GTUoS Methodology Update following SEM Committee Meeting

June 8th

Version 1.0

Release Date	Reference Document
May 2009	SEM-09-049 Methodology Options Paper
November 2009	SEM-09-107 Locational Signals Preferred Options Paper
December 2010	SEM-10-081 All-Island Generator TUoS Charging Decision Paper
April 2011	SEM-11-018 Implementation of All-Island TUoS Charging Methodology
June 2011	SEM-11-037 All-Island Generator TUoS Methodology
September 2011	SEM-11-078 GTUoS Charging Decision Paper SEM-11-079 GTUoS Methodology Statement

TABLE OF CONTENTS

Executive Summary

In SEM-11-078 the Regulatory Authorities (RAs) asked that the System Operators (SOs) examine a number of refinements to the methodology used to calculate generator tariffs. The current methodology is the culmination of a series of decisions made by the RAs going back to 2005. These decisions include the SEM High Level Design decision made in 2005 which called for all-island tariffs; the 2007 decision approving the use of a Reverse-MW Mile methodology and the 2009 decision which approved the use of a dynamic (forward looking) locational signal plus postage stamping. A dynamic (forward looking) locational signal model is designed to provide a signal to generators regarding their decision to locate on the network in order to promote efficient network development and investment, i.e. reflects costs imposed upon the system in the future.

This document describes the development work done by the SOs on the methodology to determine which refinements may be appropriate for the model based on the aspects outlined in decision paper SEM/11/078 and further clarified in a 19th December 2012 correspondence from the RAs to the SOs.

The SOs have calculated three sets of tariffs to accompany this paper. Table 1 summarizes the basis for each tariff set.

Set	Description
Set 1	**11/12 methodology**
Set 2a	**11/12 methodology but with following modifications** **-> intermediate years** **-> wider cost base as historical assets included** **-> modified rule set for plant not in merit**
Set 2b	**11/12 methodology but with following modifications** **-> intermediate years** **-> wider cost base as historical assets included** **-> NO modified rule set for plant not in merit**

Table 1: High Level Overview of 3 Sets of Tariffs

The SOs have been asked to refine the dynamic forward looking methodology which was used in 2011/12 and to evaluate alternatives for generators not in merit. As a result of this work the SOs are proposing to proceed with the continued use of the 1MW function for all three sets of tariffs, but with a slightly modified rule set for Set 2a.

In response to the SEM Committee, the SOs have also examined the option of adapting the G-TUoS methodology to include lines built for up to seven year before the year in question. This change is considered to be practicable and is consistent with the shadow period element of the methodology design. This approach has been included in Set 2a and 2b of tariffs being supplied by the SOs.

An evaluation of scenarios between year Y and Y+5 (intermediate year) was conducted and it was concluded that that there is the potential for

some additional stabilisation of tariffs, where tariffs are calculated for the intermediate years. As a result, it has been included in Set 2a and 2b of tariffs being supplied by the SOs.

	Set 1	Set 2a	Set 2b
Network	2017/18	2013/14, 2014/15 2015/2016 2016/2017 2017/2018	2013/14, 2014/15 2015/2016 2016/2017 2017/2018
Cost	2011-2018	2006-2018	2006-2018
Generators in Dispatch	4 scenarios	4 scenarios	4 scenarios
Generators out of dispatch	1MW function: 4 Scenarios (Default rule set)	1MW function: Modified rule set	1MW function: 4 Scenarios (Default rule set)
Calculation	Max of 4 scenarios	Average of the maximum of each year scenario	Average of max of each year scenario
Locational : Maximum of 30% of total revenue Postage Stamp: Minimum of 70% of total revenue			

Table 2: Technical characteristics of the 3 Sets of tariffs

Introduction

In 2005 the High Level Design principles for SEM called for All-Island Generator Tariffs to be calculated. Since then a number of publications have seen the development of an all-island methodology, in stages, including:

- **the decision to implement a Reverse-MW Mile methodology in 2007;**
- **the publication of preferred options in 2009;**
- **a decision confirming the 2009 preferred option for Generator-TUoS in 2010; and**
- **2011, when SEM Committee decided to approve the All-Island methodology (SEM/11/078) which had two elements: maximum of 30% of required revenue to be locational and minimum of 70% of required revenue to be socialized (postage stamp). This decision also requested that the SOs look at some refinements to the methodology. These refinements covered the network, cost and generator dispatch elements only. Other elements such as the locational/ postage split and the fact that tariffs are calculated on an annual basis were out of scope.**

This document describes the development work done by the SOs on the generator tariff methodology to determine which refinements may be appropriate for the model (see table 3 below) based on the aspects outlined in decision paper SEM/11/078 and further clarified in a 19th December 2012 correspondence from the RAs to the SOs. The refinements relate to the treatment of networks, cost and generators out of dispatch only. Other features of the all-island methodology were not addressed.

