uplift, as we show with our sensitivities, are more dependent on these detailed input assumptions than on the underlying impact of a change to the TLAF regime.

The SMP results we present should be seen in the overall context of the SEM system when considering the impact on generators and consumers. There are clearly significant distributional effects between generators, presented in this report, which deserve consideration. However, total generator revenues may be expected to be relatively stable with respect to change in TLAFs. This is because as the 'system TLAF' changes, generators as a whole will tend to adjust their offer prices to offset any movements in TLAF.

Energy costs for suppliers will clearly be directly affected by SMP changes stemming from different TLAFs. However, here it is worth noting that when TLAFs are not representative of actual losses, the difference will be absorbed by the Error Supplier Units in each jurisdiction, and hence these additional costs (or revenues) will presumably also ultimately be recovered from customers (albeit again with a potential distributional effect). Hence a lower or higher SMP associated with a change to TLAFs does not necessarily translate into lower or higher total costs to consumers.

[1] http://www.allislandproject.org/GetAttachment.aspx?id=50e8af39-1df7-4eb3-a027-e7fc44342db5

3 Assumptions

3.1 Demand

Annual and peak electricity demand assumptions in ROI and NI are based on EirGrid's median demand forecast from the *Generation Adequacy Report 2010-2016*[2], and SONI's median demand forecast as published in the *Seven Year Generation Capacity Statement 2010-2016*[3] respectively. This is the same approach as in the RAs' model.

ROI demand is on EirGrid's TER (Total Energy Requirement) basis. This corresponds to demand met by generation (including embedded generation) at station gate. This means that the demand assumption includes transmission and distribution losses. The RAs' validated model includes an estimate of embedded generation for ROI. NI demand is on the same basis as ROI demand, except that it excludes demand met by Customer Private Generation – this is embedded non-wind generation such as diesel generators.

The demand is mapped to half hours based on the historic half hourly load shape in ROI and NI from 2007. This is the same as in the RAs' validated model.

Because EirGrid's GAR annual demand assumptions are based on a 52-week year, we adjust the forecasts to represent full year values. The table below shows the values from the system operator reports.

Table 2 Demand assumptions

	Annual demand (GWh)			Peak demand (MW)		
	ROI	NI	SEM	ROI	NI	SEM
2010	27,206	8,960	36,166	4,747	1,660	6,376
2011	27,793	9,005	36,798	4,843	1,667	6,480

[2] EirGrid, *Generation Adequacy Report 2010-2016* (Nov 2009), http://www.eirgrid.com/media/Generation%20Adequacy%20Report%202010-2016.pdf

[3] SONI, *Seven Year Generation Capacity Statement 2010-2016 (Dec 2009)*, http://www.soni.ltd.uk/upload/Seven%20Year%20Generation%20Capacity%20Statement%202010-16.pdf

3.2 Commodity prices and generation costs

The fuel price assumptions in this modelling are based on the forward curves for ARA Coal, NBP Gas, EUA Carbon and Brent Oil from end of June 2010.

The figure below shows the fuel price assumptions for coal, gas and carbon on a quarterly basis in their traded units and currency.

Based on the spot rates on 28th June 2010, the FX assumptions throughout the model horizon are 1.24 $/€ and 0.82 £/€.

The modelling is done in real 2010 terms where we assume a constant 2% inflation rate per annum.

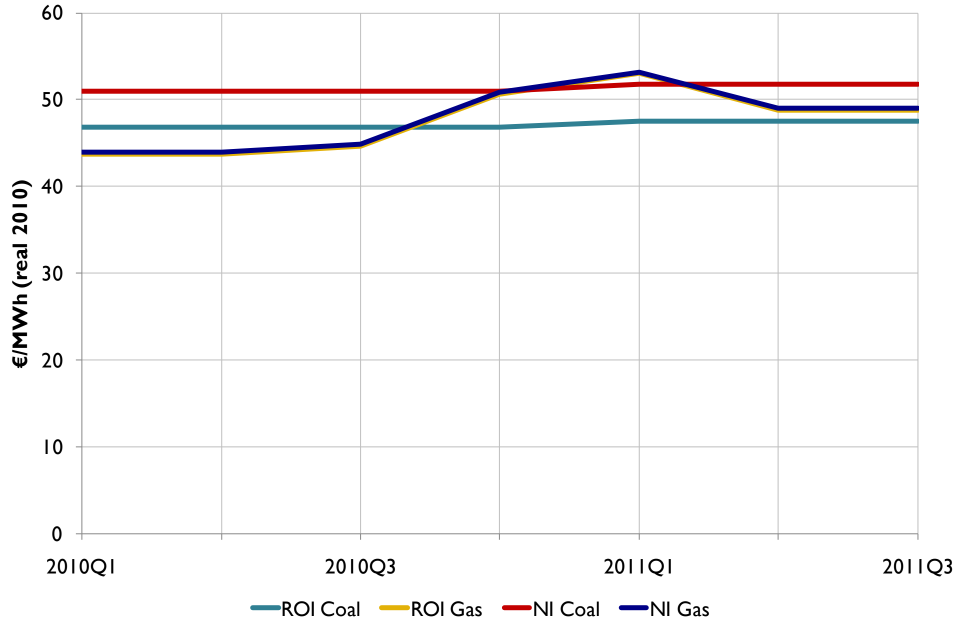
Table 3 summarises the commodity price assumptions used in the analysis.

