Single Electricity Market

Treatment of Losses in the SEM

Consultation by the SEM Committee

18th November 2011

SEM-11-098

1. INTRODUCTION

In February 2011 the SEM Committee published its Terms of Reference for and impact assessment on the proposed splitting of the treatment of losses in the market schedule from that in the dispatch schedule (SEM-11-006)[1]. Following on from this, the Market Monitoring Unit (MMU) on behalf of the SEM Committee carried out the TLAF modelling analysis in line with the requirements of the Terms of Reference. This modelling was completed in May 2011and the results of the modelling presented to the SEM Committee at its meeting on 26 July 2011. The SEM Committee requested that a full and detailed consultation on the TLAF splitting analysis and modelling results be carried out in advance of it moving to a decision on this workstream.

The purpose of this paper is to report on the results of the TLAF splitting impact analysis in the SEM and to carry out a full public consultation on this matter. The SEM Committee also encourages market participants to carry out their own TLAF modelling (preferably in line with the TLAF Splitting Terms of Reference in order that results can be compared and contrasted) and to include full details on the results of their modelling in their submissions on this consultation. This paper also outlines the scope of ongoing work which the SEM Committee has requested as well as the next steps in this project, post consultation.

Responses to this Consultation

Comments are requested from interested parties on the matters raised in this paper, specifically the SEM Committee proposals. Comments on this paper should be submitted by **17.00 on Wednesday 20 January 2012**, preferably in electronic format, to Jean Pierre Miura– details below.

Please note that the Regulatory Authorities intend to publish all responses. Therefore, confidential responses should be clearly marked as such or, where possible, confidential elements placed in a separate annex to the response.

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[1] http://www.allislandproject.org/en/transmission_decision_documents.aspx?article=5d9a6485-4f5d-431f-a207-2a6fc4005557&mode=author

2. BACKGROUND

The development of harmonised all-island transmission charges and losses arrangements was an objective stated in the original Single electricity Market (SEM) high level design (AIP/SEM/42/05)[2]. It was also stated as an objective that the harmonised transmission arrangements should provide locational signals to users that reflect the costs that they impose on the transmission system. The RAs initiated a review into all-island transmission loss adjustment factors (TLAFs) as part of a review of transmission network locational signals in January and the proposed decision paper published on 18 June 2010 (SEM-10-039)[3]. Following this period of public consultation by the Regulatory Authorities a public workshop followed in July 2010.

Note that for those wishing to review the details of the current locational TLAF methodology SEM-10-039 and the documents referred to therein give details of the basic methodology.

A decision paper was published on 24 September 2010 by the SEM Committee on all Island transmission loss adjustment factor (TLAF) arrangements (SEM-10-066)[4] for the tariff year 2010/2011. The SEM Committee decided to implement compression of the existing TLAFs as an interim solution while an enduring solution for the treatment of losses in the SEM was developed. This paper also outlined the SEM Committee's intention to examine "splitting" as a preferred long-term solution for the treatment of TLAFs in the SEM. The SEM Committee indicated its preference for stability of losses in the market schedule with as close to real time losses as the transmission System Operator could manage in dispatch.

The SEM Committee requested that the Regulatory Authorities (RAs), assisted by the Transmission System Operators (TSO's), carry out an impact analysis into splitting and report back to the SEM Committee outlining the results of the analysis. An information paper on Terms of Reference for Impact Analysis on TLAF splitting was published on the 14th February 2011 (SEM-11-006).The splitting concept involves implementing different transmission loss signals in the SEM market schedule to those in the SEM physical dispatch schedule, i.e. separating the cost recovery for transmission losses in the SEM market and their locational signal associated with TLAFs for the dispatcher in physical dispatch.

The SEM Committee provided guidance to the Regulatory Authorities with regard to splitting by stating in SEM-10-066 that, "the SEM Committee favours an

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[2] AIP/SEM/42/05

[3] SEM-10-039

[4] http://www.allislandproject.org/en/project_office_sem_publications.aspx?year=2010&section=2

efficient dispatch signal through TLAFs….[and] in the market schedule, the SEMC favours and values stability (non-volatility) e.g. Uniform TLAF or long-term zonal TLAF".

