Explanation of the methodical procedure to follow to understand the new Excel template for calculating costs of implementation of the Protocol

Introduction

This note aims to inform anyone who would have to have to work on Excel files used to calculate the expected costs for the various member countries of the ECE (Economic Commission for Europe) because of the entry into force of the Protocol on Pollutant Release and Transfer products (PRTR). It contains 13 parts of different sizes that correspond to a file for each model or, for part 6, a set of files very similar to each other. The approach followed is to provide a narrative as well as mathematical explanation in order to make the reader understand what calculations were made and for what purpose.

Each explanation is divided into three groups:
 - The purpose of the file
 - The approach and assumptions made
 - Other useful comments

There are three types of data to be entered at this time; the last sheet of this document lists the sheets as they must be entered accurately. Here we simply indicate their kind:
 - Data to be prepared by our qualified partner (Pollutant Release by activity, MCE recommended actions, ...)
 - Data to be collected by the United Nations Economic Commission for Europe (work hours of employees, number of companies to communicate ...: These data will be collected primarily through a standard questionnaire and meetings with stakeholders through the implementation of the Protocol on PRTRs).
 - The data referring to dynamic assumptions. Effectively, our data will be collected for the first two years after entry into force of the Protocol. To estimate the cost after that period, we must make assumptions (consolidation of certain sectors, more efficient companies, ...). They are mostly made in the file "INPUT".

I.   1_mapping_pollutants_to_activities_EPER_and_Aarhus_Guidance info

PURPOSE OF FILE

The first file consists of 14 sheets. In reality it is composed of seven original sheets to which are added seven transposed sheets respectively. This file is generally easy to understand. The protocol lists 67 activities and 86 pollutants. File 1 attempts to indicate the pollutants released in a given environment as a result of a particular activity.

Eg in "MxA1", the table provides information such as an activity that releases pollutants 1,2,3,5,7 and 8 in the air .

The approach and assumptions made

One essential point must be noted: we assume in this file that a given activity generates a predefined number of pollutants. This assumption is of course questionable, but it would be impossible otherwise to try to measure the cost per activity. Besides we are fully aware of its limitations, but after consultations with specialists, it seemed good to keep. We also wish to draw attention to the fact that our assumption for certain activities may be more or less fair. So if we can pretty well know the pollutants released by specific mining activities for example, it will be much harder to know the pollutants released by a chemical company, if the latter can act on orders from other companies and can then introduce different products within the same year. The relevance of this observation has therefore encouraged us to focus on specific cases. No other methods have been established to date, however, for the time-being we retain our assumption as a whole.

OTHER USEFUL NOTES

There are 14 (7x2) sheets because of three areas of release (atmosphere ["MxA1" and "MxA1t"], water ["MXW1" and "MxW1t"] earth ["MxL1" and "MxL1t"]), the specific treatment for discharges into wastewater ("MxWW1", "MxWW1t") and two methods, one of which has two subgroups, to study the transfer of pollutants. The first method to monitor transfers similar to the pollutant (hereinafter referred to as PS, Specific pollutant, the corresponding sheets are "MxT1" and "MxT1t") and the second approach to waste (the below called WAS, Specific waste, the sheets are corresponding "MxH1", "MxH1t", "MxN1" and "MxN1t"). For a better explanation of the rationale of these methods, it is necessary to refer directly to the text of the Protocol and to its paragraph 7.

II.   Pollutants_Media Aarhus (m vectors)

PURPOSE OF FILE

This file is the most succinct of all and consists of a single sheet. This actually reproduced in Annex 2 of the Protocol on the threshold of activity and used according to the method chosen by a given country. The presence of a "1" indicates the existence of a threshold, that of a "0" an absence of a threshold. These cases are rare. They are present also in the case of an approach capacity (AC, it is contrasted with the approach by number of employees or AE).

  The table is therefore the difference between the two possible methods. Moreover, it also comes with 7 sets of circles corresponding to possible releases and possible methods to quantify the transfers.

The approach and assumptions made

 None.

 OTHER USEFUL NOTES

 None.

III. MEA and National PRTR

PURPOSE OF FILE

This file consists of two sheets. On the one hand, it shows which countries have ratified international agreements relating to the implementation of control releases or transfers of pollutants. On the other hand, it gives the scope of certain national instruments for a small number of countries.

The approach and assumptions made

The first sheet, "Mx2M," said the EC countries are signatories to various international agreements related to communication issues of pollutants. The number "1" indicates that the country has signed the international agreement, "0" the opposite.

The second sheet shows some measures taken at national level in some states. It is complementary to the first and shows that efforts for control of releases and transfers of pollutants depend not only on international agreements.

OTHER USEFUL NOTES

None.

IV. Numbers of facilities

PURPOSE OF FILE

This file consists of four sheets. It provides information fairly simple to understand and statistical institutes or environmental controls in place are likely to provide us. He tells us in effect on the number of firms (by country, by activity, year) that will be provided under the Protocol.

The approach and assumptions made

The sheet "w" gives us the number of firms potentially affected by the protocol in a given country. Called "business potentially affected by the Protocol" an undertaking whose business is one of 67 activities and sub-activities listed in the protocol.