Table 3 Demand assumptions

real 2010	Coal ($/t)	Gas (p/th)	Carbon (€/t)
2010 Q1	96.6	43.0	15.4
2010 Q2	96.6	43.0	15.4
2010 Q3	96.6	44.2	15.4
2010 Q4	96.6	51.2	15.4
2011 Q1	99.0	53.9	15.4
2011 Q2	99.0	49.0	15.4
2011 Q3	99.0	49.0	15.4

Coal to gas competition is one of the main drivers of the system marginal price in the SEM. Like the Great Britain (GB) market, system marginal prices are at the moment mostly driven by the gas price. In Figure 2 we translate the fuel prices to generation costs per MWh for typical plant. This allows a better comparison of how coal to gas competition evolves over time. The generation costs in each of the markets use the same fuel adders and transport charges as are used in the validated SEM model. For this chart, gas plant are assumed to have an efficiency of 54% LHV and coal plant have an efficiency of 36%.

Figure 2 Generation costs (Base case)



4 Base case results

4.1 Base case results

This section presents the results of our Base case modelling and starts with analysing the SMP, Shadow Price and Uplift in the SEM under the existing TLAFs as well as uniform TLAFs of 0.98 for all generators.

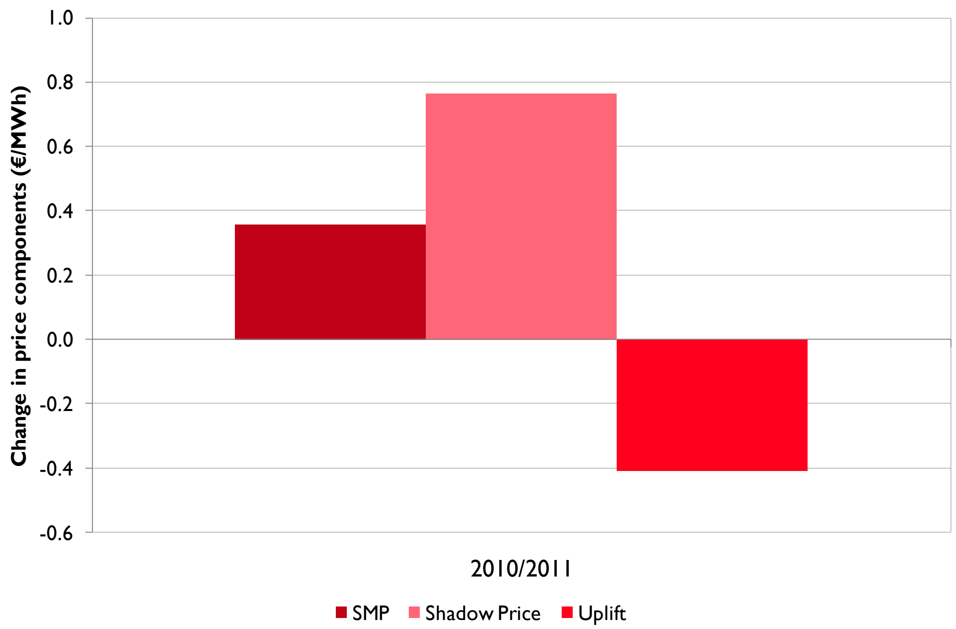
SMP

In the first year, SMPs are slightly higher under a uniform TLAF system compared to the model with the current generator TLAFs.

Shadow Price

Analysing the split between the Shadow Price and Uplift gives a clearer picture of what drives the change in SMP. While Shadow Price increases by 0.76 €/MWh, Uplift decreases slightly under uniform TLAFs, leading to an overall SMP increase of 0.36 €/MWh.

Figure 3 Change in SMP, Shadow Price and Uplift (Base case)



Uplift

As the figure on the left shows, Uplift decreases under uniform TLAFs but this does not offset the increase in Shadow Price.

However, our analysis confirmed that the effect on Uplift is highly sensitive to assumptions on start costs and fuel prices. The analysis in the Appendix regarding Start Cost assumptions and fuel price sensitivity indicates that Uplift can move in either direction depending on the assumptions made. Directional movements in Shadow Price, however, are more stable.

On a generation volume adjusted basis, uniform TLAFs lead to an increase in the annual energy cost associated with Shadow Price of about 27 €mn in 2010/11.