The aim of the splitting analysis as outlined in SEM-11-006 is to assess if the potential benefits and advantages of implementing splitting, as the long term solution for the treatment of transmission losses in the SEM, outweigh any potential costs and disadvantages of this approach. In order to assess this the RAs have carried out this modelling project and assessed the results of this modelling against the proposed set of measurement criteria.

The SEM Committee decided that the impact assessment for TLAF splitting would examine the case for splitting against the following four criteria

- Stability of the market schedule – how inframarginal rents (IMR) vary with loss factors.
- Efficiency of the dispatch schedule – how total production costs vary as loss factors move closer to real time.
- Impact on the all-island customer.
- Divergence between the market schedule and dispatch schedule – Dispatch Balancing Costs.

The modelling was carried out using the RA's validated Plexos model for 2010/11 with updated demand, generation and fuel costs assumptions made for each of the relevant years to be modelled. Constrained modelling was based on the TSOs 2010/11 Dispatch Balancing Cost model, with adjustments made to ensure the models were equivalent. The TSOs provided the indicative TLAFs for these years. Having reviewed the results of the impact assessment, and mindful of the potential impact on market participants and on consumers, the SEM Committee decided that the result set should be subject to full public consultation.

3. METHODOLOGY FOR IMPACT ASSESSMENT

The following approaches are considered in this paper

- Locational
- Compressed
- Uniform
- Quasi real time

All of these are based on the same locational methodology which has been in use since the commencement of the SEM. Under the locational arrangements, TLAFs are determined ex-ante (at the year-ahead stage, four months before the start of the relevant year) for each Generator Unit. A TLAF value is determined for day and night periods for each month, each calculated as an average of marginal transmission losses linked to that Unit at the relevant time. Under SEM-10-066 the SEM Committee decided to compress these values by 50%. These TLAF values are used by the Generator Unit when submitting bids – their offer prices (the Ps in their PQ pairs) are divided by their TLAF.

This loss-adjusted offer price is used both in setting merit order in dispatch and in the calculation of the SMP in market pricing and therefore the setting of the market schedule. The SMP is finally multiplied by the respective loss-adjusted Market Schedule Quantity (MSQ) for each Generator to ensure the correct settlement. So a good/high (e.g. >1) loss factor will in general lead to a Generator more likely being dispatched with access to the market schedule, while a poor/low loss factor (e.g. <1) will in general make it less likely that the Generator will be dispatched and get access to the market schedule.

As regards the use of quasi - real time losses in the dispatch schedule, the intention had been that the TSOs would use the existing locational methodology but apply it to an illustrative week while gradually increasing the 'granularity' of the modelling i.e. calculating TLAFs for shorter periods. For this illustrative week the same quasi - real time losses would be applied to the market schedule and the results compared to that of the existing (monthly day and night) locational losses, these compressed, and a uniform value in the market schedule.

However, the modelling tools currently available to the TSOs only enabled them to use an average wind level and not the actual wind data for the representative week. As a result it was difficult to draw any clear trends or conclusions from the results of the more frequently calculated TLAFs. Obviously, if loss factors are to be calculated on shorter time scales and used with a view to enabling a more efficient dispatch, they need to become closer and closer to representing the actual system losses as the time frame reduces. Using average wind levels does

not enable this to happen so it is not surprising that there was no clear trend in the results obtained in this way. The development and use of closer-to-real-time loss factors which would take into account accurate wind forecasts represents a much larger undertaking than was possible within the work to date.

The SEM Committee decided that the impact assessment for TLAF splitting would examine the case for splitting against the following four criteria:

3.1. Stability of the market schedule – how infra-marginal rents vary with loss factors.

Variation of infra marginal rents with loss factors i.e. the change (increase or decrease) in infra-marginal rents for power plants in each year for each treatment of losses in the market combined with different treatments of losses in dispatch. This reflects the stability of the market schedule. This criterion relates mainly to the impact on generators and therefore investment signals in the SEM and the impact on security of supply.

