Disclosure of Information to Final Customers by Suppliers

Direction

And

Responses to Comments Received

CER/06/117

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Table of Contents

1 Background 2
1.1 Legal Background 2
1.2 Consultation Background 2
1.3 Next Steps 2
2 Commission's Direction 3
3 Commission's Response to Comments Received 6
3.1 Presentation of Information 6
3.1.1 Respondents' Comments 6
3.1.2 Commission's Position 7
3.1.3 Commission's Decision 7
3.2 Calculation of Fuel Mix Information 8
3.2.1 Respondents' Comments 8
3.2.2 Commission's Position 8
3.2.3 Commission's Decision 8
Appendix 1 10
Appendix 2 17

1 Background

1.1 Legal Background

Regulation 25 of S.I. No. 60 of 2005, which transposes Article 3(6) of the Electricity Directive (2003/54/EC), requires the Commission for Energy Regulation (the Commission) to ensure that all suppliers provide reliable information on all bills/promotional materials sent to customers regarding the contribution of each energy source to the overall fuel mix of the supplier concerned over the preceding year.

1.2 Consultation Background

The Commission has been working with the Settlement System Administrator (the SSA) to develop a methodology for the central calculation of the fuel mix of suppliers. On the 1st of March 2006 the Commission published a consultation paper regarding proposals for disclosure of information to final customers by suppliers (CER/06/018) outlining the Commission's proposals for the methodology to be utilised to calculate the fuel mix of all suppliers in the market and the associated rules for the making available of this information to final customers. These proposals were to apply until the commencement date of the Single Electricity Market ('the SEM'). Following review of comments received on the above proposals, the Commission published a proposed decision paper (CER/06/085) on May 8th 2006. The Commission received comments on the proposed decision paper from the following parties:

- Airtricity
- ESB Customer Supply
- Perlico Communications Ltd
- The Green Certificate Company

All responses are available on the Commission's website.

Section 2 of this paper sets out the Commission's Direction. Section 3 summarises comments received on CER/06/085 and the Commission's responses to these comments.

1.3 Next Steps

Following the publication of this direction, the SSA will put in place the necessary systems and processes to support the implementation of the disclosure requirement. The calculation methodology, as set out in Appendix 1 of this paper, shall be incorporated into an Agreed Procedure under the Trading and Settlement Code by the SSA and submitted to the Commission for approval. Disclosure information will be made available to licensed suppliers and the Commission by the SSA in July, 2006. Suppliers will then include this

information on all bills to customers in the required format as and from two months of the date on which the information is made available to them by the SSA.

2 Commission's Direction

Under Regulation 25 of S.I. 60 of 2005, the Commission has decided to adopt the following approach for the methodology to be used to calculate the fuel mix of all suppliers in the market and the associated rules for the making available of this information to final customers. The methodology as per Appendix 1 shall be used to calculate the average fuel mix for Ireland and the fuel mix for each supplier until the commencement date of the Single Electricity Market ('the SEM').

- Suppliers, under the terms of their Supply Licence, will be required to provide fuel mix information. The methodology for the calculation of the fuel mix will be included in the Trading and Settlement Code.

- Prior to the completion of the modifications to the Supply Licence and the Trading and Settlement Code, suppliers must provide accurate information (and in the required format) in accordance with any directions issued by the Commission under Regulation 25 of S.I. No. 60 of 2005.

- The SSA will calculate the average fuel mix for Ireland and the fuel mix for each supplier in line with a methodology approved by the Commission. This calculation will be conducted with regard to data per trading period summated across the calendar year. For the purpose of this calculation the resultant summated top up and spill figures will be netted off against one another. Netting off of the summated pumping and generation values associated with pumped storage will also be conducted. For clarity all other figures inputted into the calculation will not be subject to any form of netting off. Appendix 1 sets out the methodology for this calculation. Following the publication of this direction the SSA will submit an Agreed Procedure (AP) to the Commission regarding the above for approval.

- The calculation of the fuel mix for each supplier is based on the principle that total metered generation equals total consumption for each defined energy source for all energy seen by the Ex-Post Unconstrained Schedule (EPUS).

- Suppliers must submit information, to be approved by the Commission, to the SSA on energy that is not directly included in settlement calculations. The SSA will review this information and its inclusion in the overall fuel mix. Such information must be submitted to the SSA by close of business Friday 7th July 2006.

- The Commission will approve the fuel mix for generators in Ireland, including those that operate on dual fuel, and the fuel mix of imports for input to the calculation.