4.2 Load factors and starts (Base case)

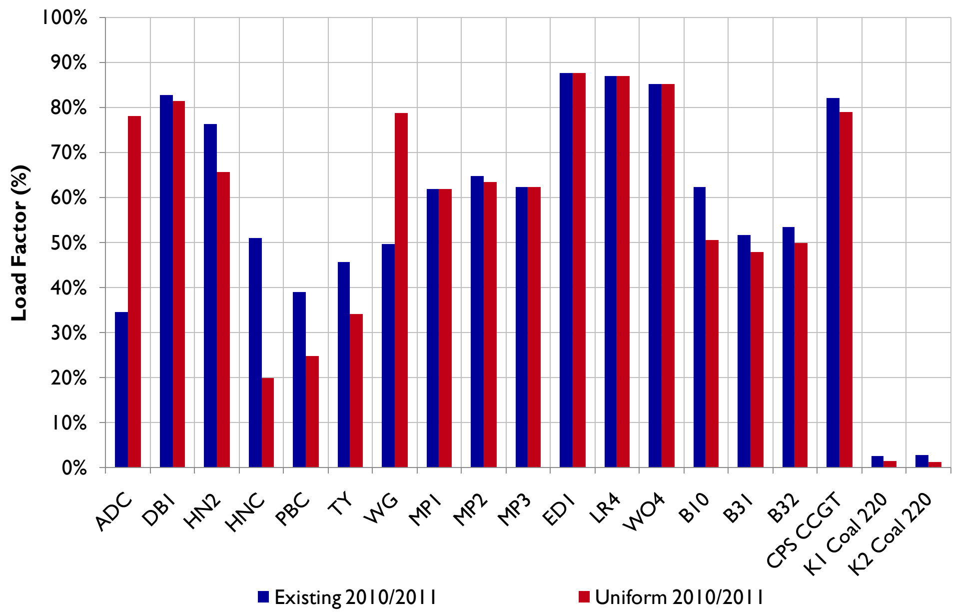
On this page we show load factors and number of starts for some key plant in the base case, under the two TLAF scenarios.

Load factors

As expected the impact is largest on those plant that currently have significantly favourable or unfavourable TLAFs. Aghada CCGT (ADC), for example, currently has significantly unfavourable TLAFs, and would see its load factor more than double under uniform TLAFs. A similar situation holds for Whitegate (WG), which would see on average a 29 percentage point (pp) increase in load factor.

On the other hand, those CCGT plant with currently favourable TLAFs would, as expected, see a significant drop in their load factors. The largest effect is on the two Huntstown plant (HNC, HN2) and Poolberg Combined Cycle (PBC), with between 11pp and 31pp drops in load factor.

Figure 4 Load factors for key plant in the SEM (Base case)

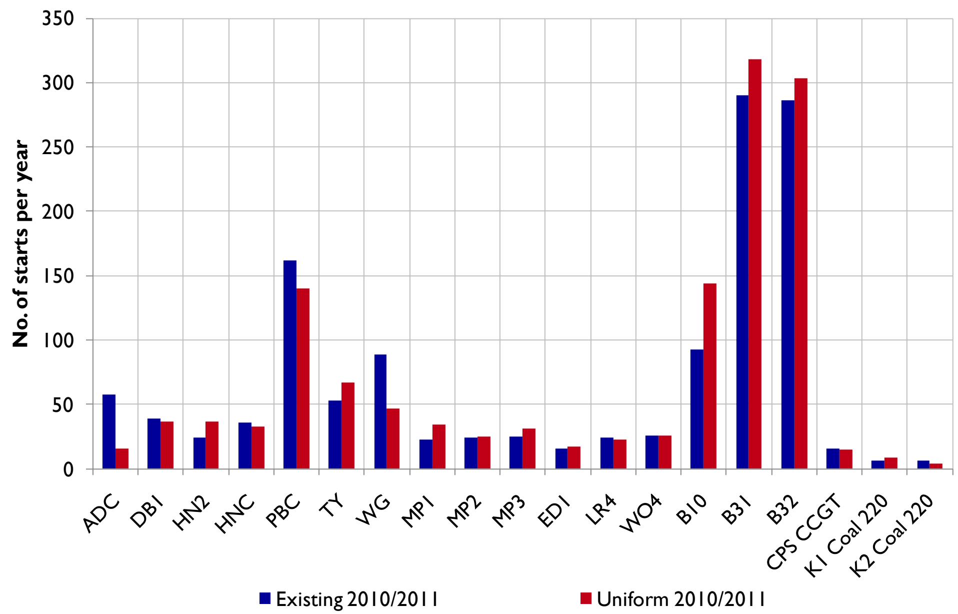


Number of starts

As we investigate further in Section 6.1, the start cost assumptions for individual plant can have a considerable impact on the results. As the figure below shows, Aghada (ADC) and Whitegate (WG), the two plants gaining appreciably in load factor, also see the number of starts decrease significantly. The picture is not quite as clear cut for the plant that see a decrease in generation levels. Huntstown (HNC), for example, sees a large decrease in load factor, but also a decrease in the number of starts. Huntstown Phase 2 (HN2), on the other hand, also has a decrease in load factor, but an increase in the number of starts.

Overall, the start costs of individual plant will influence which way the number of starts under uniform TLAFs will move. In the Base case, the CCGT plant with currently unfavourable TLAFs also have fairly high start costs (although not significantly higher than other CCGTs). This could indicate that a decrease in the number of starts for those plant could have a downward impact on Uplift. This appears consistent with the start cost analysis presented in Section 6.1.