3.2. Efficiency of the dispatch schedule – how total production costs vary as loss factors move closer to real time.

Variation of total production costs with the various combinations of dispatch and market schedule losses.

3.3. Impact on the all-island customer.

The cost to all suppliers of purchasing electricity at the trading point, which is subsequently passed on customers i.e. it is the total energy cost (market schedule only) which will have to be paid for by end users. The impact of different loss factors on this measure has been investigated. This reflects the economic impact on the all-island customer (end-user). Criterion 3 is primarily a consumer cost indicator.

3.4. Divergence between the market schedule and dispatch schedule – Dispatch Balancing Costs.

Dispatch Balancing Costs caters mainly for the Constraint Payments. Constraint payments keep generators financially neutral for the difference between the market schedule and the actual dispatch. Constraint costs arise to the extent that there are differences between the market determined schedule of generation to meet demand (the ‘market schedule’) and the actual instructions issued to generators by the TSOs (the ‘actual dispatch’)

As the impact assessment is to ascertain the impact of splitting, in each case we wished to compare how each of these measures varied as the TLAFs used in the market schedule moved further from those use in dispatching the system. So in each case a reference run e.g. locational/locational was carried out and it was then assessed how each of the measures above varied as the TLAFS in the market schedule moved along the scale in the direction of uniform. So in this case we compared the results with locational/compressed, locational/uniform.

The SEM Committee provided guidance to the Regulatory Authorities with regard to splitting by stating in SEM-10-066 that, *"the SEM Committee favours an efficient dispatch signal through TLAFs….., (and), in the market schedule, the SEMC favours and values stability (non-volatility).* Given this direction from the SEMC and the exclusion of the Quasi Real Time dimension. The following list of comparisons were considered:

Dispatch	**vs**	**Market Schedule**
Locational		Locational
Locational		Compressed
Locational		Uniform
Compressed		Compressed
Compressed		Uniform
Uniform		Uniform

Note that, for the reasons explained above, quasi-real time loss factors were not available for comparison, as intended in the original terms of reference. However the combinations listed still enable a comparison to be made for the types of loss factors currently available and under consideration. All the possible combinations of locational/compressed/uniform in dispatch/market schedule were modelled and are presented in the analysis below. However combinations where the dispatch is more uniform/less reflective of system losses than the market schedule are not desirable.

The years covered were:

- 2008/09
- 2009/10
- 2010/11
- 2011/12

The unconstrained modelling was carried out using the RA's validated Plexos model for 2010/11. Constrained modelling was based on the TSOs Dispatch Balancing Cost (DBC) model. Both models were set up so that they had equivalent inputs and settings. Backcast models (modelling to the end of 2010) included historical demand, fuel prices, carbon prices, generation and availability

data. Forecast modelling used demand and wind assumptions based on the All-Island Generation Capacity Statement 2011-2020[5]. Forecast fuel and carbon prices was sourced from the Intercontinental Exchange[6] and dated 15th April 2011. As the aim of this project was to assess the differential between models, all stochastic elements were removed from both models.

The TLAFs already available were the actuals used in 2008/9 and 2009/10 based on the locational methodology in place at the time and those used for 2010/11. The latter were based on the locational TLAFs for 2009/10, compressed by 50%. The TSOs provided forecast TLAFs for 2011/12. In addition, to assess the impact of the East West Interconnector (EWIC) the TSO provided indicative TLAFs for 2011/12 based on EWIC being included from the start. These TLAFs were calculated using the locational methodology and compressed TLAFs for all five years using the compression technique adopted for the current year i.e. 2010/11.

The TSOs also advised that an appropriate uniform TLAF to use is 0.98. In principle there will be a slightly different uniform TLAF for each year i.e. that which, when used across all generators, gives the correct total losses for the system (calculated using locational TLAFs). This value could therefore vary year on year and ensure that correct total quantity of losses is attributed to generators and correct volume of energy paid for by suppliers. However for the purpose of modelling to assess the impact of splitting the use of a single loss figure introduced very little extra variation and was considered adequate.