All-Island Methodology	
Network	Future Network
Cost	At a minimum future Network
Generators in Dispatch 2012/2013	4 Scenarios: Winter Peak 0% Wind; Summer Peak 0% Wind; Summer Peak 80% and Summer Min 80%
Generators out of dispatch	1 MW function
Locational Element is maximum of 30% of total revenue Postage Stamp is a minimum of 70%	

Table 3: Dynamic (Forward Looking) Methodology which applies to all tariff sets

The first section of this document outlines the work done by the SOs to examine whether alternative approaches should be adopted for plant that do not appear in the four scenarios i.e. refinements to the 1MW function in INTEGRA®.

The second section discusses the reasoning behind the use of assets built in the years up to Year Y (the year for which tariffs are being calculated).

The third section examines the effect of adding scenarios to the intermediate years and whether this change is viable and/or adds significant value.

The SOs have provided three sets of tariffs to accompany this paper:

- **Set 1 is based on the default (2011/2012) methodology.**
- **Set 2a includes all changes discussed in this document including additional intermediate year calculations, additional historic cost files and the modified 1MW function rule set for generators out of merit.**
- **Set 2b includes the same features as 2a but without the changed rule set for generators which are out of merit.**

1. Alternative approaches for plant not dispatched under the four existing scenarios.

Feature	Set 1	Set 2a	Set 2b
Network	2017/18	2013/14, 2014/15 2015/2016 2016/2017 2017/2018	2013/14, 2014/15 2015/2016 2016/2017 2017/2018
Cost	2011-2018	2006-2018	2006-2018
Generators in Dispatch	4 scenarios	4 scenarios	4 scenarios
Generators out of dispatch	1MW function: 4 Scenarios Existing rule set	1MW function: Modified rule set	1MW function: 4 Scenarios Existing rule set
Calculation	Max of 4 scenarios	Average of the maximum of each year scenario	Average of max of each year scenario
Locational : Maximum of 30% of total revenue Postage Stamp: Minimum of 70% of total revenue			

Table 4: Characteristics of different tariff sets

1.1. Background

The SOs looked at a number of alternatives to the default 1MW approach including: regional dispatches, a modified 1MW rule set and alternative software options.

1.2. Analysis and Development

1.2.1. Regional Approach

The approach is similar to that used by planning engineers working on regional planning issues and works as follows:

1. **The island is split into regions, with each region being studied in turn**
2. **In each region every generator is dispatched with non-region (i.e. regions not being studied) generation being reduced until demand is met**
3. **This is repeated for every region until a tariff is calculated for every generator**

By its nature, the required regional approach would force *every* generator to be dispatched in the same way that the 1MW function works in INTEGRA®. However, a key principle of the GTUoS model is that it is aligned, as close as possible, with investment planning. From a planning perspective it is unreasonable to dispatch all generation in a particular region.

1.2.2. Modified 1MW rule set

The SOs looked to determine whether it would be worthwhile discounting any unreasonable tariffs based on an additional rule set which would be more consistent with the general planning approach. In particular, the SOs considered it appropriate to apply the following rule set:

- **tariffs for thermal generators (which are not in merit order) can only be set in low wind scenarios; and**
- **tariffs for wind generators can only be set in high wind scenarios.**

This modifed rule set means that in certain cases a reduced number of scenarios would apply. For example, for tariffs produced by the 1MW function for thermal generators, only two scenarios are used i.e. Winter Peak 0% Wind and Summer Peak 0% Wind.

1.2.3. Alternative Software function (alternative software function

This approach looked at an alternative software function which produces a tariff for every node. It involved the use of a sensitivity matrix (Power Transfer Distribution Factor), circuit capacity and circuit costs to calculate a price for every node. However, with this approach the choice of slack bus is significant.

1.3. Conclusion

The table below includes an evaluation of the three alternative approaches (regional dispatch, modifed rule set and alternative software function). The default 1MW approach is used in Sets 1 and 2b of the tariffs. The SOs believe that the 1MW function remains the best solution but has calculated a set of tariffs with the following change: two scenarios are used with the 1MW function Summer Peak 0% Wind and Winter peak 0% wind.. This is the modified rule set used in Set 2a.