Figure 5 No of starts for key plant in the SEM (Base case)



4.3 Gross margin levels and redistribution effects

This page shows the impact of the uniform TLAFs on the gross margin levels of generator companies. The numbers shown exclude all wind generation.

When looking at the gross margin levels by company, the impact on individual generator companies is largely as expected and in line with the changes in load factors. On average, those companies owning generation assets with currently unfavourable TLAFs will gain considerably, while companies with currently favourable TLAFs can expect to see a significant drop in their gross margin levels.

Furthermore, as the figures on the right show, there are large redistribution effects on a jurisdictional level and from private sector companies to state-owned companies.

Figure 6 Change in gross margin by generator company (Base case)

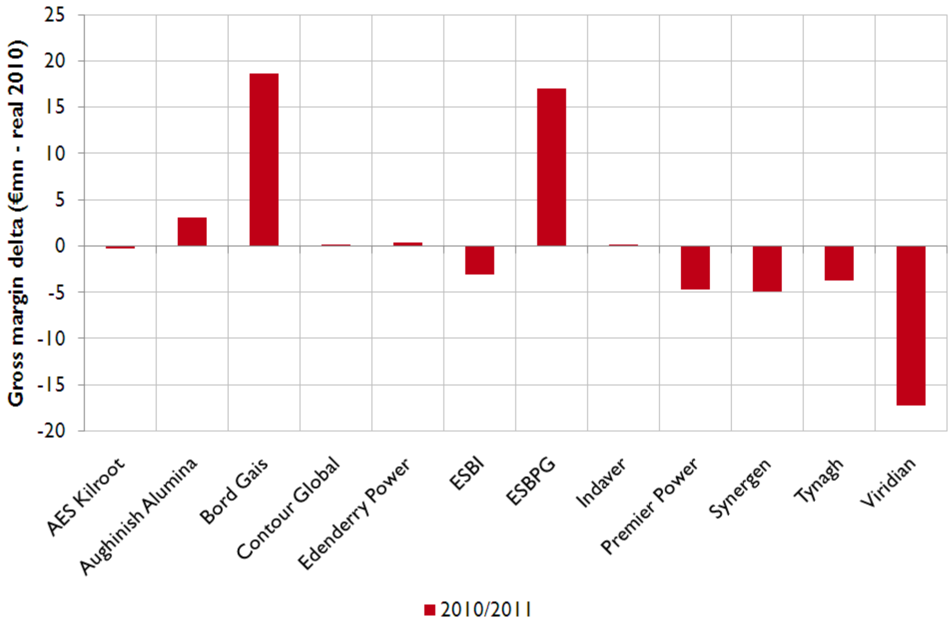
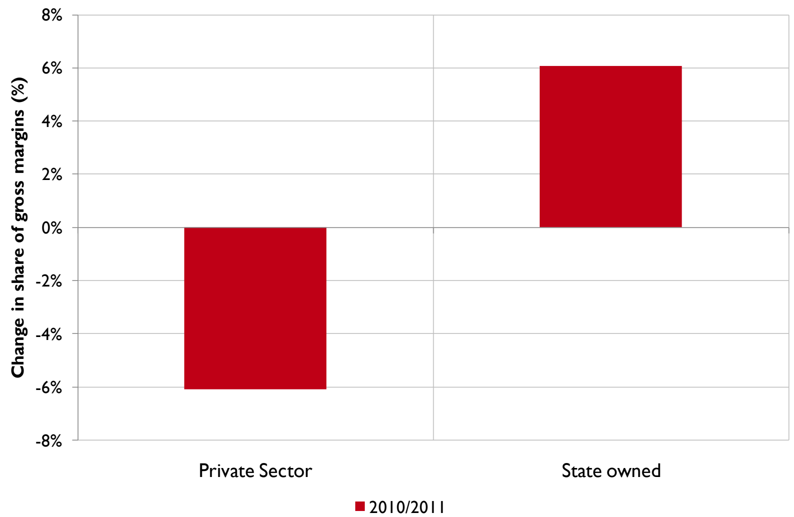


Figure 7 Change in share of gross margin by region

Figure 8 Change in share of gross margin by company type



4.4 Impact on Northern Ireland wind generation

In order to assess the impact of uniform TLAFs on wind generators in Northern Ireland, we compared the TLAF adjusted revenue streams under both TLAF scenarios. Because the RAs' validated model does not use TLAFs for wind generators we chose a 'typical' TLAF value of 1.011 for Northern Ireland in the 'Existing' scenario.

The change in the SMP between the two scenarios has an impact on the price captured by wind generators, but the largest impact is due to the less favourable TLAFs for NI wind generators under the proposed uniform system. This is not surprising, as generators that are not price setting will see a direct impact on the revenue levels from a lower TLAF. In our analysis, uniform TLAFs would lead to a revenue loss for NI wind generators of about 2.4 €mn in 2010/11.