- Suppliers may submit to the SSA contractual information regarding the energy source (s) relating to energy imported across the North-South interconnector for inclusion in the calculation of their respective fuel mixes, to be approved by the Commission. This must be submitted by close of business Friday 7th July 2006. For imported energy volumes for which such information is not submitted within the specified timelines, an average fuel mix will be applied. This will be determined by the Commission.

- In order to determine the applicable environmental impact data, the SSA will provide CO_2 emission factors to suppliers based on data obtained from the Environmental Protection Agency (the EPA) and generators, see Appendix 2.

- Suppliers will multiply their fuel disclosure percentage per energy source by the associated CO_2 emission factor, as provided by the SSA, to give the required information, i.e. CO_2 emissions in g/kWh, by energy source.

- Suppliers will be required to provide customers with information on fuel sources and associated environmental impacts within two months of the relevant information being made available by the SSA (the 'Disclosure Date').

- This information will be updated, with respect to the relevant periods, by suppliers in each subsequent year on the 'Disclosure Date'.

- The form and detail of communications to customers regarding fuel sources and environmental impacts will be subject to the prior approval by the Commission. The above information must be provided by all suppliers in the format set out in this paper and must be supplied on *either the front or back of* all bills to customers. Where this information is provided on the back of bills to customers, clear reference must be made to this on the front of all such bills. The form and detail of such will be subject to approval by the Commission, prior to its issue to final customers given the timelines specified in this document.

- The publication of fuel mix and environmental impact information on either the front or back of bills must be concluded within two months from the date on which the required information is made available to suppliers by the SSA.

- Examples of categories of energy sources that may be used for the purpose of fuel mix disclosure are coal, gas, peat, renewables, CHP, heavy fuel oil, distillate oil and other. Following the calculation of the fuel mix disclosure information by the SSA and provision of this to the

Commission, the Commission will determine what energy sources should be specified and what sources may be listed as 'Other' due to the insignificant nature of the percentage contribution to the fuel mix for the calendar year in question.

- Information provided by suppliers on promotional materials regarding fuel mix and associated environmental impacts should use the same basic format as that required to be made available on bills to final customers. The Commission will adopt a proportionate approach to enforcement of this matter.

- Suppliers that have not supplied electricity to customers for the full disclosure period (the applicable period) in question are not required to disclose a fuel mix specific to their supplier MPID. Here, such suppliers will be obliged to put the disclosure label on all bills to final customers, inline with the requirements set out in this paper, and shall include percentages by energy source for the average fuel mix for Ireland. Zero percent shall be represented for each energy source with regard to the electricity supplied by the supplier in question. Suppliers are referred to section 2.3.5 of CER/06/018 for the required labelling format.

- The methodology for the calculation of fuel mix disclosure will be used to determine the balancing position of suppliers licensed under Section 14 (1) (c) and 14 (1)(d) as per the Commission's decision on revised balancing rules for such suppliers (CER/06/086).

- For the purposes of balancing, and in accordance with CER/06/086, any licensed green or CHP supplier imbalance at the end of the balancing period immediately before the current balancing period will be included in calculations of the current balancing period, where current balancing period has the meaning as defined in CER/06/086. Here, the relevant volumes associated with the imbalance as above will be included in the calculation for the relevant supplier for the purposes of determining the balance of that supplier for the current balancing period as defined in CER/06/086. The resulting balance as determined will be subject to approval by the Commission. For the avoidance of doubt, the above pertains to the requirement placed on licensed green and CHP suppliers to balance in accordance with the Commission's Decisions on this matter and calculation of the fuel mix for disclosure to customers is not impacted by this.

3 Commission's Response to Comments Received

This section summarises the comments received by the Commission from interested parties on the matters set out in the proposed decision paper (CER/06/085) and the Commission's responses to those comments.

3.1 Presentation of Information

The Commission proposed that fuel mix and environmental impact information be published on the front of all bills to final customers as and from one month from the date on which the disclosure information is made available to them by the SSA in the format outlined in the Proposed Decision Paper, i.e. tabular form. (Please refer to section 2.3.5 of CER/06/018.)

3.1.1 Respondents' Comments

A respondent sought confirmation that their assumption that suppliers who had not traded in the year for which energy source and environmental impact information must be disclosed to final customers would not be required to publish any such data on their bills for the respective period. Said respondent stated that '*any alternative may place a new entrant at a disadvantage in terms of customer perception*'.