The sheet "x" gives the number of firms expected to communicate with the data required by the protocol in a given country. By definition, we have w> x. We hope that the same body will give us the figures of w and x in order to compare them. If ever data x are unknown, we use the assumption of 90% of business (0.9W = x): this hypothesis derives its source of "guidance document for the implementation of the EPER" that states: "the application of thresholds is to avoid the industry to have to report emissions insignificant, while ensuring that statements covering at least 90% of total industrial emissions in Europe" (Part I. 4 of the document, p.18 of the French version).

The sheet "Mxy" is more accurate than "w". It gives the same information but the segments this time not only by country but also by activity. The corresponding table is much longer. As the aggregate of "Mxy" should be in absolute equal to those of "w" was inserted in the last column of the tables "Mxy" with a check digit "w" indicates whether the audit total agree completely ("OK": no difference), relatively consistent ("Reliable data": the difference does not exceed 10%), moderately consistent and very moderately ("Problematic differential" difference does not exceed 30%), diverge ("high differential" difference not exceeding 60%) and are clearly incompatible ("ERROR: data file incompatible with w" difference exceeding 60%).

The sheet "MXZ" is very close to "Mxy": it is built the same way but in this case the accuracy and verification relate to the sheet "x" and not the sheet "w".

At this point we must indicate an important assumption. Indeed we consider that for the sheets "x" and "MXZ" the number of reports received is equivalent

depending on whether the companies have adopted a RA or a CA approach. We even go a step further by assuming that the companies themselves should communicate depending on whether the RA or CA approach is adopted by all companies.

Of course we are aware that according to the methodology chosen by the states, the chances of reaching the same result as companies subject to notification or even an equal number of reports are almost nil. But on the one hand, it is physically impossible to achieve as accurate information and on the other hand, we expect to have in reality only a marginal difference.

Moreover, it should be noted here that the assumptions of consolidation in some sectors in some countries and at certain times must appear here: in fact, a lower number of companies in the same area within a country within a year would show a consolidation of the sector. At present we have no data that would allow us to know which figures to add beyond year 1: If we fail to advance, it is possible to assume continuity (the number of companies remains unchanged over time) but with a possible risk of distortion of the relevance of our results over time. For more information on this subject, it is suggested to refer to the comments of the file "INPUT".

OTHER USEFUL NOTES

The Protocol Guidance is also in line with the chosen hypotheses. This is very clear if the authors believe that the actual results (i.e. the number and identity of the companies to be announced) will be very similar regardless of the chosen approach. It seemed appropriate to introduce this remark at this stage even if the file "MXZ" will only be used at step 9 for the file "Annex 8".

INPUT: link established. Moreover, with regards to the

gradient coefficient, it has not yet been decided whether to apply the sheet "MXY" or "MXZ": indeed, this will depend on information that we can collect. In the present state of things, it is connected to "MXZ", but this may change: in that case, the 90% assumption would certainly come into force.

V. 5 Facility_1

PURPOSE OF FILE

This data file includes the main data of companies in EEC countries (working hours and employees' wages) as well as the necessary work of various professions involved in the implementation of the Protocol on PRTRs.

The approach and Assumptions made

The sheet "Exchange rate" is not yet complete. Its purpose is simple to understand: It is to give the currency exchange rates of a given country against the USD. It has not been decided yet whether it would be best to take the average exchange rate over a given period or the rate on a specific date (in this case the rate on the day before entering the data): a short meeting should decide on this issue.

The following sheets are more related to the facts of business in different EEC countries. Some sheets are duplicated because they provide figures that depend on the chosen currency: local (local currency for lc) or dollar ($), We will only explain the first: the second is computed simply through the sheet "Exchange rate".

The sheet "MxAS (lc)" shows the average annual salary for the four professions Involved in the implementation of the protocol. It is important to note that we only intend to insert the wage amounts for the years 0 and 1. The following will be calculated automatically by the worksheet "Salary evolution" (INPUT sheet) as part of a dynamic approach to our model.

Sheets "MxA" and "MxB" show related costs for each type of relevant occupation. Added together, the data from these three sheets allow for the calculation of the overall cost for each occupation within a year: "MXC (lc)."

The sheet "MXD" then gives the number of hours worked for each type of occupation over a year. At this point we have no idea of the future evolution of these working hours: Indeed we cannot build strong economic assumptions on this subject because the issue of working time depends not only on the businesses, but first and foremost on politics: a working meeting should decide on which solution to adopt (fixed hours or assumption of reducing working time).

With a simple division, we can now know the full hourly cost for a type of profession: this is the function of sheet "MXE (lc)."

The next sheet Is "MXF" Indicating the hours equivalent managerial hours (EMH) for a given country at any given time. The Formula that gives us the EMH for the various professions is:

$$EMH[i] = \frac{\text{Total Annual Salary of } i}{\text{Annual Working hours of } i} * \frac{\text{Manager Annual Hours of Work}}{\text{Manager's Total Annual Salary}}$$

With i being one of four professions involved in the study (manager, engineer, accountant and expert in law). By definition, if i = manager, then the formula gives us 1. This sheet is necessary for us to simplify our calculations. It will be helpful for the MXH sheet.

The "MXG" sheet is automatically completed thanks to a link with the INPUT sheet (see below) which is similar (Efficiency Savings 1).