Capacity Payments

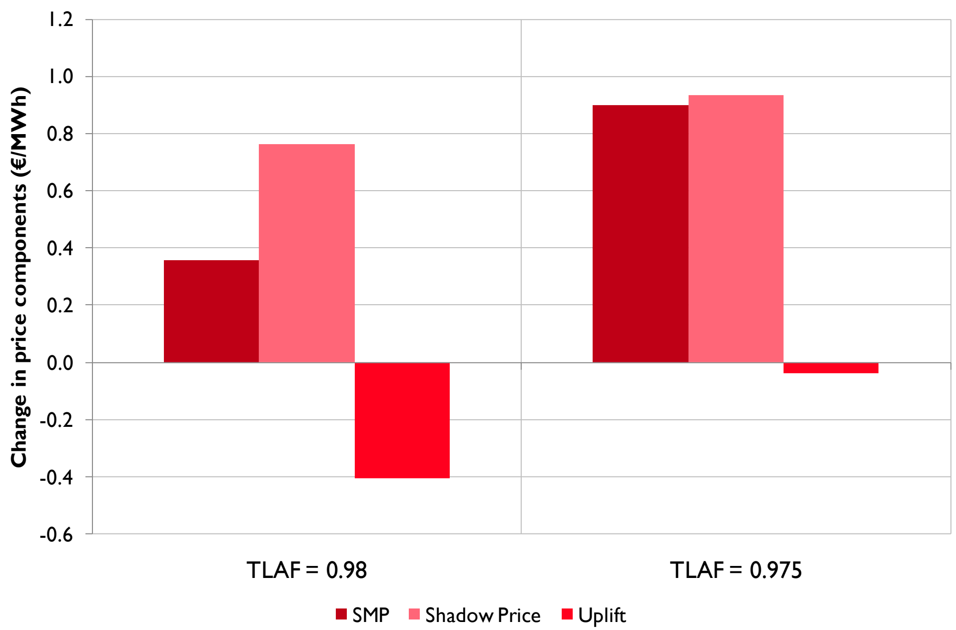
The total amount of capacity payments in the SEM would not be impacted by the change in TLAFs (if we assume that the RAs' calculation of the best new entrant cost and therefore the size of the overall capacity payment pot would not be affected). However, if the uniform TLAFs were used to determine eligible capacity, it would impact the distribution of the capacity payment pot to generators, everything else being equal. Given the current TLAFs in Northern Ireland, wind generators would be likely to see a decrease in the capacity payments received under these assumptions. We have not quantified this impact.

4.5 Sensitivity to the uniform TLAF value

In order to analyse further the effect of uniform TLAFs on the SMP, and particularly the Shadow Price, we modelled a sensitivity using a uniform TLAF value of 0.975 compared to the proposed uniform TLAF of 0.98.

The chart below shows the comparison of the effect of a move from the existing regime to each of the two TLAF scenarios. As expected, a lower uniform TLAF of 0.975 leads to an increase in SMP relative to the uniform TLAF of 0.98. However, the net effect of the actual value of the uniform TLAF does not have a significant impact on either generators or suppliers. The generators will adjust their bid price depending on the TLAF such that the net price they receive does not significantly change. On the supplier side, the level of the uniform TLAF only affects the share of losses that is accounted for directly through the TLAFs to suppliers and the share that is accounted for through the Error Supplier Unit. The overall effect on consumer costs, therefore, could also be expected to be small.

Figure 9 Change in SMP, Shadow Price and Uplift (Uniform - Existing)



5 Key messages & potential further analysis

5.1 Key messages

SMP, Shadow Price and Uplift

There was an increase in SMP under a uniform TLAF in the Base Case (shown in the Table to the right). However, this was not always the case under our sensitivities. Whilst Shadow Prices typically increased, the impact on Uplift was more variable. As the magnitude of the changes in Uplift sometimes exceeded those in Shadow Prices, the directional effect on total SMP was not consistent.

We found a particular variability in relation to start cost assumptions, especially for CCGTs. Fuel price assumptions are also important and directionally impact SMPs. The nature of Uplift in the SEM makes it particularly sensitive, in an unpredictable manner, to a wide range of assumptions, and it is correspondingly difficult to draw robust conclusions about the directional Uplift development under uniform TLAFs (see Table 5 in the Appendix).

Plant load factors and locational signals and redistribution effects

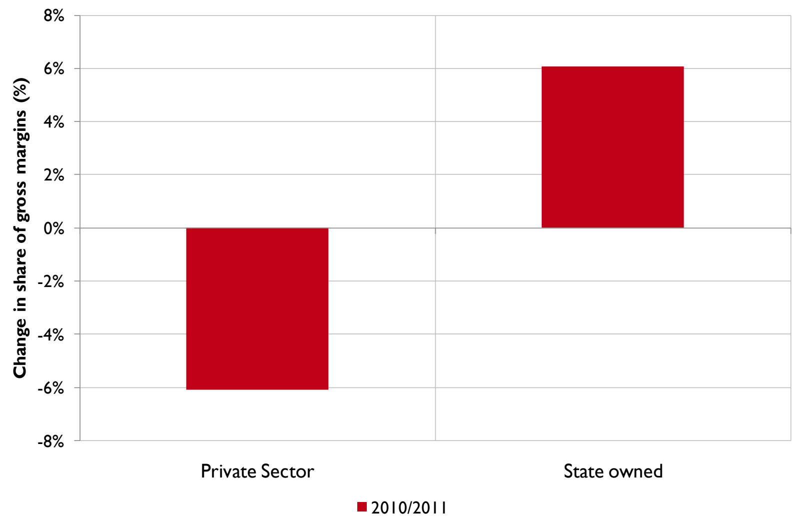
The impact on load factors and the reduction in locational signals (changes in gross margin) is clear. The effects on individual generators and company gross margin levels are consistent across a number of different scenarios and are of significant size. In addition, there is a significant jurisdictional redistribution associated with uniform TLAFs, as well as between state-owned and private sector companies (see Figure 7 and Figure 10).