The positioning of communications to customers regarding energy sources and environmental impacts on the front of all bills to customers was queried by one respondent. Said respondent stated that the method by which the data in question is communicated to final customers should have the minimum possible interruption to the billing process. Therefore, the respondent is of the opinion that an obligation to place the relevant information on the front of all bills to final customers is not preferable. It is the respondent's view that such an obligation would cause difficulties regarding the ability to adhere to the timelines for disclosure of information set out in the Proposed Decision Paper on this matter. The respondent in question aired their preference, due to the lesser impact on billing processes, to utilising pre-printed bill stationery or an insert as the means of correspondence to final customers in this regard. Also, the respondent went on to request that the Commission allow the information in question to be placed on an insert with a reference drawing the customer's attention to such located on the front of bills for 2006. This method of communication would be subject to review prior to 2007.

Another respondent commented on the difficulties of modifying / adapting their billing system in the envisaged timeframes and estimated that this may require as long as six months to complete. This respondent indicated that the consultation paper on this matter was not clear on whether or not it would be required to place the relevant data on bills or in bills to final customers. They also indicated that due to the fact that the format for presentation of the fuel mix and environmental impact information to final customers has not been finalised, the adoption of such a format on their bills would not be feasible in the required timeframe.

3.1.2 Commission's Position

The Commission has decided that suppliers who have not traded in a year for which disclosure of energy source and environmental impact information relates will not be obliged to place information regarding their fuel mix on their bills with regard to the applicable period. However it will be necessary that information regarding the average fuel mix for Ireland be provided to customers in the required format. This ensures that all customers are provided with information regarding the average fuel mix and can compare alternative suppliers' figures, where available, against this average.

It was stated in the proposed decision paper on this matter that the required information must be provided on the front of bills to final customers. Suppliers aired their concerns that such a requirement would result in their inability to adhere to the associated timelines. In this regard the Commission indicated that the insertion of such data on all bills and promotional materials sent to customers would be required in the Commission's consultation paper on this matter, which was issued on March 1st 2006. As such this obligation was indicated to suppliers some four months ago. Also with regard to the requirement to position such information on the front of bills, this was indicated in the Commission's proposed decision paper on this matter, which was issued on 8th May 2006.

With respect to the above the Commission is of the view that the placement of the required information on the front of bills to final customers is the most effective method for providing information to final customers and that the timelines afforded to do such are sufficient. However in light of comments received the Commission has decided that the information in question may be placed on the back of bills provided that a clear reference to it is made on the front of bills to final customers. Suppliers should be advised that the form and detail of all such information to be placed on the bill will be subject to approval by the Commission, in advance of their issue to final customers. Also to afford suppliers additional time to adapt their billing systems, the Commission is extending the timeframe in which Suppliers will be required to provide customers with information on fuel sources and associated environmental impacts from one month of the relevant information being made available by the SSA to two months.

Regarding the format for presentation of the fuel mix and environmental impact information the layout to be adopted by suppliers was contained in Section 2.3.5.of the consultation paper on this matter, which was published on 1st March 2006. The format of this table has not changed since and no comment on such was submitted in any round of the consultation process on this matter.

3.1.3 Commission's Decision

The Commission has decided that the fuel mix and environmental impact information may be published either on the front or back of all bills to final customers. The publication of such on the front or back of all bills to final customers must be concluded within two months from the required information being made available to suppliers by the SSA. Where information is placed on

the back of all bills to final customers, clear reference must be made to this on the front of all such bills. Suppliers should be advised that the form and detail of all such information to be placed on the bill will be subject to approval by the Commission, in advance of their issue to final customers given the timelines specified in this document.

Suppliers who have not traded in a year for which disclosure of energy source and environmental impact information relates will not be required to put in percentage figures pertaining to the energy they have supplied to their final customers with regard to the applicable period. For clarity, in this case zero percent shall be represented as the contribution of each energy source to the electricity supplied by the supplier in question. Such suppliers however must include the percentages associated with the average fuel mix for Ireland on all bills to final customers in the required format.

3.2 Calculation of Fuel Mix Information

As outlined in the Proposed Decision Paper on this matter the SSA will calculate the fuel mix for each supplier in line with the methodology approved by the Commission. This calculation will be conducted with regard to data per trading period summated across the calendar year, with the netting off of the resulting total top up and spill figures, i.e. the net top up/spill position for each supplier MPID will be calculated, and the fuel mix determined in this basis. The above calculation does not use Guarantees of Origin.