[5] http://www.eirgrid.com/media/GCS%202011-2020%20as%20published%2022%20Dec.pdf

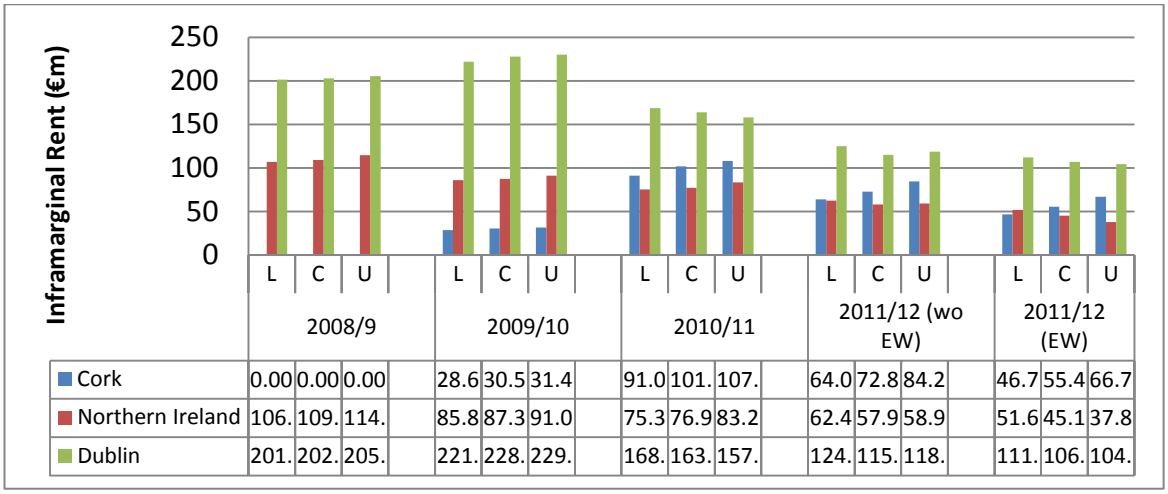
[6] https://www.theice.com/homepage.jhtml

4. RESULTS OF IMPACT ASSESSMENT

The following tables and charts represent the modelling results. It should be noted that in assessing the suitability of the various TLAF methodologies the trends are the key drivers not the absolute numbers. As these numbers are based on Plexos modelling and assumptions the absolute values will be different to actual outturn results. Results are presented for 2008/9, 2009/10, 2010/11, 2011/12 (excluding EWIC) and 2011/12 (including EWIC from the start).

4.1. Stability of the market schedule – how infra-marginal rents (IMR) vary with loss factors.

The graph below presents the allocation of infra marginal rents depending on the adopted TLAF methodology. The results were grouped for three broad regions: Cork (Aghada CCGT and Whitegate), Northern Ireland (Ballylumford 31 and 32, Coolkeeragh and Kilroot 1 and 2) and Dublin (Dublin Bay, Poolbeg, Huntstown 1 and 2)



	2008/9			2009/10			2010/11			2011/12 (wo EW)			2011/12 (EW)		
	L	C	U	L	C	U	L	C	U	L	C	U	L	C	U
Cork	0.00	0.00	0.00	28.6	30.5	31.4	91.0	101.	107.	64.0	72.8	84.2	46.7	55.4	66.7
Northern Ireland	106.	109.	114.	85.8	87.3	91.0	75.3	76.9	83.2	62.4	57.9	58.9	51.6	45.1	37.8
Dublin	201.	202.	205.	221.	228.	229.	168.	163.	157.	124.	115.	118.	111.	106.	104.