Further, although the RAs' Proposed Decision Paper does not specifically mention how capacity payments would be treated, a move to uniform TLAFs could also affect the distribution of capacity payments. If the same uniform TLAFs were directly applied in the eligible availability for capacity payment calculations, directionally there would be a similar redistribution of capacity payment funds as is the case with energy gross margin levels.

Table 4 Change in SMP, Shadow Price, Uplift (Uniform minus Existing)

€/MWh	SMP	Shadow Price	Uplift
Base case	*0.36*	*0.76*	*-0.41*
Uniform TLAF = 0.975	*0.90*	*0.94*	*-0.04*

Figure 10 Change in share of gross margin by company type



5.2 Potential further analysis

The scope of this report has been limited to the analysis of the potential change to SMP under an interim uniform TLAF regime assuming that total losses are unchanged. In practice, the changing running regimes of plant will lead to changes to transmission losses. Under the current regime, TLAFs are calculated ex-ante prior to a given year based on modelling of marginal loss factors for each generator unit. Assuming that this leads to a broadly representative set of factors, then transmission losses could be expected to increase under an interim uniform regime[4], with correspondingly higher Dispatch Quantities and total generation levels. In addition, again assuming broadly representative TLAFs in the current regime, a move to a uniform level could be expected to lead to an increase in constraints costs, as the consequence would be expected to be an increase in generation further from demand. The changes to running levels of different plant, as well as to total generation levels, will of course also affect emissions levels of carbon, SO_2 and NOx.

The extent to which the TLAFs in the current regime are in fact representative has been much discussed. Either way, we would expect that the impact of a change to the regime on losses and constraints would be a large factor in a cost benefit analysis. To analyse this fully would require detailed transmission modelling of the SEM, enabling the flows and losses to be calculated under different TLAF regimes. For the current regime, this would need to mimic the current ex-ante calculation of TLAFs for each year. Careful consideration would need to be given to appropriate sensitivity analysis – for example, to test the impact of changing demand or commodity prices between years, which could impact on the appropriateness of TLAFs under the current arrangements. This would clearly be a much more involved process than the unconstrained (MSQ) modelling conducted for this report, and would likely take several months to complete.

In determining the distributional impact of a change in TLAFs, we noted in the introduction the importance of considering changes in the overall cycle of payments between participants in the SEM, and ultimately the impact on consumers. This will in part be a function of the way in which the Error Supplier Units operate under the Trading and Settlement Code, and the way in which associated costs (or revenues) are recovered by the respective parties in each jurisdiction. The fuller analysis outlined above could be used to understand the potential impact here. We also mentioned the impact on the distribution of capacity payments, which could be modelled in detail.

[4] As discussed in the Proposed Decision Paper, this could be addressed in a long term solution through the use of real time TLAFs for dispatch purposes.