Approach	Tariff for Every Generator	Generation Assumptions Reasonable	Compatible To existing approach	Used in Set
100% Regional Tariff Approach	Yes	No	Yes	Not used in any set
Modifed 1MW rule set	Yes	Yes	Yes	Set 2a
Alternative software function	Yes	Yes	No (the choice of slack is significant which impacts tariffs)	Not used in any set

Table 5: Comparative Evaluation of alternative approaches for plants <u>not</u> dispatched under the various scenarios

2. Consideration of adapting methodology to include assets built before year Y in cost recovery

Feature	Set 1	Set 2a	Set 2b
Network	2017/18	2013/14, 2014/15 2015/2016 2016/2017 2017/2018	2013/14, 2014/15 2015/2016 2016/2017 2017/2018
Cost	2011-2018	2006-2018	2006-2018
Generators in Dispatch	4 scenarios	4 scenarios	4 scenarios
Generators out of dispatch	1MW function: 4 Scenarios	1MW function: Modified rule set	1MW function: 4 Scenarios (NO Modified rule set)
Calculation	Max of 4 scenarios	Average of the maximum of each year scenario	Average of max of each year scenario
Locational : Maximum of 30% of total revenue Postage Stamp: Minimum of 70% of total revenue			

Table 6: Characteristics of different tariff sets

2.1. Background

For the tariffs calculated for 2011/2012 only assets planned in the next 5 years have been included in the cost base for the locational element. However, it is the intention that once assets are introduced in the cost file they will only be removed 7 years post-commissioning or 12 years since they were first introduced, whichever occurs first. Thus over time, while the locational cost base mostly includes future assets it will also include existing assets.

As 2011/2012 was the first year of the default tariff model (i.e. before adjustments outlined in SEM/11/078 and the correspondence of the 19th December 2012) it does not include any historical assets. Year on year as the TUoS model is used; existing assets would gradually be included in the cost base.

The RAs have requested that the SO consider adapting the methodology to include assets built before year Y in the cost recovery.

2.2. Analysis and Development

The purpose of including projects in the cost base after they have been commissioned is to avoid "free riding" i.e. a project delays its connection date in order to avoid paying TUoS. Set 1 does not include any historical assets in the cost base. However, adapting the methodology to include assets built in the last 7 years (i.e. the shadow period) could be considered as a fairer model.

2.3. Conclusion

The SOs can confirm that it is possible to include assets built in the last 7 years into the cost file for the locational element. The Set 2a and 2b tariffs have been produced using this wider cost base (2006 – 2018).

3. The impact of adding scenarios to the intermediate years

3.1. Background

This report examines whether adding the intermediate years leading up to Y+5 timeframe for the tariff calculation would add significant value. The manner in which the SOs have applied the intermediate years approach is to undertake the default Y+5 approach (i.e. using the network of Y+5, compute the tariff[1] under each of the dispatch scenarios and select the maximum tariff across these dispatch scenarios) to each of the individual years' network for the next five years. Following this, the average of the maximum tariffs derived for the individual years is taken. This average figure is taken for the generator's unadjusted locational tariff.

	Set 1	Set 2a	Set 2b
Network	2017/18	2013/14, 2014/15 2015/2016 2016/2017 2017/2018	2013/14, 2014/15 2015/2016 2016/2017 2017/2018
Cost	2011-2018	2006-2018	2006-2018
Generators in Dispatch	4 scenarios	4 scenarios	4 scenarios
Generators out of dispatch	1MW function: 4 Scenarios No Modified rule set	1MW function: 2 Scenarios Modified rule set	1MW function: 4 Scenarios (NO Modified rule set)
Calculation	Max of 4 scenarios	Average of the maximum of each year scenario	Average of max of each year scenario
Locational : Maximum of 30% of total revenue Postage Stamp: Minimum of 70% of total revenue			

Table 7: Characteristics of different tariff sets

3.2. Analysis and Development

Previously the SEMC (SEM/10/081) outlined that the TUoS "charging arrangements should produce cost-reflective generator TUoS charges, which provide signals that promote efficient use of the transmission system. It is also important for the methodology to be transparent and provide an appropriate level of stability and predictability. It is accepted that often these objectives will conflict with each other and further stabilising methods may be used if required". Based on this statement it is the SOs' understanding that value, in this specific instance, will be judged by whether the application of including intermediate years increases the stability (and predictability) of the tariff charges without unduly impacting

[1] This is an unadjusted tariff i.e. it is before a postage stamp element is applied to ensure revenue recovery.

upon the signal that would be sent as compared to the default methodology.