3.2.1 Respondents' Comments

One respondent noted that the methodology proposed is at variance with that adopted by most other EU member states due to the fact that it does not rely on Guarantees of Origin in its determination of suppliers' fuel mixes.

3.2.2 Commission's Position

With regard to the use of Guarantees of Origin to ascertain the fuel mixes of suppliers, this approach is not been used as such a scheme has not to date been adopted in Ireland. The adoption of Guarantees of Origin in the Ireland is a matter for the Department of Communications, Marine and Natural Resources. The Commission would like to highlight that the methodology described in this Direction will apply up to the commencement date of the SEM. The calculation of suppliers' fuel mixes post the commencement of the SEM is not within the scope of this Direction and will be dealt with in due course.

3.2.3 Commission's Decision

The average fuel mix of Ireland, suppliers' fuel mixes and the associated environmental impact information will be calculated in accordance with the methodology as outlined in the Proposed Decision Paper on this matter, except in the case of pumped storage.

The treatment of pumped storage within the aforementioned calculation is being altered from that highlighted in the Proposed Decision paper, so that it will not feature as a distinct energy source on final customers' bills. This approach is being adopted due to the fact that pumped storage is not by its nature a primary energy source. For pumped storage the associated generation and pumping values will be summated across the calendar year and netted off against one another. Due to this approach pumped storage will now be treated within the calculation as solely pumping, equivalent of demand. This is possible as the generation efficiency of pumped storage is less than unity, i.e. pumped storage consumes more energy while pumping than it produces when generating.

Suppliers' fuel mixes and the associated environmental impact information will be calculated with regard to data per trading period summated across the calendar year. The resultant summated top up and spill figures will be netted off against one another. Netting off of the summated pumping and generation values associated with pumped storage will also be conducted. For clarity all other figures inputted into the calculation will not be subject to any form of netting off. Appendix 1 of this paper describes the methodology, inclusive of associated assumptions, behind the calculation. This calculation does not employ Guarantees of origins.

Appendix 1
Methodology for the Calculation of Fuel Mix

The fuel mix of each supplier Market Participant ID (MPID) will be calculated on the basis of a mathematical formula. This formula will be based on the principle that total metered generation (plus imports minus exports) equals total consumption.

The mathematical formulation will determine the final fuel mix ratios for all participants in the market. This will require the solving of systems of linear equations.

For energy not in settlement, suppliers may submit the fuel mix of such energy, based on metered generation, to be approved by the Commission, for adding to the volumes used to calculate their fuel mix disclosure.

In this proposal each generator and supplier is considered as a separate entity or participant. The fuel mix will be calculated for each MPID.

For each generator, the physical energy injection is known (for example 100 MWh) and the fuel mix is known (for example hydro).

Where there is a unit with dual/multi firing, a set percentage as approved by the Commission will be used.

For interconnector imports, the volumes are also known, and the fuel mix as approved by Commission will be used.

For a supplier MPID, the total amount of demand is known. The purpose of this disclosure process is to determine the fuel mix of that demand.

All financial transactions (e.g. sales, purchases, top up, spill) from the settlement system will be used as an input to this calculation.

It is assumed that, when a contract is made, the sale is according to the final fuel mix of the seller.

The net physical position for each entity should equal zero, i.e.,
Generation + Imports + Purchases + Top Up – (Demand + Exports + Sales + Spill) = 0

Negative generation (e.g. when Turlough Hill is pumping) will be modelled as demand.

There are two steps involved in the calculation of the fuel mix as follows:

I. For each MPID, all figures (Generation, Imports, Purchases, Demand, Exports & Sales) will be aggregated over the required time period, i.e., a calendar year. Top-up and Spill volumes will be aggregated over the required time period as above and then netted off to produce one net volume (either Top Up or Spill) for each MPID. For 'Pumped Storage' generating units, eg. Turlough Hill, positive generation figures(when in generating mode) and negative generation figures(when in pumping mode) will be netted off against each other and a 'Net Generation' total will be used (See assumptions below).

II. Following the aggregation over the calendar year of all figures for each MPID, the netting off of aggregated top up and spill figures and the netting off of positive and negative generation figures re pumped storage as above, the resulting figures for each MPID will be used to calculate the fuel mix for each MPID. These resulting figures will be input to the mathematical model detailed in the next section to obtain the fuel mix of each MPID.

Mathematical Model Overview

Let there be **P** active participants or 'entities' in the market and **K** different fuel types.

