**Disclosure of Information to Final Customers by Suppliers
A Consultation Paper by the Commission for Energy
Regulation**

**CER/06/018
1st March 2006**

Executive Summary

Article 3(6) of the Electricity Directive (2003/54/EC) (transposed under Regulation 25 of S.I. 60 of 2005) requires that the Commission ensures 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. In addition, the provision of information regarding environmental impact of electricity produced from that fuel mix is required.

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. This paper outlines the Commission's proposals 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 mathematical model used here as developed by the SSA is appended to this paper.

The Commission proposes that a similar methodology to that employed in Great Britain for the calculation of environmental impacts be used here. An example of the application of this approach is outlined in Appendix B of this document.

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1 Introduction

This is a consultation document by the Commission for Energy Regulation ("the Commission") regarding information disclosure as required under Regulation 25 of Statutory Instrument No. 60 of 2005.

1.1   LEGISLATION

Article 3(6) of the Electricity Directive (2003/54/EC) (transposed under Regulation 25 of S.I. 60 of 2005) requires that the Commission ensures 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.

Regulation 25.1 of S.I. No. 60 of 2005 states as follows:

25. (1) The Commission shall ensure that the public electricity supplier and all licensed suppliers furnish reliable information on or in bills or promotional materials sent to final customers as respects:

> *(a) the contribution of each energy source, expressed in accordance with Article 3.6 of the Directive to the overall fuel mix of the supplier concerned over the preceding year;*
>
> *(b) details of any existing and publicly available reference sources which contain information on the environmental impact, at least in terms of carbon dioxide emission, and the radioactive waste resulting from the electricity produced by such overall fuel mix over the preceding year.*
>
> *(2) The Commission may direct holders of a licence under section 14 of the Act of 1999 to provide it with information relating to the matter referred to in paragraph 1.*

1.2   CONSULTATION PAPER

Section 2 of this consultation paper set out the Commission's proposals for the calculation of the fuel mix, for each supplier, to apply until the commencement of the Single Electricity Market ('the SEM'). The supplier can use this information to comply with its fuel mix disclosure requirement. The approach to be adopted post SEM start date is not discussed in this consultation paper. The Commission's proposals relating to the provision of environmental impact information are included in section 3.

1.3   CONSULTATION PROCESS

Interested parties are invited to comment on the issues raised in this paper by close of business on Friday March 24th 2006. The Commission requests that respondents structure their comments to address the specific proposals outlined in the document. Where possible, reference to the section number should be made with specific comments. The Commission regrets that it cannot undertake to provide individual responses to submissions on this paper. Responses may be published in full on the Commission's website, therefore respondents should include any confidential information in a separate annex.

Submissions on this paper should be forwarded to:

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1.4   NEXT STEPS

Following review of comments received, the Commission will issue a decision paper by April 14th 2006. If respondents express an interest in the provision of a workshop by the SSA on the mathematical model appended to this paper the Commission will progress this. Respondents are requested to indicate such an interest within two weeks of the issue of this paper such that this can be facilitated at an early date.

2 Commission's Proposals

2.1   FUEL MIX INFORMATION

In drafting its proposals the Commission has been mindful of the need to ensure that information provided by suppliers to customers regarding the fuel mix supplied is accurate and is provided in a transparent manner. This will allow customers compare the different mixes of fuel sources for all suppliers in the market. In addition, the proposals should result in the provision of information that, as far as is practicable, reflects actual energy generated and

sold on to final customers by suppliers in line with the Directive and S.I. No. 60.

2.1.1 Information on Energy Sources

Under Regulation 25 (1) (a) of S.I. No. 60 of 2005 the Commission is required to ensure that the public electricity supplier and all suppliers publish reliable information on or in bills and promotional materials sent to final customers regarding the contribution of each energy source to the overall fuel mix of the supplier concerned over the preceding year.

The format in which the relevant information should be provided and the compliance cycle are detailed in section 2.3.5 of this document.

The Commission proposes that the requirement to provide fuel mix information will be placed on suppliers through their Licence. This requirement will be included in the forthcoming review of Supply Licence conditions. The calculation of the fuel mix information will be included in the Trading and Settlement Code. After the completion of this consultation process, the Commission will modify the Trading and Settlement Code accordingly. Prior to the completion of the modifications to the Supply Licence and the Trading and Settlement Code, suppliers will be required to provide accurate information in accordance with any directions issued by the Commission regarding the provision of such information and/or the format of such information under Regulation 25 of S.I. No. 60 of 2005.