Graph 1: Stability of the market schedule – Cork/Northern Ireland/Dublin

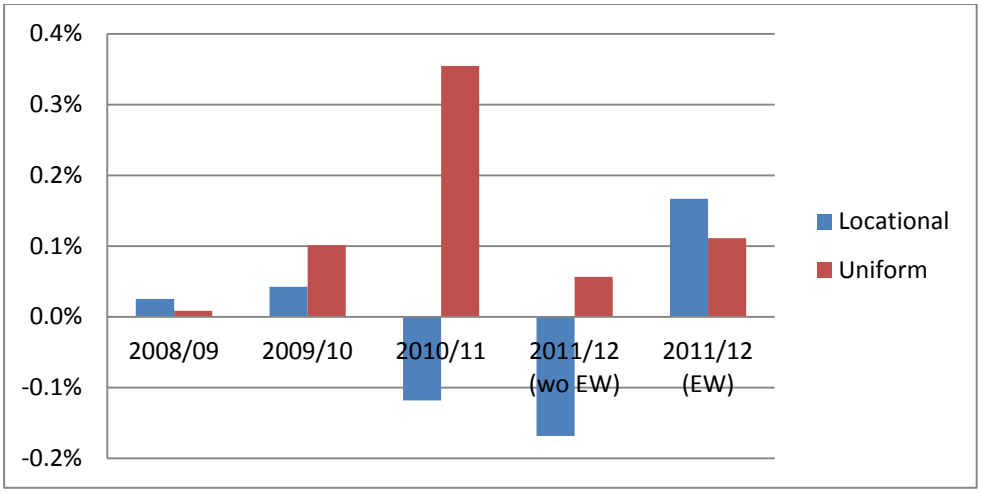
4.2. Production Efficiency of the dispatch schedule – how total production costs (Constrained Dispatch) vary as loss factors move closer to real time.

The table below presents the modelled total production costs, in €m, for each TLAF set employed in the dispatch schedule.

	2008/09	2009/10	2010/11	2011/12 w/o EW	2011/12 EW
Locational	1195.1	1184.3	1691.0	1776.5	1802.0
Compressed	1194.8	1183.8	1693.0	1779.5	1799.0
Uniform	1194.9	1185.0	1699.0	1780.5	1801.0

Table 1: Production Efficiency of the dispatch schedule

The first chart below shows the % change in production costs of using locational or uniform TLAFs relative to compressed – all in the market schedule. The second chart shows compressed and uniform relative to locational in €m.



Graph 3: Production Efficiency of the dispatch schedule

Overall there is a very small difference in production costs. In general the production costs are slightly higher for uniform but 2011/12 with EW in shows small decreases relative to locational as we move to compressed then uniform.

4.3. Constraint Costs

The table below shows constraint costs depending on the combination of employed TLAF methodology in the market schedule and in the dispatch. These are calculated purely based on Plexos modelling and ignore other elements that may affect the overall DBC pot. The Green cells highlight the lowest constraint costs in €m for each year. The red cells highlight the highest constraint costs.

Dispatch	Market	2008/09	2009/10	2010/11	2011/12 w/o EW	2011/12 EW
Locational	Locational	24	44	123	158	212
Locational	Compressed	27	43	125	159	213
Locational	Uniform	25	43	126	156	217
Compressed	Compressed	27	42	127	162	210
*Compressed	Locational	24	43	125	161	209
*Compressed	Uniform	25	43	128	159	214
Uniform	Uniform	25	44	134	160	216
Uniform	Compressed	27	44	133	163	212
*Uniform	Locational	24	44	131	162	211

Table 2: Constraint Costs in €m

* The SEMC is of the view that some of the scenarios presented above are less desirable than others, as it was explained in the section 3 and ToR of this analysis (SEM-11-006)

The alternative table below summarises the constraints costs as the TLAFs used in the market schedule are moved further away from those used in the dispatch schedule.