There are 3 types of these "entities": Generators, Suppliers and the Top-up & Spill Balancing Mechanism. They are all treated equally in this model. They are all simply 'entities' or 'participants' in the market regardless of their type.

An "Active Entity" is an entity performing **any number** of the following "activities":
Generating, importing, exporting, purchasing, selling, topping up, spilling, pumping (e.g. Turlough Hill's negative generation), or having a certain amount of demand.

These activities can be grouped into 3 categories:

1. Sources of energy (injection nodes) into the system: Generating & importing.
2. Physical withdrawal nodes of energy from the system: Demand, exporting & pumping.
3. Transfer of energy from one entity to another: Purchasing, selling, topping up & spilling. Top-ups & spills will be deemed as purchases or sales to/from the balancing mechanism entity.

All activities in any one of these groups are exactly equivalent, e.g. there is no distinction between generation and imports or between demand, exports and pumping.

The known quantities in this model are the generated and imported quantities and their fuel mix ratios.

The unknown quantities are the final fuel mix ratios of each entity. That includes generators because any entity can theoretically buy, sell, export, top-up, have demand or negative generation, etc.. Any of these activities would change the fuel mix of a generator.

This leads to a system of linear equations with the same number of variables as equations which can be solved using any of the well known linear algebra methods (Gauss-Jordan elimination, row reduction method, matrices, etc…).

For every calendar year there will be as many linear equation sets as there are fuel types (K). Each one of theses sets of linear equations will have the same number of equations/variables as there are active participants or entities (P) in the calendar year in question.

Mathematical Model - Derivation and Formulation

Assumptions

- The generation for multi fuelled units can be distinguished by a pre determined annual set percentage approved by the Commission.
- North-South trade (Imports) fuel mix can be determined ex-ante and provided by the Commission.
- Sales (transfer) of energy from any participant (entity) are at the fuel mix ratio of the seller.
- All calculations below will be using aggregated figures for the required period (i.e, a calendar year), as explained above.
- 'Net Generation' figures will be used for Turlough Hill. The balancing period required for this calculation **MUST** be at least long enough to give us a **negative** net generation figure. A minimum of 2 or 3 days is more than enough. This will do away with the need for a fuel type for Turlough Hill, as the generation figures will always be negative. (See next point)
- Turlough Hill's negative generation will be modelled as demand because it is equivalent to any other "physical withdrawal node" in this model.

Formulating the K sets of equation systems:

Let f_{pk} denote the fuel mix ratio for participant p of fuel type k.
(Each f_{pk} variable is a ratio between 0 and 1).

Let T_{pm} denote the total quantity of the trades (purchase, sale, top-up or spill) from entity p to entity m in that direction.
(Top-up is equivalent to a purchase from the 'balancing mechanism' entity).

Let D_p denote the total sum of abs (demand)+abs(exports)+abs(pumping or negative gen) for entity p.
(abs is the absolute value).

Let S_p denote the total sum of all abs (sales)+abs(spill) from entity p to all other entities.
(Spill is equivalent to a sale to the 'balancing mechanism' entity).

Let G_{pk} denote the total sum of generation+imports for entity p **of fuel type k**. Only positive generation figures are aggregated here. Negative generation (pumping) is excluded as it is deemed to be demand.

Variables or Unknowns to solve for:

A (**K**) number of systems of linear equations are required to be solved here.
In each system, we are solving for the following (**P**) number of unknowns or variables:

In linear equation system 1 (corresponding to fuel type 1): f_{11}, f_{21}, f_{31}… f_{P1}.
In linear equation system 2 (corresponding to fuel type 2): f_{12}, f_{22}, f_{32}… f_{P2}.
…
In linear equation system K (corresponding to fuel type K): f_{1K}, f_{2K}, f_{3K}… f_{PK}.

Linear equation system 1 (corresponding to fuel type 1):
There are P equations with P unknowns:

Principle used: The net physical position plus the net trading position should equal zero (1st law of thermodynamics).

Every equation in this set relates to one participant with one fuel type, where:
Purchases+Topup+(Gen+Imports) = (Demand+abs(-ve Gen)+Sales+Spill).