The Commission proposes that the SSA will calculate the fuel mix for each supplier in line with the methodology approved by the Commission. This will ensure that one methodology for calculating the fuel mix information will be adopted by suppliers. As the methodology for the calculation of the fuel mix will be incorporated into the Trading and Settlement Code, it will be auditable as part of the annual market audit of the SSA. The Commission will approve the fuel mix for generators in the Republic of Ireland, including those that operate on dual fuel, and the fuel mix of imports from Northern Ireland for input to the calculation.

2.1.2 High Level Principles

The Commission proposes that the calculation of the fuel mix for each supplier will be based on the principle that total metered generation equals total consumption for each defined fuel source for all energy seen by the Ex-Post Unconstrained Schedule (EPUS). The mathematical formulation determines the fuel mix ratios for all participants in the market and requires the solving of a system of linear equations for every settlement period in a year.

For energy that is not directly included in settlement calculations, suppliers are required to submit information to the SSA on the fuel mix of such energy based on metered generation for review by the SSA and inclusion in the overall fuel

mix calculations. The proposed methodology provided by the SSA is outlined in Appendix A.

The Commission refers interested parties to its recently published consultation paper on revised balancing rules for licensed green and CHP suppliers where it is proposed that the outputs from the fuel mix calculation will be used to determine qualification for access to first tier top up by suppliers on a sliding scale from a minimum requirement of 51% green and/or CHP fuel supplied to final customers.[1]

2.2   ENVIRONMENTAL IMPACT INFORMATION

2.2.1 High Level Principles

Under S.I. 60, suppliers are required to make available information regarding the environmental impacts of the electricity supplied at least in terms of carbon dioxide emissions and the radioactive waste resulting from the electricity produced by such overall fuel mix over the preceding year.

The Commission proposes to adopt a similar approach to that used in Great Britain in relation to the provision of environmental impact information.[2] In other words, the Commission proposes to adopt standardised emissions factors which are provided to suppliers. These factors are calculated based on total emissions per fuel type for the year in question divided by the total associated output. Suppliers then multiply their fuel disclosure percentage per fuel type by the associated factor to give the required information, i.e. CO2 emissions in g/kWh, by fuel type. The sum of this across all fuel types is required. A worked example of how this is done in Great Britain is provided in Appendix B for review.

The Commission notes that the information provided pertains to direct emissions associated with the various fuel types and, therefore, does not capture indirect emissions associated with the fuel mix supplied to final customers.

2.3   SCHEME REQUIREMENTS

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1   [1] Revised Balancing Rules for Licensed Green and CHP Suppliers Under the Trading and Settlement Code: A Consultation Paper by the Commission for Energy Regulation (CER/06/004)

2   Ref: http://www.dti.gov.uk/energy/consumers/fuel_mix/index.shtml   and http://www.ofgem.gov.uk/temp/ofgem/cache/cmsattach/13216_282_05.pdf?wtfrom=/ofgem/whats-new/archive.jsp

2.3.1 Applicable Period

Regulation 25 (1) of S.I. No.60 of 2005 states that the necessary information should be provided for the pervious calendar year. Therefore, the fuel mix of each supplier and for the market and the required standardised emissions factors will be calculated after the end of the previous year. The first relevant calendar year is 1st January 2005 to 31st December 2005. The Commission will request the SSA to provide an implementation plan for review. Currently, the SSA estimates that a suitable arrangement can be put in place for June.

2.3.2 Information Provision Period

Suppliers will be required to provide customers with information on fuel sources and associated environmental impacts within one month of the relevant information being made available by the SSA. The form and detail of the communications is subject to prior approval of the Commission. For example, if the SSA makes the 2005 fuel source information available on June 1st of 2006, suppliers are required to provide this information to customers by September 1st 2006 (the 'disclosure date'). The first disclosure date will be determined by the Commission following a review and approval of the SSA's implementation plan.

2.3.3 Information Update

Suppliers will be required to update their fuel source and environmental impact information for each applicable period by the associated disclosure date for each period. Updating information once per annum is consistent with the Directive and will provide for ease of comparison of suppliers by final customers.

2.3.4 Information to be Provided

The Commission proposes that fuel mix and environmental impact information be published on each supplier's bill issued to final customers as and from the first disclosure date. The following categories of energy sources must be used for the purpose of fuel mix disclosure; Coal, Gas, Nuclear[3], Peat, Pumped Storage, Renewables, CHP, Heavy Fuel Oil and Distillate Oil. Where the definition of a fuel source is provided in the Electricity Regulation Act 1999 or subsequent legislation this will apply.