The "MXH" sheet then shows the EMH for the various stages (initial and final) by country and by year. For this purpose it combines the data from sheets "MxF" and "MXG". "MXH" will be used in subsequent calculations in file "Annex 7" (sheet "j" and sheet "m") as will be discussed later.

Sheet "MXI" finally completes the file. It shows the number of hours spent by each profession in the calculation of releases and transfers of pollutants in according to one of three methods allowed by the Protocol: measurement,

calculation and estimation. This sheet is filled using data and improvement of work assumptions that are contained in the file INPUT (Efficiency Savings 2).

OTHER USEFUL NOTES

 The assumptions made at this level are very important and it is necessary to keep them and transcribe them during the final editing of the study on the cost of entry into force of the Protocol.

INPUT: link ESTABLISHED with the sheets "Efficiency Savings 1" and" Efficiency Savings 2".

VI. Intermediary file_media 6.x

 PURPOSE OF FILE

 The 7 6.x files are intended to identify the costs resulting from the entry into force of the Protocol for a medium or a given type of transfer. By themselves, they are only intermediate files for which aggregation will be used to determine the costs for companies and for EEC countries.

 The approach and assumptions made

 The sheet "3M" indicates the pollutants addressed by the various international agreements for a given environment or a specific type of transfer. We had to create such a sheet in each file 6.x for the following reason: certain types of pollutants are considered by some international agreements only for a number of environments or transfer.

 Example: the Rotterdam agreement provides for the reporting of pollutant 21 regarding soil discharges, but not in the atmosphere.

 This led us to include such a table in each of the 6.x. files. Number 1 indicates a requirement to report, whereas number 0 an absence of such obligation. Note

that due to the calculations of sheet "4M" (see following) we have also introduced its transpose.

The sheet "4 M" is a matrix product between sheets "2M" file 3 and of the correspondent "3MT" of file 6.x. It indicates which products, in the medium or the specific type of given transfer, countries already report on (the number 0: no reporting at this time;> 0: reporting)

Explanation of matrix calculus (for a medium or type of given transfer)

3Mt $\qquad$ PRODUCT

$$\text{INTERNATIONAL AGREEMENT} \quad \begin{array}{c} \\ A1 \\ A2 \\ A3 \end{array} \begin{array}{cccc} i & j & k & l \\ \left(\begin{array}{cccc} 1 & 0 & 0 & 0 \\ 0 & 1 & 1 & 0 \\ 1 & 0 & 1 & 1 \end{array}\right) \end{array}$$

2M $\qquad$ INTERNATIONAL AGREEMENT $\qquad$ 4M $\qquad$ PRODUCT

$$\text{COUNTRY} \quad \begin{array}{c} \\ A \\ B \\ C \end{array} \begin{array}{ccc} A1 & A2 & A3 \\ \left(\begin{array}{ccc} 1 & 0 & 0 \\ 1 & 1 & 1. \\ 0 & 1 & 0 \end{array}\right) \end{array} \qquad \text{COUNTRY} \quad \begin{array}{c} \\ A \\ B \\ C \end{array} \begin{array}{cccc} i & j & k & l \\ \left(\begin{array}{cccc} 1 & 0 & 0 & 0 \\ 2 & 1 & 2 & 1 \\ 0 & 1 & 1 & 0 \end{array}\right) \end{array}$$

Here is the explanation of the matrix:
i) Country A has subscribed to the international agreement A1
ii) the international agreement requires A1 to report on the product i
iii) Country A then reports on the product i (any score above 0 indicates that the country is required to disclose)

The sheet "3N" is similar to "3M", but refers to national standards rather than international agreements. It works, however, along the same logic as "3M". Thus, "4N" is made exactly as "4M" but taking into account national standards (in a way this corresponds to an international agreement signed by only one country).

The sheet "4L" identifies existing licenses in a given country (still for a medium or a specific type of transfer, we do not specify more later). Finally "Mx5" is a general summary for each country, indicating which products for which an effort is already made (1) or not (0). "Mx5t" simply transposes the matrix of "Mx5."

The matrix "Mx6E" is then constructed so as to know what efforts are still required for a given country according to the AE approach. For this, it performs a subtraction between the data file 2 (which, as we recall, gives the existence of thresholds or no for each medium or given type of transfer) and data from "Mx5t." Number 1 that appears in this table shows that an effort must be made by a country for the product concerned; a 0 instead, indicates that the country is already reporting on this product. If we have therefore followed the reasoning,

"Mx6E" may be the reverse of "Mx5t" (where there was 1 there are now 0 and vice versa) and this is the case. This table has been created, however, because of the AC approach.

Indeed, for AE, the columns of file 2 are filled with 1. But in the case of AC there are some 0 in certain columns. Thus a slight adjustment is necessary. Here's the explanation: Suppose AC does not enforce reporting on product i for a given medium. Moreover, country A has no obligation to report on the same product i. Thus in the corresponding box we would have a 0 in "Mx5t" showing that the country makes no effort for product i. So we would make a mistake in writing 1 in "Mx6C" because AC does not require effort and therefore should figure as a 0. Nevertheless, the expected differences are not great. It seemed, however, useful to make these slight adjustments to stay as precise as possible. We would like to point out that we could do without the existence of the sheets "Mx6E" but for the sake of clarity we decided to include them along with the sheets "Mx6C" (and we know that we could have move sheets "Mx6E" and "Mx6C" files 6.6 and 6.7 due to the presence of these figures everywhere for the specific transfers in file 2, but for clarity again we preferred to keep them). We also include the transposed "Mx6E" and "Mx6C" that will be used in subsequent calculations (MX10).