Re-arranging this equation:

$$
\begin{aligned}
&-(D_1+S_1)f_{11} + T_{21}f_{21} + T_{31}f_{31} + T_{41}f_{41} + \dots + T_{P1}f_{P1} = -G_{11}\\
&+ T_{12}f_{11} - (D_2+S_2)f_{21} + T_{32}f_{31} + T_{42}f_{41} + \dots + T_{P2}f_{P1} = -G_{21}\\
&+ T_{13}f_{11} + T_{23}f_{21} - (D_3+S_3)f_{31} + T_{43}f_{41} + \dots + T_{P3}f_{P1} = -G_{31}\\
&+ T_{14}f_{11} + T_{24}f_{21} + T_{34}f_{31} - (D_4+S_4)f_{41} + \dots + T_{P4}f_{P1} = -G_{41}\\
&+ T_{15}f_{11} + T_{25}f_{21} + T_{35}f_{31} + T_{45}f_{41} + \dots + T_{P5}f_{P1} = -G_{51}\\
&\quad\vdots \qquad \vdots \qquad \vdots \qquad \vdots \qquad \vdots \qquad \vdots
\end{aligned}
$$

$$
\begin{array}{cccccc}
 & \cdot & \cdot & \cdot & \cdot & \cdot \\
+ & T_{1P}f_{11} + & T_{2P}f_{21} + & T_{3P}f_{31} + & T_{4P}f_{41} + \ldots - (D_P+S_P)f_{P1} & = -G_{P1}
\end{array}
$$

Note the diagonal coefficients where T_{pp} does not exist, but instead, we have: $-(D_p+S_p)$.

Linear equation system 2 (corresponding to fuel type 2):
Using the same pattern, coefficients and principle as system 1:

$$
\begin{array}{cccccc}
- (D_1+S_1)f_{12} + & T_{21}f_{22} + & T_{31}f_{32} + & T_{41}f_{42} + \ldots + & T_{P1}f_{P2} & = -G_{12} \\
+ T_{12}\, f_{12} - (D_2+S_2)f_{22} + & T_{32}f_{32} + & T_{42}f_{42} + \ldots + & T_{P2}f_{P2} & = -G_{22} \\
+ T_{13}\, f_{12} + & T_{23}f_{22} - (D_3+S_3)f_{32} + & T_{43}f_{42} + \ldots + & T_{P3}f_{P2} & = -G_{32} \\
+ T_{14}\, f_{12} + & T_{24}f_{22} + & T_{34}f_{32} - (D_4+S_4)f_{42} + \ldots + & T_{P4}f_{P2} & = -G_{42} \\
+ T_{15}\, f_{12} + & T_{25}f_{22} + & T_{35}f_{32} + & T_{45}f_{42} + \ldots + & T_{P5}f_{P2} & = -G_{52} \\
 & \cdot & \cdot & \cdot & \cdot & \cdot \\
 & \cdot & \cdot & \cdot & \cdot & \cdot \\
 & \cdot & \cdot & \cdot & \cdot & \cdot \\
 & \cdot & \cdot & \cdot & \cdot & \cdot \\
+ T_{1P}f_{12} + & T_{2P}f_{22} + & T_{3P}f_{32} + & T_{4P}f_{42} + \ldots - (D_P+S_P)f_{P2} & = -G_{P2}
\end{array}
$$

Linear equation system 3 (corresponding to fuel type 3):

Using the same pattern and principle as system 1:

$$
\begin{array}{c}
\cdot \\
\cdot \\
\cdot \\
\cdot \\
\cdot
\end{array}
$$

And finally…
Linear equation system K (corresponding to fuel type K):

Using the same pattern and principle as system 1:

$$
\begin{array}{cccccc}
- (D_1+S_1)f_{1K} + & T_{21}f_{2K} + & T_{31}f_{3K} + & T_{41}f_{4K} + \ldots + & T_{P1}f_{PK} & = -G_{1K} \\
+ T_{12}\, f_{1K} - (D_2+S_2)f_{2K} + & T_{32}f_{3K} + & T_{42}f_{4K} + \ldots + & T_{P2}f_{PK} & = -G_{2K} \\
+ T_{13}\, f_{1K} + & T_{23}f_{2K} - (D_3+S_3)f_{3K} + & T_{43}f_{4K} + \ldots + & T_{P3}f_{PK} & = -G_{3K} \\
+ T_{14}\, f_{1K} + & T_{24}f_{2K} + & T_{34}f_{3K} - (D_4+S_4)f_{4K} + \ldots + & T_{P4}f_{PK} & = -G_{4K} \\
+ T_{15}\, f_{1K} + & T_{25}f_{2K} + & T_{35}f_{3K} + & T_{45}f_{4K} + \ldots + & T_{P5}f_{PK} & = -G_{5K} \\
 & \cdot & \cdot & \cdot & \cdot & \cdot \\
 & \cdot & \cdot & \cdot & \cdot & \cdot
\end{array}
$$

$$\begin{array}{cccccc} \cdot & \cdot & \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot & \cdot & \cdot \end{array}$$

$$+ \quad T_{1P}f_{1K} + \quad T_{2P}f_{2K} + \quad T_{3P}f_{3K} + \quad T_{4P}f_{4K} + \ldots - (D_P+S_P)f_{PK} = -G_{PK}$$