Under any tariff methodology there are a number of factors that influence changes in a generator's tariff from one year to the next. These primarily include the following:

a) A change in the revenue requirement that the tariffs set out to collect;
b) The pool of "chargeable MW's" that the revenue requirement has to be recovered from. This will heavily influence the postage stamp element.
c) The dispatch used for each scenario. This will change every year reflecting the modeling information updated annually; and
d) The change in the network asset portfolio used.

Therefore, the SOs will evaluate the use of the intermediate years' methodology as opposed to the default methodology under these factors.

3.2.1. Change in revenue requirement

The same revenue requirement would be applied to either methodology. Nevertheless the impact of this on individual generators' tariffs in terms of movement from one year to the next may differ. This can occur as the amount set out to be collected from the locational element will naturally differ between the two approaches. Correspondingly the postage stamp adjusted requirement will differ. The postage stamp scaling arguably has a distorting effect on individual tariffs and may contribute to year on year volatility. However, it is difficult to ascertain whether a particular approach would lead to greater or less volatility based on this criterion.

3.2.2. Pool of chargeable MW'S

The pool of chargeable MWs should remain constant for both approaches and therefore need not be considered further.

3.2.3. Dispatch Scenarios

The underlining premise of the forward looking dynamic methodology (as determined by the SEM Committee SEM/11/078) is that today's dispatch (the dispatch scenarios using an unconstrained model) is applied to a future network in order to determine the impact generators today have on the future network build. The dispatch information will evolve for each year that a tariff is calculated. However, the same dispatch would be calculated regardless of whether the intermediate years approach is taken or not. Once more it is difficult to determine whether the change in dispatch from year to year will have a greater/lesser impact on a generator's tariff depending on the approach selected.

3.2.4. Network Asset Portfolio

The intermediate years approach captures the network evolution that is expected to occur up to and including Y+5 years. The default Y+5 approach will specifically assess the dispatch on the forecast network of that particular year. The network structure in a particular year determines

the flow direction of a generator's dispatch and influences tarrifs. Also the values of the assets in a particular year determine the locational element tariff[2] (i.e. before any further adjustments are made to the tariff). Without having data available over a number of years to compare how the inclusion of additional network years in the calculation impacts upon volatility, it can nevertheless be assumed that the intermediate years approach has the potential to lead to more stable tariffs.

This assessment is based on the simple notion that an average of a number of outputs, which the intermediate years approach entails, will lead to a lesser change from one year to the next, than an approach that uses one single output, i.e. the default Y+5 methodology. Any significant change in the network asset portfolio seen in one particular year would be fully reflected in the default methodology whereas in the intermediate years approach it would be countered by the outputs from the other year's network used in its calculation. This could reduce year on year volatility in the tariffs.

3.2.5. Impact on Locational Signal

The intermediate years approach may provide for a stronger and more reliable signal, as it has the potential to provide a more stable tariff. Such stability may provide a greater opportunity for generators to internalise the signal in its decision making process as the signal may not be as transient as before.

3.3. Additional Complexity

The inclusion of intermediate years increases the level of complexity and scale of work involved in calculating the tariffs significantly. Instead of running the model for a single year it requires the model to be run an extra five times.

In addition, the analysis of tariffs is more complicated, as there are now, many more variables that can impact tariffs. While the SOs strive to make the model as accurate as possible it may be appropriate to balance the level of complexity (with associated risks) involved in calculating these tariffs against the scale of revenue collected from them (less than 30% of Generator TUoS).

3.4. Conclusion

The SOs have examined whether the intermediate years' approach will lead to greater stability as compared to the default Y+5 years approach without unduly impacting the locational signal. The SO assessment indicates that it has the potential to increase the stability of a generator's tariff over time. Moreover, it could potentially vary the type of location signal that is provided to a generator but that this signal could nevertheless be robust. Based on this assessment the SOs have incorporated the intermediate years approach in the second set of tariffs as it has the potential to enhance the overall tariff methodology.

[2] Please note that the cost of the asset itself (as measured by the Modern Equivalent Asset Value) is not utilized in the tariff calculation but rather the annuity factor of the cost of the asset.