Sheet MX7 is central to the file: it provides the link between pollutants and the methods of calculation possible to quantify their release or transfer (remember here that this is one of three MCE methods). Number 1 corresponds to a necessary action to be performed for a given pollutant, number 0 shows instead that the action is not necessary). So this table should be completed by our qualified partner in the field of study of pollution.

Sheet "MX8" is also the result of a matrix calculation that uses data from other files. It was nonetheless deemed necessary to insert it into the file 6.x due to its use in the same file. "MX8" gives the number of companies that are expected to report on a given product in a given country whether they already report on it or not. The resulting matrix is calculated as follows

	M1t	PRODUCT			
		i	j	k	l
	I	1	0	0	1
ACTIVITY	II	0	1	0	0
	III	1	0	1	1

MxZ   ACTIVITY

		I	II	III
	A	45	3	8
COUNTRY	B	5	1	22
	C	1	3	7

M8   PRODUCT

		i	j	k	l
	A	53	3	8	53
COUNTRY	B	27	1	22	27
	C	8	3	7	8

Here is the explanation of the matrix:
i) there are 45 companies in country A now in business which need to report, regardless whether they are presently doing so or not.
ii) activity I generates pollutants I and i
iii) 53 firms in country A will have to report on product i, whether or not they presently do so.

We also show the transpose of the last sheet, "Mx8t," which will be used in the calculation immediately following.

We'll move on to the sheet "Mx9E." This sheet carries a cell by cell multiplication of two matrices (it is not a product of matrix) ie sheets "Mx8t" and "Mx6E." **The final matrix gives the number of companies that need to report (because they do not yet) for a given pollutant for a given country** if all adopt an EA approach.

Explanation:

COUNTRY

		A	B	C
	i	53	27	8
PRODUCT	j	3	1	3
	k	8	22	7
	l	53	27	8

Matrix "Mx8t" we took the transpose of the last matrix

COUNTRY

		A	B	C
	i	0	1	0
PRODUCT	j	0	0	1
	k	1	1	0
	l	1	1	0

Matrix "Mx6E": for example country A has no more work to be carried out for

products i and j but still does for products k and l.

The result matrix "Mx9E" is:

$$
\text{PRODUCT} \quad
\begin{array}{c}
\\
i \\
j \\
k \\
l
\end{array}
\begin{array}{c}
\text{COUNTRY} \\
\begin{array}{ccc}
A & B & C
\end{array} \\
\left(
\begin{array}{ccc}
0 & 27 & 0 \\
0 & 0 & 3 \\
8 & 22 & 0 \\
53 & 27 & 0
\end{array}
\right)
\end{array}
$$

Interpretation of the result matrix:
 8 companies have to communicate about product k in country A (nothing is being done at the present moment) and 53 companies in that country will have to report on product l (nothing is being done at the present moment).

The sheet "Mx9C" performs the same calculations, but referring this time to the AC approach. In both cases we have revealed the transposed versions of the two sheets ("Mx9Et" and "Mx9Ct" respectively).

The sheet "E g" then performs a calculation that may seem strange: in the matrix obtained by "Mx9Et," lines are added in order to produce a theoretical figure which is called the "number of pollutants appearing in all registers "for a given country. If we take the example matrix above and taking into account the result matrix, we have for example: 61 pollutants appeared in all the registers of country A (in fact 0 +0 +8 +53 = 61). This concept provided by the sheet will be used for further calculations as discussed in the following (costs for the regulator: this link will be explained in the relevant section on this regulator, "9 Regulator"). It is important to note at this stage we are counting the pollutants that will be added specifically under the protocol. Indeed, in our cost model, we seek to estimate the surplus due to the introduction of the protocol and not the total cost due to existing or non-existing regulations for companies and for countries of the EEC. The sheet "g C" looks like "E g" except that it is calculated by "Mx9Ct."

  The sheet "Mx10E" then gives the number of EMH hours needed for firms in a country, based on substances: only EMH for substances that are not yet covered by an international treaty, a national PRTR or a license are taken into account. The calculation is somewhat complex and requires a little clarification. Indeed it does, on the one hand, a matrix calculation and on the other hand, an increase of cell by cell of the two matrices. The following example will be clearer:

	M7		PRODUCTS		

$$
\text{CALC. METHOD} \quad
\begin{array}{c}
 \\ m \\ c \\ e
\end{array}
\begin{array}{cccc}
i & j & k & l \\
\left(\begin{array}{cccc}
1 & 0 & 1 & 0 \\
0 & 1 & 1 & 0 \\
0 & 0 & 0 & 1
\end{array}\right)
\end{array}
$$