Proposed Solution Method:

A "Gauss–Jordan Elimination" algorithm can easily be implemented using arrays in a programming language such as Visual BASIC. The array would be populated with the coefficients and constants in any linear equation system.

This method produces what is called a "Reduced Row Echelon Form" which is the equivalent of solving a system of linear equations.

An improvement in the numerical stability of this algorithm can be achieved by using a "Pivoting" procedure. This procedure exchanges rows to move the entry with the largest absolute value to the "pivot position" before eliminating a variable.

In effect, it avoids division by small numbers as much as possible. It finds the larges possible number in the matrix column and divides by that number.

A full detailed description of this method and pseudo code for the algorithm used can be found on the following web page: http://en.wikipedia.org/wiki/Gauss-Jordan_elimination

Notes

- ***Trivial solutions excluded at source:*** The use of "Active Participants Only" in the algorithm discussed above ensures that the problem is formulated in a non trivial fashion (for example a participant with no trades, physical injections or withdrawals is not included in the calculation in relevant period).

- **The solution of the disclosure problem revolves around the invertibility of the equivalent matrices.** If any matrix is a mathematical singular there can be no solution. This needs a thorough mathematical analysis to determine the conditions of invertibility or non-invertibility. Based on initial investigation SSA strongly believe that the matrices will generally be non singular and hence theoretically solvable. In the event that any matrix is a mathematical singular, the SSA shall propose a methodology to manage this issue to the Commission for approval.

- Initial investigation suggests that **issues of numerical instability that may arise when wide ranging data is used will not prevent a theoretical solution from being determined.** In addition, the SSA shall endeavour to ensure that the design of the system, to implement the approved methodology, is appropriate to the potential of the above to occur. In the

event that numerical instability arises, the SSA shall propose a methodology to manage this issue to the Commission for approval.

- **The proposed methodology is based on the fact that, in any trading period, the cross-border import and export loss factors are equal,** otherwise there will be losses and the total energy in the system will not be balanced. Note that the two loss factors have been equal in every trading period since 2001 and they are also forecasted to be equal in 2006. Therefore, it is not anticipated that this will be an issue. However, in the event that the cross border import and export loss factors are not equal, the SSA will propose a methodology to manage this issue to the Commission for approval.

- **Actual generation figures and physical top up and spill figures will be used for generation.** In the current settlement system, it is the tradable quantities that are taken as the amount of energy injected into the system rather than actual generation while ESB PES demand is calculated using total actual generation. Therefore, differences arise between the physical generation and the net tradable quantities due to the difference between the total physical generation/demand and total tradable quantities in the EPUS after transmission loss factors are applied. The proposed approach involves using actual generation and physical top up and spill for generators rather than financial imbalances. Physical imbalances will be calculated as financial imbalances less tradable quantity plus actual generation. This would carry the correct fuel mix ratios used by generators into the disclosure system.

Appendix 2
Determination of Environmental Impact Data for Disclosure Purposes

In order to determine the environmental impact data associated with each energy source the following data with respect to the 2005 and 2006 calendar year for Ireland will be used:

• the total mass of each fuel combusted in the production of electricity;

• the total energy (in volume terms) produced from each energy source in question.

The total mass as above is then multiplied by the appropriate net calorific value (TJ/kt) as provided by the EPA. With regard to the net calorific value of Natural Gas, this is based on information obtained from Bord Gáis Éireann acting as the Network Operator, as approved by the Commission (please refer to the subsequent paragraph). The resulting figure is multiplied by the appropriate fuel factor (tCO_2/TJ) as modified by the associated oxidation factor. The net calorific values, fuel factors and oxidation factors are those provided by the EPA, refer to Table 1.