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[3] Note that nuclear output may be included in the fuel mix for imported power and is therefore included on the fuel list.

2.3.5 Presentation of Information

The format for presentation of the fuel mix and environmental impact information is that contained in Table 1 below. Use of the same format for presentation by all suppliers will provide for ease of comparison of suppliers by final customers.

Table 1: **Presentation of Information**

Supplier Z Disclosure Label Applicable Period: January 2005 to December 2005		
Electricity supplied has been sourced from the following fuels:	**% of total**	
	Electricity supplied by Supplier Z	**Average for Ireland (for comparison)**
Coal	X %	X %
Natural Gas	X %	X %
Nuclear	X %	X %
Renewable	X %	X %
CHP	X %	X %
Pumped Storage		
Peat		
Distillate Oil		
Heavy Fuel Oil		
Total	100 %	100 %
Environmental Impact		
CO_2 Emissions	X g per kWh	X g per kWh
Radioactive Waste	X g per kWh	X g per kWh
For more information on the environmental impact of your electricity supply visit www.SupplierZ.ie or call 00353 X XXX XXXX		

2.4 PROMOTIONAL MATERIALS

Regulation 25 (1) of S.I. No. 60 of 2005 states that the Commission shall ensure that reliable information regarding the fuel mix of each supplier and the environmental impact of same is provided on or in bills *or promotional materials* sent to final customers.

The Note of DG Energy and Transport on Directives 2003/54 and 2003/55 on the Internal Market in Electricity and Natural Gas states defines promotional materials as materials handed out or sent directly to customers, but do not

include newspaper, magazine, bill-board and television advertisements.[4] Therefore, promotional material includes welcome packs for new customers, materials provided doorstep sellers seeking to attract new customers and material sent to households encouraging them to sign up to a supplier.

The Commission considers that 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 in or with bills to final customers. References to such information provided on promotional material should reference information provided in this format also.

This requirement will be enforced under licence condition and will be included in the forthcoming review of Supply Licence conditions.

The Commission will adopt a proportionate approach to enforcement of this matter.

3 Request for Comment

Interested parties are invited to comment on the issues raised in this paper by close of business on Friday March 24th 2006. The Commission requests that respondents structure their comments to address the specific proposals outlined in the document. Where possible, reference to the section number should be made with specific comments. The Commission regrets that it cannot undertake to provide individual responses to submissions on this paper. Responses may be published in full on the Commission's website, therefore respondents should include any confidential information in a separate annex.

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[4]Ref:
http://europa.eu.int/comm/energy/electricity/legislation/doc/notes_for_implementation_2004/labelling_en.pdf

Appendix A: Proposed Methodology for the Implementation of Disclosure Requirement

The proposal is that the fuel mix of each supplier 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 determines the fuel mix ratios for all participants in the market and to do this requires the solving of a system of linear equations, for every settlement period, in a year. 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.

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

The net physical position for each entity should equal zero, i.e.,

Generation + Imports + Purchases + Top Up
            – (Demand + Exports + Sales + Spill) = 0]

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

For interconnector imports the fuel mix as approved by Commission will be used.

For a supplier, 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 to 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.

Mathematical Model Overview:

In a given trading period, 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 **<u>any number</u>** 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 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... at the same as every other entity. 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 trading period, 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 trading period in question.

Mathematical Model - Derivation and Formulation:

Assumptions

- The fuel type for all generation units in Ireland will be approved by the Commission

- 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 will be approved by the Commission.

- Sales of energy from a participant are at the fuel mix ratio of the seller.

- Turlough Hill's negative generation figures (when in pumping mode) are treated as demand as they are the same as any other "physical withdrawal node" in this model.

- All calculations are based on a half hour settlement trading periods.

Formulating the K sets of equation systems in a given trading period:

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 <u>in that direction</u>.

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:

We are solving for the following 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 .

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:

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

$$\vdots$$

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

Note the diagonal coefficients where T_{pp} does not exist. It is substituted with $-(D_p+S_p)$.