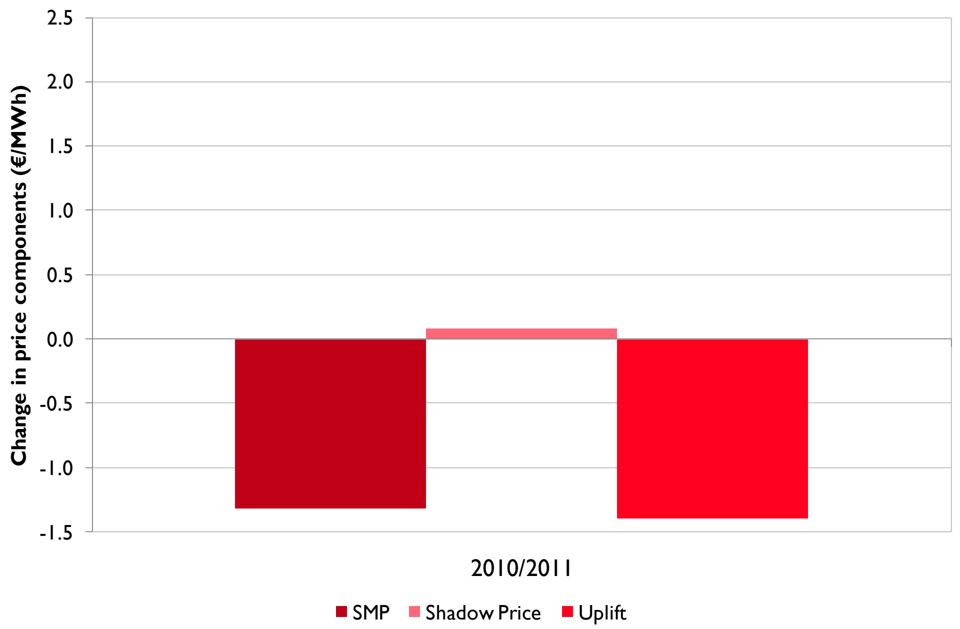
6 Appendix – Analysis of Uplift deltas

6.1 Start cost assumptions

We have suggested that the effect of uniform TLAFs on Uplift is highly variable and the direction of the Uplift movement can change on the basis of detailed model assumptions. In order to test this hypothesis, we ran two start cost scenarios. The first one is a scenario in which CCGT plant with currently favourable TLAFs (eg Huntstown) are set up in the model with low start costs, while those CCGT plant with unfavourable TLAFs (eg Aghada CCGT) are given high start costs. The second scenario is the reverse of this: high start costs for CCGT with currently favourable TLAFs and low start costs for CCGT with unfavourable TLAFs. (For the purpose of these sensitivities, we have assumed that the start costs offered would not be adjusted to take account of new running regimes.)

As the figure below shows, in a scenario using ***low start costs for CCGT plant with favourable TLAFs***, the SMP **decreases** in a system of uniform TLAFs. The reverse effect is observable in the other scenario: the figure on the right hand side shows that SMP **increases** under uniform TLAFs in the scenario using ***high start costs for CCGT plant with favourable TLAFs***. In both cases Shadow Price increases under uniform TLAFs.

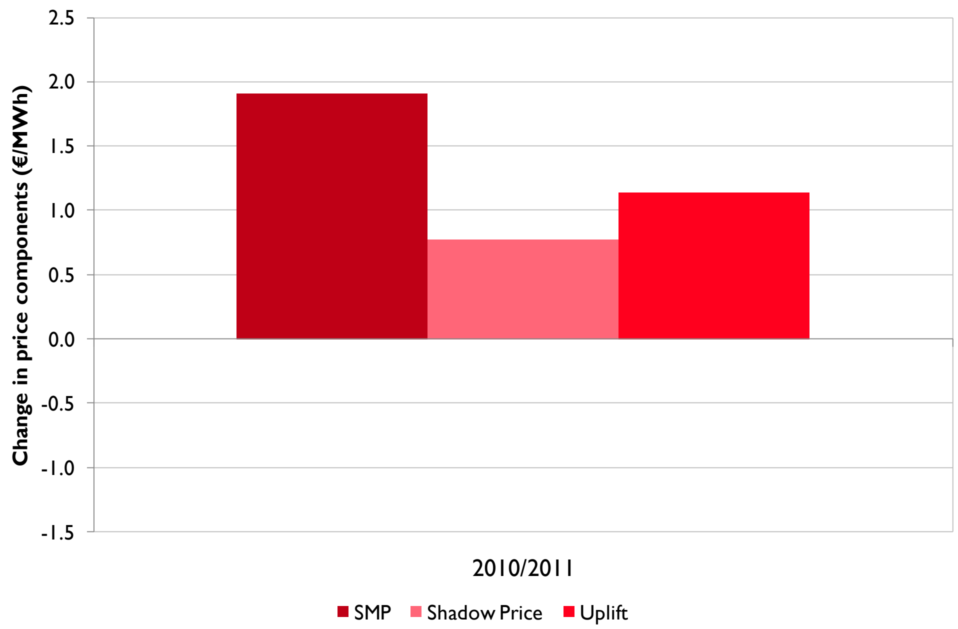
Figure 11 Change in SMP, Shadow Price and Uplift (low start costs for favourable TLAF CCGT)



The hypothesis behind this change in the impact of uniform TLAFs in the scenario with high start costs for CCGTs with currently favourable TLAFs is as follows. Under uniform TLAFS, those CCGT plant that currently have favourable TLAFs will tend to have lower load factors (see Figure 4). This in turn implies that those plant will tend to experience a higher number of starts, increasing start costs and setting higher Uplift.

The same logic holds for the scenario with low start costs for CCGT plant with favourable TLAFs. The plant that have relatively high start costs see an improvement of their TLAFs under the uniform framework. The load factor of those plant will tend to increase and the number of starts will tend to decrease. At the same time the plant with currently favourable TLAFs will tend to see an increase in the number of starts, but because the start costs are low, the impact is relatively minor. These results confirm that Uplift is sensitive to individual start cost assumptions. We infer from this that the changes in Uplift we see in the base case are driven by changes in individual unit running regimes. The observed changes are therefore unlikely to be robust across a range of scenarios.

Figure 12 Change in SMP, Shadow Price and Uplift (high start costs for favourable TLAF CCGT)



6.2 Sensitivity to fuel prices

To test the sensitivity of the model results to changes in fuel prices, we ran two simple gas price scenarios. The High Gas scenario has a 10% higher gas price, and the Low Gas scenario a 10% lower gas price, compared to our Base case. The results are shown on this page and demonstrate that changes to fuel prices can have a significant effect on the impact of uniform TLAFs.