MxI — Method

$$
\text{UNTRY} \quad
\begin{array}{c}
 \\ A \\ B \\ C \\ D
\end{array}
\begin{array}{ccc}
m & c & e \\
\left(\begin{array}{ccc}
3 & 8 & 2 \\
4,5 & 6 & 3 \\
3,5 & 9 & 2 \\
4,5 & 6 & 2
\end{array}\right)
\end{array}
$$

Sub - result — PRODUCTS

$$
\text{COUNTRY} \quad
\begin{array}{c}
 \\ A \\ B \\ C \\ D
\end{array}
\begin{array}{cccc}
i & j & k & l \\
\left(\begin{array}{cccc}
3 & 8 & 11 & 2 \\
4,5 & 6 & 10,5 & 3 \\
3,5 & 9 & 12,5 & 2 \\
4,5 & 6 & 10,5 & 2
\end{array}\right)
\end{array}
$$

Here is the explanation of the matrix:
 i) In country A, it will take 3 EMH to achieve m, 8 EMH to achieve c and 2 EMH to achieve e.
 ii) For product i, m must be adopted, for example, or for product k it will be necessary to adopt m and c.
 iii) Overall, a company in country A will have to spend three EMH to report on product i 8 EMH for product j, 11 EMH for product k and 2 EMH for product l.

  At this point the values do not show the surplus generated by the protocol but the work necessary to report on the products contained in the protocol expressed in EMH, whether efforts are already made or not: to correct this imperfection, a second calculation is then performed in the same sheet through a cell by cell multiplication of two matrices. We continue the previous example for the sake of clarity:

PRODUCTS

$$
\text{COUNTRY} \quad
\begin{array}{c}
 \\ A \\ B \\ C \\ D
\end{array}
\begin{array}{cccc}
i & j & k & l \\
\left(\begin{array}{cccc}
3 & 8 & 11 & 2 \\
4,5 & 6 & 10,5 & 3 \\
3,5 & 9 & 12,5 & 2 \\
4,5 & 6 & 10,5 & 2
\end{array}\right)
\end{array}
$$

Sub-matrix results whose explanation has been provided.

$$
\begin{array}{c}
\text{PRODUCT} \\
\begin{array}{cccc}
i & j & k & l
\end{array} \\
\text{COUNTRY}
\begin{array}{c}
A \\ B \\ C \\ D
\end{array}
\left(
\begin{array}{cccc}
0 & 0 & 1 & 1 \\
0 & 1 & 0 & 0 \\
1 & 1 & 0 & 1 \\
1 & 0 & 1 & 1
\end{array}
\right)
\end{array}
$$

Matrix "Mx6Et." A "1" indicates an effort to achieve: Country A doesn't have to do anything for products i and j, but so does for products k and l.

The result matrix "Mx10E" is:

$$
\begin{array}{c}
\text{PRODUCTS} \\
\begin{array}{cccc}
i & j & k & l
\end{array} \\
\text{COUNTRY} \quad
\begin{array}{c}
A \\ B \\ C \\ D
\end{array}
\left(
\begin{array}{cccc}
0 & 0 & 11 & 2 \\
0 & 6 & 0 & 0 \\
3{,}5 & 9 & 0 & 2 \\
4{,}5 & 0 & 10{,}5 & 2
\end{array}
\right)
\end{array}
$$

Interpretation of the result matrix:
A company in country A will spend an average of 11 EMH to report on product k and 2 EMH to report on product l. The "0" indicates that communications are already made for products i and j.

Note again that the results are dynamic: indeed greater efficiency is expected in time and the EMH for "mce" actions should therefore decrease. The sheet "Mx10C" performs the same calculations as "Mx10E" but referring this time to the AC approach.

  The sheet "Mx11E (lc)" then gives the expected cost for a company in a given country, at any given time to report on a given product. The calculation is done using the previous results and the salaries of managers in different countries at different times (sheet "MXI" File 5 Facility_1). This gives a cost in local currency. The sheet "Mx11E ($)" indicates the same cost but in $ depending on the running exchange rate. The sheets' Mx11C (lc) "and" Mx11C ($) "are very similar but refer to the AC approach.

 NB: Later, in this paper, we will explain further the E-type and / or ($)-type sheets : we will actually realize that some relate to the AC approach and the others indicate the amount in USD and not in local currency.

We should now turn to the last set of sheets files 6.x. "Mx12E (lc)" gives the costs for business types ("facility representative") in a given country at any given time: the data are calculated using "Mx11E (lc)" and "Mx1" from File 1. A concrete example will allow a better understanding; we turned again to a matrix calculation:

M1   ACTIVITE

PRODUCTS

$$\begin{array}{c} \\ i \\ j \\ k \\ l \end{array}\begin{array}{ccc} I & II & III \\ \begin{pmatrix} 1 & 0 & 1 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \\ 1 & 0 & 1 \end{pmatrix} \end{array}$$

M11   PRODUCTS

COUNTRY

$$\begin{array}{c} \\ A \\ B \\ C \\ D \end{array}\begin{array}{cccc} i & j & k & l \\ \begin{pmatrix} 0 & 0 & 22 & 4 \\ 0 & 9 & 0 & 0 \\ 7 & 18 & 0 & 4 \\ 4{,}5 & 0 & 10{,}5 & 2 \end{pmatrix} \end{array}$$