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

$$- (D_1+S_1)f_{12} + T_{21}f_{22} + T_{31}f_{32} + T_{41}f_{42} + \ldots + T_{P1}f_{P2} = -G_{12}$$
$$+ T_{12}f_{12} - (D_2+S_2)f_{22} + T_{32}f_{32} + T_{42}f_{42} + \ldots + T_{P2}f_{P2} = -G_{22}$$
$$+ T_{13}f_{12} + T_{23}f_{22} - (D_3+S_3)f_{32} + T_{43}f_{42} + \ldots + T_{P3}f_{P2} = -G_{32}$$
$$+ T_{14}f_{12} + T_{24}f_{22} + T_{34}f_{32} - (D_4+S_4)f_{42} + \ldots + T_{P4}f_{P2} = -G_{42}$$
$$+ T_{15}f_{12} + T_{25}f_{22} + T_{35}f_{32} + T_{45}f_{42} + \ldots + T_{P5}f_{P2} = -G_{52}$$

$$\vdots$$

$$+ T_{1P}f_{12} + T_{2P}f_{22} + T_{3P}f_{32} + T_{4P}f_{42} + \ldots - (D_P+S_P)f_{P2} = -G_{P2}$$

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

Using the same pattern and principle as system 1:

  .
  .
  .
  .
  .

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

Using the same pattern and principle as system 1:

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

  .   .   .   .   . .
  .   .   .   .   . .
  .   .   .   .   . .
  .   .   .   .   . .

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

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

- 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 B: Environmental Impact Calculation – Worked Example
Extract from Fuel Mix Disclosure by Suppliers in Great Britain' Draft
Guidelines OFGEM , June 2005, (146/05) Ref:
http://www.ofgem.gov.uk/temp/ofgem/cache/cmsattach/11669_14605.p
df**

Appendix 2 Sample fuel mix disclosure data table

A2.1 This set of data tables is to be provided on an annual basis by the DTI for use in the calculation of fuel mix and environmental information. The actual figures will be calculated each year from official sources. The numbers shown in this table are for illustrative purposes only and are not based on official figures. They are, however, used in the calculation of the worked example in Appendix 5.

Sample Fuel Mix Disclosure Data Table

1. Residual fuel mix for apportioning electricity for which the licensee does not hold evidence as set out in paragraph 9.

Fuel	Percentage
Coal	33
Natural gas	37
Nuclear	25
Renewable	2
Other	3

2. Grams per kWh of carbon dioxide emitted in the production of electricity of each fuel to be used in the calculation of average carbon dioxide emissions as set out in paragraph 10 (a).

Fuel	g/kWh
Coal	1,000
Natural gas	380
Nuclear	0
Renewable	0
Other	750

3. Grams per kWh of radioactive waste, being fuel burnt in the reactor to be subsequently discharged as spent fuel, to be used in the calculation of average generation of radioactive waste as set out in paragraph 10 (a).

Fuel	g/kWh
Nuclear	0.012

4. GB average fuel mix (for comparison)

Fuel	Percentage
Coal	33
Natural gas	37
Nuclear	25
Renewable	2
Other	3

5. Losses factor: 1.09
   (not to be applied to all supply from embedded generation)

Appendix 5 Worked example

A5.1 To illustrate how the figures in a supplier's fuel mix table are derived a worked example is provided in this appendix. Step 1 shows a fictional supplier's data for a disclosure period. Step 2 shows how the residual fuel source data is combined with the evidenced fuel source data to reach the percentage of each energy source in the total supplied by the licensee in the disclosure period. Step 3 shows how the carbon dioxide emissions are calculated and step 4 shows a completed fuel mix disclosure table.

Step 1

Amount supplied

Total supplied as determined under renewables obligation orders:	=	1000 MWh
of which embedded generation:	=	100 MWh
Losses factor:	=	1.09
Total purchased for supply	$= (900 \times 1.09) + 100 =$	1081 MWh

Evidence held on 1 July

REGOs:		50	MWh
Generator declarations	Coal:	300	MWh
	Gas:	350	MWh
	Nuclear:	160	MWh
	Renewable:	10	MWh
	Other:	40	MWh

Residual

Residual [1081 - (50 + 300 + 350 + 160 + 10 + 40)] = 171 MWh

Step 2

In the table below the first column shows the fuel, the second column shows the amount of electricity supplied that has been evidenced through REGOs and generator declarations. The third column shows the residual amount of electricity (171 MWh) which is apportioned according to the percentages in the fuel mix disclosure data table published by DTI. For example, to calculate the residual amount for coal multiply 0.33 by 171 which equals 56.4. This is repeated for each fuel type. Column 4 is the sum of columns 2 and 3. Column 5 gives the percentages for column 4.

Fuel	MWh with evidence	Residual	Total	Percentage
Coal	300	56.4	356.4	33
Gas	350	63.3	413.3	38
Nuclear	160	42.8	202.8	19
Renewables	60	3.4	63.4	6
Other	40	5.1	45.1	4
Total	**910**	**171**	**1081**	**100**