		Increase in Constraint Costs from Splitting				
Dispatch	**Market**	2008/09	2009/10	2010/11	2011/12 (wo EW)	2011/12 (EW)
Locational	Compressed	12.4%	-1.6%	1.6%	0.6%	0.5%
	Uniform	4.1%	-0.7%	2.4%	-1.3%	2.4%
Compressed	Locational	-11.2%	1.7%	-1.6%	-0.6%	-0.5%
	Uniform	-7.5%	0.9%	0.8%	-1.9%	1.9%
Uniform	Locational	-4.0%	0.7%	-2.2%	1.3%	-2.3%
	Compressed	8.0%	-0.9%	-0.7%	1.9%	-1.9%

Table 3: Constraint Costs variation of costs

There is no clear trend here as the constraints costs are affected both by the volumes of constrained running and factors such as fuel costs. 2010/11 and 2011/12 with the EW interconnector in both show a trend to increased constraints costs as the divergence increases. The table below presents the comparison between the non-split options against the *status quo* (Compressed-Compressed).

	2008/09	2009/10	2010/11	2011/12 (wo EW)	2011/12 (EW)
Locational	-10.1%	2.8%	-3.1%	-2.5%	1.0%
Uniform	-7.1%	3.8%	5.5%	-1.2%	2.9%

Table 4: Constraint Costs – Locational/Uniform vs. Compressed

4.4. Impact on the all-island customer.

The table below shows consumer costs depending on the combination of employed TLAF methodology in the market schedule and in the dispatch. The Green cells highlight the lowest consumer costs in €m for each year. The red cells highlight the highest consumer costs. There are two scenarios for 2011/12, the first considers the influence of the EW Interconnector and the second do not.

Dispatch	Market	2008/09	2009/10	2010/11	2011/12 w/o EW	2011/12 EW
Locational	Locational	2,114	2,085	2,757	2,978	3,050
Locational	Compressed	2,128	2,101	2,764	2,958	3,031
Locational	Uniform	2,148	2,113	2,785	2,990	3,026
Compressed	Compressed	2,128	2,100	2,766	2,961	3,028
*Compressed	Locational	2,114	2,084	2,759	2,981	3,047
*Compressed	Uniform	2,148	2,113	2,787	2,993	3,023
Uniform	Uniform	2,148	2,114	2,793	2,994	3,025
Uniform	Compressed	2,128	2,102	2,772	2,962	3,030
*Uniform	Locational	2,114	2,085	2,765	2,982	3,049

Table 5: Impact on the all-island customer in €m

* The SEMC is of the view that some of the scenarios presented above are less desirable than others, as it was explained in the section 3 and ToR of this analysis (SEM-11-006)

The alternative table below summarises the consumer costs as the TLAFs used in the market schedule are moved further away from those used in the dispatch schedule.

		Increase in Constraint Costs from Splitting				
Dispatch	**Market**	2008/09	2009/10	2010/11	2011/12 (wo EW)	2011/12 (EW)
Locational	Compressed	0.7%	0.8%	0.3%	-0.7%	-0.6%
	Uniform	1.6%	1.4%	1.0%	0.4%	-0.8%
Compressed	Locational	-0.7%	-0.8%	-0.3%	0.7%	0.6%
	Uniform	0.9%	0.6%	0.8%	1.1%	-0.2%
Uniform	Locational	-1.6%	-1.4%	-1.0%	-0.4%	0.8%
	Compressed	-0.9%	-0.6%	-0.8%	-1.1%	0.2%

Table 6: Impact on the all-island customer variation

Once again these tend to increase with splitting for past years while future years, especially with the EW interconnector in, show a reduction as we move from locational to compressed to uniform in the schedule. The overall impacts are small in absolute terms. The table below presents the comparison between the non-split options against the status quo (Compressed-Compressed).

	2008/09	2009/10	2010/11	2011/12 (wo EW)	2011/12 (EW)
Locational	-0.6%	-0.8%	-0.3%	0.6%	0.7%
Uniform	0.9%	0.6%	1.0%	1.1%	-0.1%

Table 7: Impact on the all-island customer Locational/Uniform vs. Coompressed

4.5. Divergence between the market schedule and dispatch schedule

The table below outlines the divergence of the market schedule from the dispatch schedule depending on the combination of employed TLAF methodology in the market schedule and in the dispatch. This is calculated by summing the total absolute differences between MSQ and DQ for each half hour for each generator over the relevant year. The Green cells highlight the lowest divergences between market volumes and dispatch volumes in GWh for each year. The red cells highlight the highest divergence. MSQ stands for Market Scheduled Quantities and DQ Dispatched Quantities. There are two scenarios for 2011/12, the first considers the influence of the EW Interconnector and the second do not.