M12   ACTIVITE

COUNTRY

$$\begin{array}{c} \\ A \\ B \\ C \\ D \end{array}\begin{array}{ccc} I & II & III \\ \begin{pmatrix} 4 & 0 & 26 \\ 0 & 9 & 0 \\ 11 & 18 & 11 \\ 6{,}5 & 0 & 17 \end{pmatrix} \end{array}$$

Here is the explanation of the matrix:
i)   The first matrix is "Mx11E (lc)" has just been explained. We took
EMH [A] = 2 lc
EMH [B] = 1.5 lc
EMH [C] = 2 lc
EMH [D] = 1 lc
So we multiplied the lines of "Mx10E" to find these values.
ii) Activity I generates products i and l. We now use the non-transposed matrices of a file. We can see that we had already used the transposed matrices of the same file for calculating "MX8" (see p.12 of this document).
iii) Thus, the cost for a company in country A in this activity I will be 4 in lc, in activity II it will be 0 and in activity III, 26.

OTHER USEFUL NOTES

  Undoubtedly the calculations of intermediate files 6.x are the heaviest and most difficult to understand. However, they are the heart of the calculation methodology that we adopted.

VII. Annex 7

<u>PURPOSE OF FILE</u>

 This file is quite simple aims to provide the costs of setting up the initial and final measurements due to the introduction of the protocol. These costs are based on country and time.

<u>THE APPROACH AND ASSUMPTIONS MADE</u>

 The idea is fairly easy to grasp: these costs, we have seen, depend neither on the country nor the industry sector, nor the size of the company. The first table ("j" for the initial measurements and "m" for the final measurements) is the number of EMH for a company in a given country at any given time. We then multiply this number of hours by the hourly wage of a manager (in local currency, lc, or dollars, $) for the cost to a company in a given country at a given time ("k (lc) "and" k ($) "are the sheets for the initial measurements," n (lc) "and" n ($) "for those final measurements).

 The other sheets are just as additional information: they give the cost of these measurements for all companies in a country at a given period, in local currency or in dollars. They are not linked to another file.

 <u>OTHER USEFUL NOTES</u>

 None.

VIII. 7 Facility_2

<u>PURPOSE OF FILE</u>

 The file shows the costs for business types in different countries and over time depending on the activity they perform.

<u>THE APPROACH AND ASSUMPTIONS MADE</u>

 Calculations in the file are again quite simple.

 There are 8 sheets such as "RFC E-WW-WS (lc)" (RFC: Representative facility costs) which gives the cost for a typical firm in a country and at a specific time in case of adoption of the AE approach and of the WS methodology; the cost is expressed in local currency. The result is actually obtained by summing the data

from some 6.x files (this depends on the adopted approaches and methodologies) in all cases, the sheets are "MX12 * (*) type." So there are 8 sheets of "RFC-WW *- * (*) type" because of the choice between AC and AE, WAS and PS and lc and $ (2x2x2 = 8). In addition to the costs related to measurements MCE, these sheets also include the costs associated with initial and final measurements calculated in the previous file. The total sum of these three costs (MCE measurements, initial and final) gives therefore ultimately the cost for a typical firm in a country in an activity and a specific time period.

OTHER USEFUL NOTES

 None.

IX. Annex 8

 PURPOSE OF FILE

 Give the cost of each activity in the different countries and over time.

THE APPROACH AND ASSUMPTIONS MADE

 With these sheets, we can know the costs of activities in a given country and at one point by a cell by cell multiplication of matrices of the sheets "RFC-WW *- * (*)" of the previous file with the matrices sheet "MXZ" file "4 Number of facilities." The following example will allow a better understanding of the above:

$$\text{COUNTRY} \quad \begin{array}{c} \\ A \\ B \\ C \\ D \end{array} \begin{array}{ccc} \overset{\text{ACTIVITY}}{} \\ \begin{array}{ccc} I & II & III \end{array} \\ \begin{pmatrix} 4 & 0 & 26 \\ 0 & 9 & 0 \\ 11 & 18 & 11 \\ 6,5 & 0 & 17 \end{pmatrix} \end{array}$$

This matrix shows such as "RFC E-WW-WS (lc)." A company in country A present in activity I will have to bear a cost of 4 in lc due to the entry into force of the Protocol. In the same country, the cost will be zero for a business performing activity II and 26 for a business performing activity III.

$$\text{COUNTRY} \quad \begin{array}{c} \\ A \\ B \\ C \\ D \end{array} \begin{array}{ccc} \overset{\text{ACTIVITY}}{} \\ \begin{array}{ccc} I & II & III \end{array} \\ \begin{pmatrix} 45 & 3 & 8 \\ 5 & 1 & 22 \\ 1 & 3 & 7 \\ 6 & 10 & 17 \end{pmatrix} \end{array}$$

"MXZ" this matrix has been used to calculate "MX8" 6.x file (see page 12). So, for example, there are 45 companies in country A working on activity I and who

must report, regardless whether they already do so or not at the moment.