Please note that Table 1 states that the net calorific value for Natural Gas is "Not required" and stipulates to use those values stated on "BGE Bills". In this regard the Commission has decided, for the purpose of determining the required environmental impact information, that an average net calorific value for Natural Gas based on the combined mean daily average net calorific value associated with the entry points onto the Irish Transmission System, i.e. the Moffat and Inch Entry Points, weighted with respect to the volumetric flow of Natural Gas through these entry points will be used (refer to Table 2). For coal, site specific values will be used for the net calorific value and the fuel factor as provided by the EPA, refer to Table 2.

With regard to said energy production data such data will be with respect to the interface with the transmission system. All energy production data will be adjusted by an average weighted transmission loss factor (subject to the approval of the Commission). The resultant CO_2 emission factors (g/kWh) are to be determined by dividing the CO_2 emissions (in mass terms) associated with the production of electricity from each aforementioned energy sources by the respective loss factor adjusted energy data. These resultant CO_2 emission factors will be provided to suppliers by the SSA. Suppliers will multiply these CO_2 emission factors by their associated fuel mix disclosure percentages per fuel type as provided by the SSA. Suppliers shall summate the above values and include this value in the row entitled CO_2 emissions under the Environmental Impact section of the Disclosure Label to be placed on bills as well as any such information placed on promotional materials inline with the requirements as outlined in this Direction.

Table 1: Country Specific Net Calorific Values and CO2 Emission Factors for use in the Annual Installation Emissions Report (2005)

(Source:http://www.epa.ie/Licensing/EmissionsTrading/HowtoApply/FileUpload,3426,en.pdf)

Version 1- 26 October 2005

Country Specific Net Calorific Values and CO_2 Emission Factors for use in the Annual Installation Emissions Report

Subject to revision, the following factors may be used for calculating CO_2 emissions for **2005 only**. They are based on Ireland's Specific Emission Factors used in the 2003 National Inventory reported to UNFCCC, unless otherwise stated. Please note that this table may be updated at anytime as new information becomes available. The fuel factor does not include an oxidation factor; this must be applied separately **(except for cement kilns where combustion is assumed to be practically 100%).** The operator must ensure that the most recent version of this table is used when calculating CO_2 emissions for submission in the verified Annual Installation Emissions Report.

Fuel Factors

Fuel	t CO_2/TJ
Coal	Site specific
Kerosene	71.76
HFO/RFO	76.38
LPG	64.13*
Diesel / Gas Oil	73.67
Natural Gas	57.26**
Pet Coke	100.8***
Crude Oil	Site specific

*Source: Flogas Ireland Ltd. analysis data for commercial propane (LPG).
**Source: Average for 2000-2003 only, from EPA weighted average of BGE analysis of Interconnector and Kinsale gas.
*** IPCC 1996.

Net Calorific Values

Fuel	NCV (TJ/kt)
Coal	Site specific
Kerosene	44.20
HFO/RFO	41.24
LPG	46.68*
Diesel / Gas Oil	43.31
Natural Gas	Not required, use bills**
Pet Coke	31.00***
Crude Oil	Site specific

*Source: Flogas Ireland Ltd. analysis data for commercial propane (LPG).
**Note BGE Gas bills show kWh based on Gross Calorific Value - convert to Net Calorific Value by multiplying by 0.903 and then convert to TJ by multiplying by 3.6×10^{-6}
*** Source IPCC 1996.

Tier 1 Oxidation Factors to be applied for all combustion (except cement kilns)

Fuel	Oxidation factor
Coal	0.99
Kerosene	0.995
HFO/RFO	0.995
LPG	0.995
Diesel / Gas Oil	0.995
Natural Gas	0.995
Pet Coke	0.99
Crude Oil	0.995

(From Annex II of the Monitoring and Reporting Guidelines, Commission Decision 2004/156/EC)

Table 2: Net Calorific Values (NCV) for Natural Gas and Coal.

Site Specific Values	
Fuel	**NCV**
Natural Gas	0.000039 (TJ/m^3)[1]
Coal	25.5 (TJ/ktonne)[2]

[1] The average net calorific value for Natural Gas was based on the combined mean daily average net calorific value associated with the entry points onto the Irish Transmission System, i.e. the Moffat and Inch Entry Points, weighted with respect to the volumetric flow of Natural Gas through these entry points. The data utilised for the above calculation was provided by Bord Gáis Éireann acting as the Network operator.

[2] Value obtained from the Annual Installation Emissions Report submitted to the EPA with regard to the Moneypoint generating Station. Please note that the Moneypoint generating station is the only generating station utilising Coal as a primary energy input.