DQ	MSQ	2008/09	2009/10	2010/11	2011/12 (wo EW)	2011/12 (EW)
Locational	Locational	7,200	8,904	12,712	15,166	17,983
Locational	Compressed	7,508	8,984	13,634	15,380	18,263
Locational	Uniform	7,700	9,119	14,548	15,815	18,464
Compressed	Compressed	7,252	8,728	12,977	14,806	17,587
*Compressed	Locational	7,468	8,980	13,014	15,297	17,952
*Compressed	Uniform	7,531	8,979	14,010	15,307	18,029
Uniform	Uniform	7,359	8,735	12,609	14,818	17,716
Uniform	Compressed	7,471	8,865	12,755	14,875	17,992
*Uniform	Locational	7,637	8,981	13,300	15,301	18,144

Table 8: Divergence between the market schedule and dispatch schedule in GWh

* The SEMC is of the view that some of the scenarios presented above are less desirable than others, as it was explained in the section 3 and ToR of this analysis (SEM-11-006)

The alternative table below summarises the fluctuations of the divergence as the TLAFs used in the market schedule are moved further away from those used in the dispatch schedule.

		Increase in Constraint Costs from Splitting				
Dispatch	**Market**	2008/09	2009/10	2010/11	2011/12 (wo EW)	2011/12 (EW)
Locational	Compressed	4.3%	0.9%	7.3%	1.4%	1.6%
	Uniform	6.9%	2.4%	14.4%	4.3%	2.7%
Compressed	Locational	3.0%	2.9%	0.3%	3.3%	2.1%
	Uniform	3.8%	2.9%	8.0%	3.4%	2.5%
Uniform	Locational	3.8%	2.8%	5.5%	3.3%	2.4%
	Compressed	1.5%	1.5%	1.2%	0.4%	1.6%

Table 9: Divergence between the market schedule and dispatch schedule - Variation

The table below presents the comparison between the non-split options against the status quo (Compressed-Compressed).

	2008/09	2009/10	2010/11	2011/12 (wo EW)	2011/12 (EW)
Locational	-0.7%	2.0%	-2.0%	2.4%	2.3%
Uniform	1.5%	0.1%	-2.8%	0.1%	0.7%

Table 10: Divergence between the market schedule and dispatch schedule – L/U vs. Compressed

5. CONSULTATION QUESTIONS

1. What is the respondent's own interpretation of the results of the impact assessment?

2. Which of the below four options would the respondent recommend and why?

    a. Proceed to split the treatment of losses in the market schedule and the dispatch, using uniform loss factors for the purposes of the market schedule

    b. Proceed to split the treatment of losses in the market schedule and the dispatch, using compressed loss factors for the purposes of the market schedule.

    c. Decide not to split the treatment of losses in the market schedule and the dispatch and continue to use locational loss factors in both the market schedule and the dispatch.

    d. Decide not to split the treatment of losses in the market schedule and the dispatch and use compressed loss factors in both the market schedule and the dispatch.

    e. Other

6. NEXT STEPS

In SEM-11-067 the SEM Committee decided that further modelling should be undertaken by the Regulatory Authorities and the System Operators. The Regulatory Authorities are currently giving consideration to whether further modelling should be carried out to help inform a future decision. Should the Regulatory Authorities consider that further modelling is required the nature and objectives of this modelling will be communicated to industry.

- Consultation concludes 20th January 2012.
- Proposed Decision by the SEM Committee – end of March 2012
- Decision by the SEM Committee June 2012.
- TSO consultation on 2012-13 TLAFs – 1 to 31 of July 2012
- Publication by TSOs of TLAFs for 2012 – 2013 - 1 September 2012
- Application of enduring solution to TLAFs 1 October 2012