The result matrix also indicates for example that the total cost in country A, for a given period, of all companies performing activity I will be 180 lc.

$$
\text{COUNTRY} \quad
\begin{array}{c}
 \\
 \\
 \\
 \\
\end{array}
\begin{array}{c}
\text{ACTIVITY} \\
\begin{array}{ccc} \text{I} & \text{II} & \text{III} \end{array} \\
\begin{array}{c} \text{A} \\ \text{B} \\ \text{C} \\ \text{D} \end{array}
\left(
\begin{array}{ccc}
180 & 0 & 208 \\
0 & 9 & 0 \\
11 & 54 & 77 \\
39 & 0 & 289
\end{array}
\right)
\end{array}
$$

OTHER USEFUL NOTES

By its very nature this file is also an intermediate file when no data is to be entered and all calculations are based on data from other files. Its character, however, is broader and it is the first step in defining the costs that interest us.

X. 8 Facility_3

 PURPOSE OF FILE

  This is again a spreadsheet file that complements the previous, going further in the calculations. A separate file was made so as not to have a file with too many sheets that would make it difficult to read.

THE APPROACH AND ASSUMPTIONS MADE

  The first sheets give the cost to be borne by companies per country over time. "E-TC per country WW-WS (lc)" is obtained through the sum of costs by activity given by the paper "Total Costs E-ww-WS (lc)" of the previous file. So it's just a general summary sheet for each country.

  The sheet after the first group is "Tax rates". It gives tax rates over time for companies in different countries. Since the determination of this rate depends on the policy and can not make concrete assumptions for this purpose, the method will certainly be that of a single rate over time, ie the current rate of taxation for the companies.

  This sheet allows us then to calculate the actual costs ("RTC per country E-WW-WS (lc)" RTC means "Real total costs") for companies in different countries, that is to say, after taking into account the tax rates.

 OTHER USEFUL NOTES

  None.

XI. Regulator 9

<u>PURPOSE OF FILE</u>

This file attempts to quantify the costs to be borne by the national regulatory bodies under the Protocol.

<u>The approach and assumptions made</u>

The first 4 sheets "gtotal WW-*- *" give "the number of pollutants that appeared in all the registers" in the sheets "g" of files 6.x: to know that number because our assumption is based on the fact that the higher the number, the more the work supported by the regulatory body will be important and therefore the higher the resulting cost which will need to be faced.

The four sheets that follow, the image of "RC E-WW-WS" (RC stands for "Regulator costs") thus provide costs for regulatory agencies. Monetary data that must be entered are in local currency. The cost will be given in local currency and $ at the end of the first tables. There are 11 tables per sheet, because of the number of years taken into account (years 0 to 10 years).

We emphasize two points. First we will set the amount of theoretical variables (coefficient of decentralization, varying the number of hours worked ...): this can only be made after a meeting with some national agencies. Otherwise we return to the assumption made in the first 4 sheets: we are fully aware of the limitations that may exist. A figure such as 50 can also mean that 50 different companies release a single product or a single enterprise releases 50. The costs will certainly be different in these two cases, but in this area it is not possible to make too many demands. Besides our hypothesis about the importance of effective work in the final cost for the regulator remains valid.

The last eight sheets, like the "Summary E-WW-WS (lc)," are a summary of the previous four sheets. They are there for the sake of clarity.

<u>OTHER USEFUL NOTES</u>

The hypothesis of a greater work efficiency can also be made to the regulator. A red box appears, therefore, in the sheets of "RC E-WW-WS" type: remarks that are valid for companies (sheets "Efficiency Savings 1" and "Efficiency Savings 2" file "INPUT") also apply to the regulatory agency. So if you enter 0.1, this means that the efficiency will be increased by 10% between year 1 and year 10.

XII. INPUT

<u>PURPOSE OF FILE</u>

 This file lists all the assumptions that we want to establish, with the exception of those concerning the increased efficiency of work within regulatory agencies (see previous section). It was created for the sake of clarity and efficiency. Just enter the necessary assumptions (consolidation, wage developments, efficacy endpoint tasks) and then refer to the result files to see how far the results have changed.

<u>The approach and assumptions made</u>

<u>Consolidation Assumptions:</u>

 This file currently refers to "MXZ" from File 4, but if our research does not allow us to complete "MXZ", we will need to change it a bit to connect it to "Mxy". In expectation, however, we retain the link with "MXZ".

 We then list for each country and for each activity the rate of consolidation or activity expansion from year 1 to year 10. Thus, if we enter 1.1 in box 1a of the activity in Albania, this means that in nine years (between year 1 and year 10), the number of firms in this activity will have increased in Albania by 10%. We assume then an unchanged decreasing coefficient (α) during the 9-year period calculated as follows: $\alpha^9 = 1.1$ or $\alpha = 1.1 ^ {(1 / 9)} \approx 1.01$.

And suppose there are 100 companies in Albania performing activity 1a year in year 1, then the automatic calculation gives the following results:

YEAR	1	2	3	4	5	6	7	8	9	10
Number of companies	100	101	102	103	104	105	107	108	109	110

 And we have therefore 110 = 1.1 x 100.

Inflation evolution, evolution Salary:

 This sheet shows the expected inflation for each country in the coming years. Its relevance is currently unknown. The following worksheet however, clearly shows its nature: it deals with the average evolution of professions covered by the protocol in the years to come. Since this data can be difficult to find, the assumption of indexation of wages to inflation is considered: this explains the presence of the first sheet, "Inflation evolution."