The results show that the impact on SMP, whilst always upwards, varies significantly between the sensitivities. Within this, the Shadow Price increase in both sensitivities is lower than the Base Case. Uplift, as we have seen previously, is more volatile and shows directionally different behaviour between the sensitivities. This result further confirms that it is difficult to draw robust conclusions with regard to the impact on Uplift of a change to uniform TLAFs.

Figure 13 Change in SMP, Shadow Price and Uplift (High Gas)

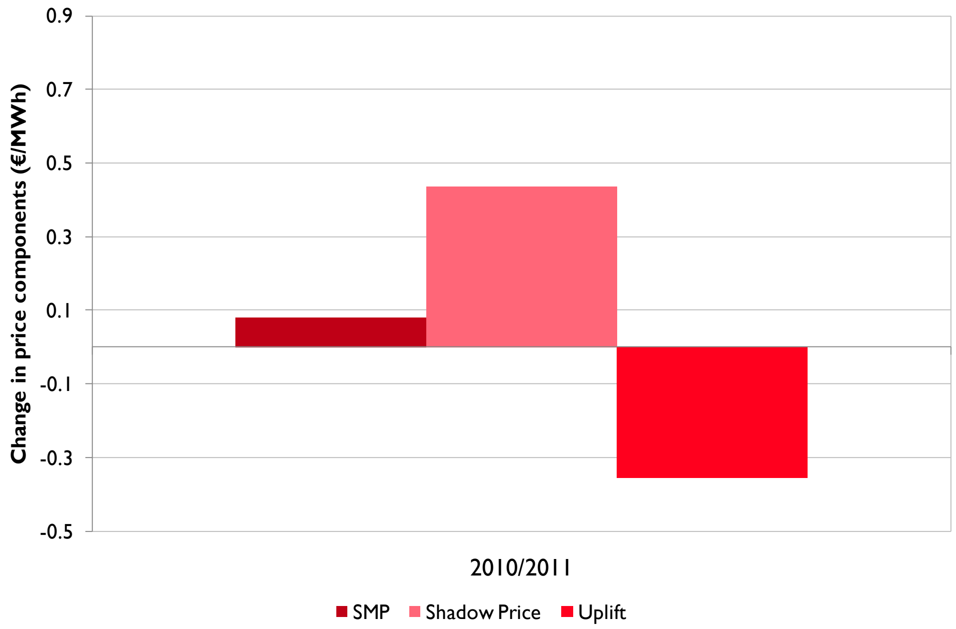
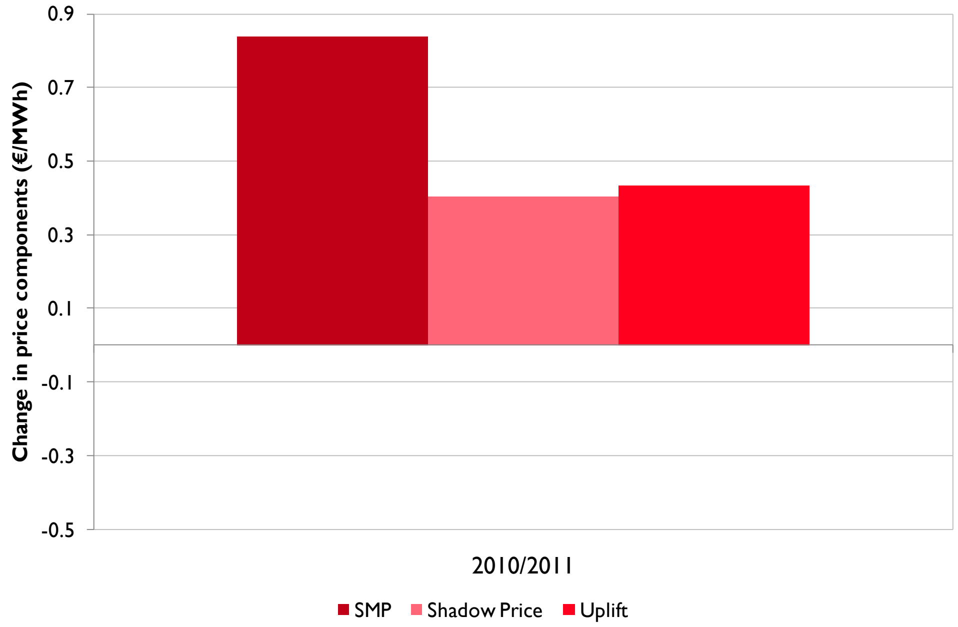


Figure 14 Change in SMP, Shadow Price and Uplift (Low Gas)



REDPOINT

6.3 Data table

Table 5 **Change in SMP, Shadow Price, Uplift (Uniform minus Existing)**

€/MWh	SMP	Shadow Price	Uplift
Base case	0.36	0.76	-0.41
Uniform TLAF = 0.975	0.90	0.94	-0.04
Low start cost for favourable TLAF CCGTs	-1.31	0.08	-1.39
High start cost for favourable TLAF CCGTs	1.91	0.77	1.14
High Gas	0.08	0.44	-0.35
Low Gas	0.84	0.40	0.43