For "Salary evolution," the methodology is similar to that of "Consolidation assumptions": we must reinsert in the column of year 10 the salary evolution between year 1 and year 10 for the 4 professions under the protocol. An annual average increase is calculated for the other years.

Efficiency Savings 1, 2 Efficiency Savings:

 This sheet must contain data collected from companies regarding the estimated working time for each of the four professions involved. Then, the red box must be filled with the assumption of time efficiency: for example, if you enter 0.1, then you would expect an efficiency of 10% between year 1 and year 10.

 The sheet "Efficiency Savings 1" indicates the hours required for each type of occupation for well specified stages which are grouped into two subsets: the initial stages (assumed to take place only during the first year [0 years] following the entry into force of the protocol) and the final stages that actually correspond to a series of tasks that will be repeated after the first year of the protocol. The sheet "MXG" is meant to be very general: it is supposed to be applicable regardless of the size and whatever the nationality of the company. So there are two assumptions implicit in this model. First the work required by the Protocol within a company is the same whatever its size (in a way the protocol requires companies to produce work "fixed" independent of their size): Naturally we are aware that this approach is not entirely true, but we have kept it for practical reasons (obtaining information based on activities and size of companies is beyond our reach and would substantially complicate the model without any obvious interest) believing that the final margin of error will be minimal because ultimately the numbers that appear represent an average. Second, the work required by the Protocol within a company is the same regardless of nationality; here this reintroduces the principle of equal efficiency in the space for different professions. Concretely this means for example that an engineer of a country is supposed to work as well as an engineer of any EEC country and then if he spends three hours for a given stage, then any engineer from any country will also spend 3 hours for the same task.

 It is also important to note the dynamic nature of the table: there is no question that over time, the hours spent for certain tasks will decline until they reach a plateau. This will require integrating gradient coefficients certainly starting at year 2. The determination of these coefficents remains in question: a working meeting seems once again necessary on this matter. As part of the field work that must follow, the existing regulatory bodies must be contacted and asked what findings have already been made at the enterprise level with the introduction of new regulations: their knowledge will probably allow us to set the average rates for the relevant years. In the present state of things, a gradient

coefficient must be inserted in the red box of the sheet in the manner explained in the same sheet.

 The sheet "Efficiency Savings 2" is currently incomplete. The basic idea is to fill it with the help of a qualified partner in matters of pollutant releases and transfers. This partner would tell us the best methods for calculating releases and transfers of a given pollutant. For the moment, due to a lack of information on this, we have established by default 30 actions for each of the three methods recommended by the protocol (which reaches a total of 90 possibilities for 86 pollutants). Precision work and explanation must be conducted at any price in the shortest time to meet this deficiency.

 The dynamic aspect of this paper also needs to be underlined: the same problem as that of "MXG" arises at this level, namely an increased efficiency of stakeholders over time: the remarks that we can do are similar to those already set out above. This paper therefore presents similarities with the previous one.

XIII. Total Costs

<u>PURPOSE OF FILE</u>

This file is the last of the model. Essentially, this is a final summary of all the above data.

<u>APPROACH AND ASSUMPTIONS MADE</u>

The first 8 sheets such as "per FTC country E-WW-WS (lc)" (FTC: Final total costs) give the final cost by country by adding the costs for companies and the costs for regulators. We emphasize one point: the costs for companies are based on sheets "TC per country E-WW-WS (lc)" and not "RTC per country E-WW-WS (lc)" because otherwise we distort reality by not taking into account the state costs due to lower revenues from corporate taxes. An example will make the above clearer. Imagine a country where the corporate tax rate is 30%. The profit made by all companies before tax and before application of the protocol is 1000. If we estimate the cost of the Protocol to 100, then 100 will be the figure used in the sheet "TC per country E-WW-WS (lc)" and this is what we would use for the calculation of "Total costs". However, the number 70 (100 X(1-30%)) will appear in the paper "RTC per country E-WW-WS (lc)." In fact the cost incurred by the country in general is 100 as lower corporate earnings reduces their contribution to the IS: the state has received 30 (100 x 30%) less and we have 70 + 30 = 100. This explains why the calculation is constructed in such a way.

The following 8 sheets then give the total costs for all regions: it is a simple sum of national data sets in certain well-defined groups.

The sheet "STPR" (Social time preference rate) contains the data (not cash) that will be used to set a discount rate for each country to determine the cost of 11 years involved in the current cost. This cost appears in the last sheet, "NPV" (Net present value).

<u>OTHER USEFUL NOTES</u>

None.

File	Sheet	Data to be submitted by		
		Parthner	UNECE	Assumptions
1 mapping pollutants…	MxL1	X		
	MxH1	X		
	MxN1	X		
4 Number of facilities	w		X	
	x		X	
	MxY		X	
	MxZ		X	
5 facility_1	Exchange rate		X	
	MxAS (lc)		X	
	MxA		X	
	MxB		X	
	MxD		X	
6.x Intermediary file	M4L		X	
	M7	X		
8 Facility_3	Tax rates		X	
9 Regulator	RC *-WW-*		X	X
INPUT	Consolidation assumptions			X
	Inflation evolution			X
	Salary evolution			X
	Efficiency savings 1		X	X
	Efficiency savings 2		X	X

Total costs	STPR		X	